DEPARTMENT OF DEFENSE
Developmental Test and Evaluation and Systems Engineering

FY 2011 Annual Report

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Contents

Figures

Tables

Index to Program Assessments

1 EXECUTIVE SUMMARY

The Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E)) and the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)) are pleased to submit this joint DASD(DT&E) and DASD(SE) FY 2011 Annual Report in response to 10 U.S.C. 139b and 2430 note. This report addresses activities relating to the Major Defense Acquisition Programs (MDAPs) including:

- A discussion of the extent to which the MDAPs are fulfilling the objectives of their systems engineering (SE) plans and developmental test and evaluation (DT&E) plans.
- A discussion of the waivers of and deviations from requirements in Systems Engineering Plans (SEPs), Test and Evaluation Master Plans (TEMPs), and other testing requirements that occurred during the preceding year with respect to such programs; any concerns raised by such waivers or deviations; and the actions that have been taken or are planned to be taken to address such concerns.
- An assessment of the organization and capabilities of the Department of Defense (DoD) for SE, development planning, and DT&E with respect to such programs.
- Any comments on such report that the Secretary of Defense considers appropriate.

1.1 Developmental Test and Evaluation

This report provides descriptions of DASD(DT&E) activities and initiatives, assessments of the military departments' T&E organizations and capabilities, and a listing of engagements with major programs that have reached a significant milestone or programs that have conducted considerable DT&E activity in fiscal year 2011 (FY 2011). In addition to the military department assessments, organizational and capabilities assessment of two DoD Components with acquisition responsibility - the Defense Information Systems Agency (DISA) and the Missile Defense Agency (MDA) - are included.

For FY 2011, Components with MDAPs and programs on the Office of the Secretary of Defense (OSD) Test and Evaluation (T&E) Oversight List were required to provide self-assessment reports to the DASD(DT&E). The Components provided updates to their FY 2010 reports regarding T&E involvement in early acquisition activities, T&E planning and strategic execution, T&E execution, and T&E personnel. In addition, the Components were asked to provide details of the T&E workforce composition to include all categories of T&E personnel.

DASD(DT&E) requested information on the designation of T&E Key Leadership Positions (KLPs) for MDAP and MAIS programs, the use of Defense Acquisition Workforce Development Fund (DAWDF) Section 852 funding in support of the T&E workforce and any impact to the T&E organizations based on the March 21, 2011 Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)), Directive-Type Memorandum (DTM) 11-003, "Reliability Analysis, Planning, Tracking, and Reporting."

DASD(DT&E) continues to explore the composition of the T&E workforce. There is reliance on support contractors and developer T&E support. Non-Acquisition coded and non-T&E coded

personnel are still the major contributors to the T&E activities. A significant number of T&E resources remain outside this Defense Acquisition Workforce Improvement Act (DAWIA)-certified workforce which therefore excludes them from being accounted for in this report.

DASD(DT&E) is reporting on 39 programs that have reached a significant milestone or had significant test event(s) in FY 2011. None of the programs reported in this report has requested a deviation or a waiver from the TEMP.

1.2 Systems Engineering

In FY 2011, DASD(SE) pursued a number of initiatives in the areas of policy and guidance, program engagement and oversight, and workforce development designed to improve the Department's systems engineering performance, capability, and capacity. In FY 2011, USD(AT&L) signed DoD Instruction 5134.16, establishing DASD(SE)'s authority over systems engineering policy, assigning responsibilities and functions, and prescribing relationships and authorities for DASD(SE) pursuant to 10 U.S.C. 139b. DASD(SE) developed new policy and guidance that streamlined key acquisition documents including SEPs and Program Protection Plans (PPPs). DASD(SE) also led the development of a new policy by the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)), Directive-Type Memorandum (DTM) 11-003, "Reliability Analysis, Planning, Tracking, and Reporting," to ensure a Department-wide focus on reliability in the acquisition life cycle.

DASD(SE) updated the Defense Acquisition Guidebook (DAG) Chapter 4 (Systems Engineering) to reflect changes resulting from policy and guidance updates and led the development of a new DAG chapter on program protection. DASD(SE) also updated the DAG with new guidance on how manufacturing readiness should be used in response to section 812 of the Ike Skelton National Defense Authorization Act (NDAA) for Fiscal Year 2011.

DASD(SE) worked closely with the Joint Staff during its recent initiative to update the Joint Capabilities Integration and Development System (JCIDS) to ensure a more complete and deliberate role for the Joint Staff to provide informed advice to the Milestone Decision Authority at Milestone (MS) A. DASD(SE) continued to evolve its development planning efforts, providing information to pre-Materiel Development Decision (MDD) and MS A activities and participating in a number of Analysis of Alternatives (AoA) senior advisory groups. Figure 5-1 provides a summary of this activity.

DASD(SE) uses the Defense Acquisition Program Support (DAPS) methodology to review programs, supporting SEP development, review, and approval; technical assessments; and review of program measures and metrics. Table 5-1 summarizes these FY 2011 SEP-related activities. Tables 5-2 and 5-3 enumerate the significant DASD(SE) engagements for all 134 MDAPs, Major Automated Information System (MAIS) programs, and special interest programs with which DASD(SE) had interactions in FY 2011.

In the area of workforce development, DASD(SE) sponsored Defense Acquisition University (DAU) course development and revision as the Functional Leader for the career fields of Systems Planning, Research, Development, and Engineering–Systems Engineer/Program Systems Engineer (SPRDE-SE/PSE) and Production, Quality, and Manufacturing (PQM). DASD(SE) supported a number of workforce development initiatives to attract and maintain the DoD and industry engineering

workforce, including the Assistant Secretary of Defense for Research and Engineering (ASD(R&E)) Science, Technology, Engineering, and Mathematics (STEM) efforts. DASD(SE) also initiated the 21st Century Engineering Workforce Development project in collaboration with DAU. The ultimate goal of this project is to identify the essential technical knowledge, skills, and abilities needed by DoD systems engineers to contribute to the technical success of acquisition programs. DASD(SE) is leveraging its investment in the DoD Systems Engineering Research Center (SERC) to sponsor four collaborative research tasks focused on improving workforce performance. Table 5-4 shows the latest workforce data for each Service and DASD(SE) as well as planned growth and outyear end-state.

DASD(SE) assessed the Departments of the Army, Navy, and Air Force systems engineering organizations and capabilities. As part of the FY 2011 Service Assessments, DASD(SE) acknowledges evidence of progress made by each Service in the form of new and revised policy and guidance; identification of additional resources, training, and tools; and reorganizations to enhance the systems engineering and development planning capabilities of Service engineering organizations. The self-assessments identify the challenges each Service faces and the tailored initiatives under way to strengthen each Service's systems engineering and development planning capabilities. The Service systems engineering self-assessments that form the basis for the discussion in Section 6 are provided in their entirety in Appendices A through C.

Despite this progress, DASD(SE) continues to observe systemic issues during technical reviews related to adequate Program Management Office (PMO) staffing to support execution of systems engineering on MDAPs and MAIS programs. The military departments continue to work to identify lead or chief systems engineers and other related supporting technical staff members across programs.

In FY 2011, DASD(SE) provided technical oversight, guidance, and assessments through continuous program engagements and focused independent reviews of major programs. Section 7 contains detailed assessments of 42 selected MDAPs, MAISs, and special interest programs that were the focus of significant DASD(SE) activity in FY 2011.

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2 DASD(DT&E) ACTIVITIES

2.1 Policy and Guidance Summary

In FY 2011, the DASD(DT&E) led and participated in several policy updates. The DASD(DT&E) led the development of DoD Instruction (DoDI) 5134.17, "Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E))," which assigns responsibilities and functions and prescribes relationships and authorities for the DASD(DT&E). The DoDI was signed on October 25, 2011.

As the Functional Leader of the T&E career field, the DASD(DT&E) changed the education requirements for the T&E career field. Effective October 1, 2012, the T&E career field will require a baccalaureate or graduate degree in a technical or scientific field such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science.

The DASD(DT&E) updated the guide "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts," and supported the ongoing updates to the DoDI 5000.02, "Operation of the Defense Acquisition System," the Defense Acquisition Guidebook (DAG), the T&E Management Guide, and the Defense Acquisition University (DAU) T&E curriculum.

The DASD(DT&E) chaired or participated in many standing policy and guidance working groups, such as the T&E Working Group, and other Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L))-led groups. The DASD(DT&E) participated in working groups regarding the information technology (IT) acquisition process, modeling and simulation (M&S), and cyber defense T&E. On January 31, 2011, the USD(AT&L) designated the DASD(DT&E) as the DoD T&E representative on the M&S Steering Committee.

The DASD(DT&E) continued work on scientific T&E design that was started in FY 2010. The DASD(DT&E) is working with the Director of Operational Test and Evaluation (DOT&E) to increase the use of scientific and statistically based T&E methodologies by the Military Departments and Defense Agencies. The DASD(DT&E) plans to approve a Scientific Test and Analysis Techniques (STAT) in T&E Implementation Plan and to establish a STAT in T&E Center of Excellence in FY 2012.

Section 835 of the National Defense Authorization Act (NDAA) for Fiscal Year 2012 mandated that the Secretary of Defense shall require that each MDAP be supported by a Chief Developmental Tester and governmental test agency, serving as Lead Developmental Test and Evaluation Organization for the program. This mandate requires policy changes, and the DASD(DT&E) is working to add the changes into the next update to the DoDI 5000.02, the DAG, the T&E Management Guide, and the DAU T&E curriculum.

2.2 Measurable Performance Criteria

The DASD(DT&E) continued to develop measurable performance criteria and associated metrics to gain insight into DT&E performance. The primary intent is to institutionalize the process and use of

criteria and metrics within the office of DASD(DT&E) and improve MDAP success in entering and exiting initial operational test and evaluation (IOT&E). The effort will also improve the overall document quality of the TEMP and the Assessment of Operational Test Readiness (AOTR).

The effort will be accomplished in four phases:

- Phase I - Develop framework, performance criteria and associated metrics.
- Phase II - Pilot the framework.
- Phase III - Expand scope of pilot program.
- Phase IV - Integrate into the DASD(DT&E) decision support capability.

Phase I was conducted in FY 2010 and was reported in last year's annual report. A framework, along with an initial set of performance criteria and associated metrics, was developed during that phase.

In FY 2011, Phase II refined the initial set of performance criteria and associated metrics. Two MDAPs provided data to improve the framework. The effort resulted in a framework of 14 performance criteria, with each performance criterion evaluated for usefulness and appropriateness, availability of data, and the level of effort to obtain the data. Those identified below with an asterisk (*) require further study to determine their value and applicability to the current or a future framework.

1. Key performance parameters (KPPs) are functionally traceable to Warfighter capabilities.*
2. KPPs are evaluated for mission capabilities.
3. Establish evaluation framework for KPPs and critical technical parameters (CTPs).
4. Execute evaluation framework for KPPs and CTPs.*
5. Demonstrated technical progress and system maturity.
6. Assess safety of the system.*
7. TEMP adequacy and currency.
8. DT&E resource management.
9. DT&E phase schedule performance.
10. Adherence to T&E policy and process.*
11. T&E program effectiveness and efficiency.*
12. AOTR accuracy.
13. T&E workforce certification status.
14. Fill identified T&E KLPs.

As part of the framework, the DASD(DT&E) developed a method for assessment. For each performance criterion, the Action Officer (AO) both assesses performance against the particular criterion and provides a confidence level in making the assessment.

For the performance assessment, the DASD(DT&E) uses the stoplight colors of green, yellow, and red. The meaning of each stoplight assessment color was developed uniquely for each criterion to reflect the proper status. A "Not Rated" assessment is also available, as appropriate.

The confidence assessment consists of three levels: high, medium, and low.

- High confidence is assessed when the presence and maturity of program T&E artifacts and documentation is consistent with expectations at the program's point in its life cycle.
- Medium confidence is assessed when the presence of program T&E artifacts and documentation is consistent with expectations at the program's point in its life cycle, but detail and maturity of documentation is lacking.
- Low confidence is assessed when there are omissions, gaps, inconsistencies, lack of expected detail, and/or conflicting data and information observed in program T&E artifacts and documentation.

The data from the first two programs in Phase II is being evaluated, and the performance criteria will be revised or reduced as appropriate based on the results. The pilot phase will continue in FY 2012 with four more programs on the OSD T&E Oversight List for DT&E. Data collection and analysis feasibility will be reevaluated and the framework revised accordingly.

As part of the pilot phase to ensure that the proposed measurable performance criteria provide the desired insight to support DT&E decisions, the DASD(DT&E) is developing a process to track acceptance of developmental testing recommendations. This office is developing a listing of developmental testing recommendations, per the Acquisition Decision Memoranda (ADMs), and the minutes of the Defense Acquisition Board (DAB) and Overarching Integrated Product Team (OIPT) meetings, of six programs and is in the process of tracking acceptance.

2.3 T&E Acquisition Workforce Development

During FY 2011, the DASD(DT&E) participated in the T&E competency assessment with the Office of the Director of Human Capital Initiatives. The Center for Naval Analyses conducted the assessment with 25 identified competency areas, using input from subject matter experts selected by the Components. The competency assessment survey was sent to all members of the T&E acquisition workforce and to individuals identified by the Components as supporting T&E. The 31 percent overall participation rate exceeded the participation rates for competency assessments in most other acquisition career fields.

The results were presented to the T&E Functional Integrated Product Team (FIPT), which is reviewing the competencies against the existing DAU T&E curriculum to determine any gaps in training. The T&E FIPT is also reviewing other acquisition courses and continuous learning modules (CLM). The T&E FIPT will look for alternative approaches to close training gaps, such as modifying DAU courses to include additional practical applications. In addition, the T&E FIPT will identify changes to the T&E curriculum to develop the workforce that conducts T&E of Information Technology (IT) systems to address the anticipated changes in the acquisition of IT systems.

The DASD(DT&E) updated the CLM for "Modeling and Simulation for T&E," and began to update the CLM for "Introduction to Probability and Statistics," both offered by DAU. Additionally, the DASD(DT&E) coordinated with DAU to insert a STAT overview section into the "Intermediate Systems Acquisition" course.

2.4 Program Engagement

The DASD(DT&E) provides an impartial evaluation of a program's key issues and risks needing design resolution before production. The primary DT&E product at technical reviews is credible knowledge of a system, a component, or technology maturity, as well as the ability to provide the end user with a characterization of a system's capabilities and limitations. Program insight comes from early and continuous engagement with the programs on the OSD T&E Oversight List. In FY 2011, the DASD(DT&E) advised 22 DABs, 59 OIPTs, and two Nunn-McCurdy reviews. The DASD(DT&E) completed and released two AOTR reports and approved 44 TEMPs. Two additional AOTRs were released during the first quarter of FY 2012, and their assessments are included in this report.

2.5 DASD(DT&E) Focus Areas

In FY 2011, the DASD(DT&E) concentrated interest on the following areas. The results of the DASD(DT&E) assessments of these areas and recommendations for the path ahead are provided below.

2.5.1 Lead DT&E Organization

Background. In the FY 2010 annual report, the DASD(DT&E) reported its plans to investigate implementation of a common model across the Components for a Lead DT&E Organization. The responsibilities of the Lead DT&E Organization should include coordinating the planning, management, and oversight of all DT&E activities for a program; maintaining insight into program contractor activities; coordinating the T&E activities of other participating Government activities; and providing an objective assessment of the DT&E results to the program manager (PM).

In FY 2011, the DASD(DT&E) provided recommendations for future policy considerations that require PMs to designate a Lead Government DT&E Organization for programs on the OSD T&E Oversight List. Section 835 of the NDAA for FY 2012 mandated that the Secretary of Defense shall require that each MDAP be supported by a governmental test agency, serving as Lead DT&E Organization for the program. The Lead DT&E Organization for an MDAP shall be responsible for:

- Providing technical expertise on T&E issues to the chief developmental tester for the program;
- Conducting DT&E activities for the program, as directed by the chief developmental tester; and
- Assisting the chief developmental tester in providing oversight of contractors under the program and in reaching technically informed, objective judgments about contractor DT&E results under the program.

The DASD(DT&E) will work with the Components on the implementation of the Lead DT&E Organization for each program. There will be a number of challenges, such as the Naval Sea Systems Command (NAVSEA) processes for ships and the U.S. Air Force Space and Missile Systems Center processes for space systems, that do not make it easy to identify a Lead DT&E Organization.

Next Steps. The DASD(DT&E) will continue to support the DoD staffing and coordination process for future policy updates and adjudicate any comments, if necessary. The DASD(DT&E) will work with the Components to implement the Lead DT&E Organization for each program and will provide status of the implementation. Future annual reports will document progress, as needed.

2.5.2 Prioritizing Use of Government versus Contractor Capabilities

Background. In the FY 2010 annual report, the DASD(DT&E) reported that there is no binding DoD-wide policy or guidance prioritizing use of and investment in Government capabilities for DT&E. These DoD T&E capabilities encompass either (1) facilities and intellectual capital, or (2) only intellectual capital located at numerous DoD installations.

In FY 2011, the DASD(DT&E) provided recommendations for future policy considerations that require an acquisition program office to consider DoD T&E capabilities, using a structured decision process that includes a business case analysis, to ensure that the Government is getting best value. This process will provide insight on program plans for developing, sustaining, or using non-DoD T&E capabilities. It is the DASD(DT&E)'s position that the Government avoids unnecessary duplication of capabilities, accounts for funding used to provide T&E capabilities in support of acquisition programs, retains core T&E capabilities within the DoD, and optimizes the effectiveness of Government facilities.

Next Steps. The DASD(DT&E) will continue to support the DoD staffing and coordination process for future policy updates, and adjudicate any comments, if necessary. The DASD(DT&E) will review the FY 2012 and future budget submissions for T&E funding. Future annual reports will document progress, as needed.

2.5.3 Cost of DT&E

Infrastructure Costs

Background. The DASD(DT&E) and the Test Resource Management Center (TRMC) collaborated on an initiative to better determine the costs incurred by the DoD to operate and sustain Major Range and Test Facility Base (MRTFB) capabilities, including the intellectual capital, of the T&E infrastructure. The goal is to better understand the cost of doing business within the MRTFB. In January 2012, TRMC sent a memorandum requesting the Military Departments and Defense Agencies to review and provide any changes to the MRTFB Composition List. This memorandum also requested that the Military Departments and Defense Agencies provide cost data; beyond the level of the MRTFB Exhibits, down to the recognized capability level. Expanding on the DoDI 3200.11, "Major Range and Test Facility Base (MRTFB)," dated December 2007, definition of a T&E capability, a recognized capability will be a facility or range, plus its intellectual capital and any associated costs. Costs may be combined under a major facility complex, which can include multiple

items on the MRTFB Composition List. The DASD(DT&E) and the TRMC will work cooperatively with the Military Departments and Defense Agencies to address any concerns, since it may take several iterations to mature the product to its desired end state.

Next Steps. The DASD(DT&E) will coordinate with the Military Departments and Defense Agencies to identify the recognized capabilities and collect requested cost data for analysis alongside the MRTFB Exhibits and Budget Item Justifications. The process will be revised, as appropriate. Future annual reports will document progress, as needed.

Program T&E Costs

Background. DoD 7000.14-R, "Department of Defense Financial Management Regulations (FMRs)," directs statutory and regulatory financial management requirements, systems, and functions for all appropriated and non-appropriated, working capital, revolving, and trust fund activities. The regulations provide instructions applicable to budget formulation for the T&E Exhibit (T&E-1) needed for review and analysis of T&E funding requirements included in the DoD Components' requests. In FY 2011, the T&E-1 was modified to include, starting in FY 2012, additional information on prior year funding as well as an estimate for completion.

Next Steps. The DASD(DT&E) will review future budget submissions for T&E funding to ensure:

- T&E resources required for programs on the OSD T&E Oversight List, as identified in each TEMP, are adequately funded.
- DoD is not maintaining unwarranted test capabilities at private industry facilities.
- Unwarranted duplication does not exist among DoD Component assets.
- Test facilities and capabilities required are adequately funded and supported.
- New major test facilities are warranted and meet the needs of the DoD Components.

Future annual reports will document progress, as needed.

2.5.4 Incorporating T&E into the Contracting Process

Background. The DoD established a policy for conducting peer reviews of solicitations and contracts to ensure consistent policy implementation, improve the quality of contracting processes, and facilitate sharing of best practices and lessons learned throughout the DoD. The Office of the Director of Defense Procurement and Acquisition Policy facilitates the peer reviews as well as organizes the teams of reviewers for all solicitations valued at $1 billion or more and for all contracts for services valued at $1 billion or more. The DASD(DT&E) is participating on the OSD peer review teams, as appropriate, for solicitations valued at $1 billion or more. To date, the DASD(DT&E) has participated in peer reviews for the Ground-based Missile Defense (GMD), the Joint Air-to-Ground Missile (JAGM) , and the Joint Light Tactical Vehicle (JLTV) programs.

In FY 2011, the DASD(DT&E) participated as a team member on OSD teams that were formed for Phase 1 peer reviews. The DASD(DT&E) participation helps ensure that T&E requirements are clearly articulated by the Government and understood by prospective offerors, and allows sharing of

T&E information across major procurements prior to requests for proposals (RFPs) release. The DASD(DT&E) focused on the following in the RFPs:

- T&E Management. Ensure that the RFP describes the overall T&E management structure, responsibilities, experience of T&E staff, and application of T&E best practices.
- T&E Data. Ensure that the RFP describes the contractor's approach to technical data, to include management, control, access, and delivery of T&E data.
- M&S. Ensure that the RFP describes allocation of M&S responsibilities, expectations, and M&S tools for T&E.
- Reliability, Availability, Maintainability (RAM). Ensure that the RFP describes the approach and procedures to perform T&E for RAM.
- Information Assurance (IA). Ensure that the RFP describes the contractor's IA responsibilities for T&E.
- T&E Planning and Resources. Ensure that the RFP describes the change management process for updates to test plans and test assets; Government and contractor test resources required; and that a business case analysis was conducted and documented within the TEMP for use of contractor-unique resources instead of Government-owned facilities.
- Software Testing and Reporting. Ensure (if applicable to program) that the RFP describes the responsibilities of the contractor and Government during test execution. Ensure that the process for contractor deficiency reports and resolution is described.

The DASD(DT&E) completed an update to the guide, "Incorporating Test and Evaluation into Department of Defense Acquisition Contracts," in October 2011which addresses T&E items common across DoD Components. The guide was developed to assist T&E professionals when drafting statements of work and RFPs.

Next Steps. The DASD(DT&E) will continue to support the follow-on phases of OSD peer reviews, as well as any new OSD teams that are formed to review solicitations for programs on the OSD T&E Oversight List. In addition, the DASD(DT&E) will update the October 2011 guide on a periodic basis as best practices are developed. Further discussion of this topic in future reports is dependent on any significant activities in this area.

2.5.5 T&E Policy Initiatives

Background. In FY 2011, the DASD(DT&E) provided recommendations for future policy considerations that include fact-of-life changes to statute and policy, and those directed by the USD(AT&L) memoranda on "Implementation of the Weapon Systems Acquisition Reform Act (WSARA) of 2009," and "Reliability Analysis, Planning, Tracking, and Reporting."

The recommendations for future policy considerations included:

- Language delineating the role of the Chief Developmental Tester (categorized as a T&E KLP).
- A requirement for the identification or designation of a Lead DT&E Organization.

- A replacement of the Test and Evaluation Strategy (TES) with the TEMP at Milestone (MS) A.
- Identification within the TEMP of contractor DT&E and Government DT&E, prioritizing the use of Government test facilities.
- A requirement to include a reliability growth curve within the TEMP beginning at MS B and a requirement to report on progress to plan for reliability growth assessment.
- An emphasis on scientific and statistical rigor when developing the T&E program.
- Guidance on T&E in support of such programs as Information Technology (IT) and defense business systems.
- Guidance on T&E in support of rapid acquisition.

Next Steps. The DASD(DT&E) will support the DoD staffing and coordination process for future update to T&E policies and adjudicate any comments, if necessary. Future annual reports will document progress.

2.5.6 Scientific Test and Analysis Techniques (STAT) (formerly known as Scientific Test and Evaluation Design (STED))

Background. In the FY 2010 annual report, the DASD(DT&E) reported its plan to create a working group on scientific T&E design to increase the use of scientific and statistically based T&E methodology and tools by the DoD acquisition community.

In FY 2011, the DASD(DT&E) chartered a working group composed of representatives across DoD Components and OSD agencies. The group reviewed and discussed scientific and statistical techniques and the limitations of those techniques, as well as their applications and experiences during DT&E. The results of the working group will also inform the DOT&E Advisory Group, which is developing a two-year road map on the science of test.

The DASD(DT&E), in coordination with the DOT&E and the DoD Components, led the development of a list of STAT terms and definitions for the DoD acquisition community. The DASD(DT&E) provided the completed glossary to DAU for their T&E website.

The working group is preparing an implementation plan in collaboration with the DoD Components, DOT&E, and DAU to provide a path ahead that will increase use of STAT in T&E. The intent of the implementation plan is to increase awareness and use by the DoD acquisition community of sound scientific and statistical methods within TEMP and test plan development, and in the evaluation and analysis of test results. The implementation is a multipronged effort that includes training, software, guide books, and advisory services.

The STAT in T&E effort will be executed in three phases. The development of a STAT T&E Center of Excellence (STAT T&E COE) is critical to the success of the first phase. The COE will assist pilot programs identified by the Components to demonstrate the benefits of a scientifically based approach to test and analysis.

The STAT T&E COE is a reachback T&E capability that will provide advice and limited assistance, promote collaboration and use of best practices in the employment of STAT in both developmental test and evaluation (DT&E) and operational test and evaluation (OT&E) to enable defensible results. The STAT T&E COE will serve as a T&E capability for the acquisition community that will be independent of the DASD(DT&E) or DOT&E involvement with the T&E WIPTs.

Next Steps. The DASD(DT&E), in collaboration with the U.S. Air Force's Air Education and Training Command, will embark on a three-year pilot effort to establish a STAT T&E COE under the stewardship of the Air Force Institute of Technology, Wright-Patterson AFB. This initiative will allow DoD to support the T&E workforce by facilitating the development of efficient and cost effective TEMPs and test plans, and more rigorous evaluation of test results.

The DASD(DT&E) plans to establish the STAT T&E COE by the 4th quarter FY 2012. Future annual reports will document progress, as needed.

2.5.7 Cyber Defense T&E

Background. In the FY 2010 annual report, the DASD(DT&E) noted that requirements for T&E in the defensive cyber domain for MDAP and Major Automated Information System (MAIS) programs are not fully understood. U.S. information and weapon systems have become much more interconnected over the last several years as the DoD has moved toward net-centric warfare. Although this interconnectedness drastically improves operational synergy, it also opens up these weapon systems to cyber attacks. Thus, it is critical that these systems are adequately protected to ensure the superiority of our Armed Forces in the cyber domain as well as the land, air, sea, and space domains. To have confidence that our cyber capabilities are improving and our weapon systems can fight through attacks and still complete the mission, thorough cyber testing needs to be incorporated into weapon system and operational support system development.

In FY 2011, the DASD(DT&E), in concert with the TRMC, developed a cyber test strategy for DT&E and T&E infrastructure composed of four focus areas:

- Process – DoD policy, directives, and guidance for cyberspace DT&E requirements within the acquisition process.
- Methodology – Scientific test approaches, metrics, and measures to assess defensive and offensive cyberspace warfighting requirements in weapon system and operational support system programs.
- Infrastructure – DoD cyber labs, ranges, networks, tools, and instrumentation development and coordination required for T&E of cyberspace requirements in defense programs.
- Workforce – Cyberspace-specific T&E training for T&E professionals in labs, ranges, and operations, recognizing that the developer may also be the tester and operator.

In FY 2011, the DASD(DT&E) and the TRMC planned an initial cyber pilot event to focus on cyber test infrastructure gaps and to examine different test methodologies. The initial cyber pilot event, which simulated cyber attacks on a command and control system involved in a Joint Close Air Support mission, was completed in December 2011. Positive results garnered from this pilot

included: a draft set of cyber test metrics/measures; an initial cyber DT&E methodology; and an initial understanding of the workforce skills required for cyber DT&E. This initial cyber pilot event was a valuable first step in understanding T&E in the defensive cyber domain.

DASD(DT&E) continues to work with the TRMC and DOT&E to improve the Department's cyber testing capabilities. DASD(DT&E), DOT&E, and TRMC are working to provide significant improvements to the cyber testing infrastructure and to the Department's ability to portray operationally-realistic, threat-representative environments. In addition, these offices worked closely together to establish testing strategies in support of FY 2011 NDAA Section 933 (Cyber Acquisition).

Next Steps. The DASD(DT&E) and the TRMC plan to expand the four focus areas into specific items which will be explored and refined through a number of future cyber test events. This effort will leverage already planned events as well as identify the need for additional dedicated events.

These future cyber events will need to explore the four strategic focus areas in order to assist policy development, test procedures, test infrastructure capabilities, and an understanding of the training needed for the T&E workforce in the defensive cyber domain. Future Annual Reports will document progress, as needed.

2.5.8 T&E Management Guide

Background. The T&E Management Guide is a technical management educational guide, published by DAU, to be utilized within the T&E curriculum at DAU and as a source of reference for all T&E workforce members. Since the T&E Management Guide was last issued in January 2005, many changes in the T&E area have occurred.

In FY 2011, the DASD(DT&E) initiated an effort to update the T&E Management Guide. The Components and OSD Agencies reviewed the complete guide and provided updates on the following areas: STAT in T&E, Chief Developmental Tester, Lead DT&E Organization, cyber defense T&E, interoperability, space systems, reliability and T&E, and software testing. The DASD(DT&E) is adjudicating and incorporating the updates.

Next Steps. The DASD(DT&E) will continue to update the guide and publish it by the end of FY 2012. Future annual reports will document progress, as needed.

2.5.9 Assessment of Operational Test Readiness (AOTR)

Background. In response to the FY 2010 Annual Report, the Senate Armed Services Committee requested that the DASD(DT&E) provide additional information on AOTRs in the FY 2011 Annual Report submission. This section includes a summary of the AOTR process and the DASD(DT&E)'s assessment of systems' readiness for IOT&E and how those systems then performed in IOT&E.

AOTR Process. The DASD(DT&E) conducts an independent AOTR for all ACAT ID and special interest programs designated by the USD(AT&L) prior to entering IOT&E. Each AOTR assesses the attainment of KPPs and evaluates the risks associated with the system's ability to meet operational suitability and effectiveness goals. This assessment is based on capabilities demonstrated during DT,

including pre-MS C operational assessments, and criteria described in the TEMP. As prescribed in DoDI 5000.02 and subsequent policy documents, the AOTR report is provided to the USD(AT&L), DOT&E, Service Acquisition Executives (SAEs), and the Service Vice Chiefs, and is intended to inform the SAEs of the determination of materiel system readiness for IOT&E. In order to gain in-depth technical knowledge of system performance during DT, the DASD(DT&E) engages individual program management offices early and continuously throughout the acquisition lifecycle. The DASD(DT&E) staff members also observe both contractor and Government DT at various test sites to collect detailed test data and develop accurate assessments of system performance.

Summary of AOTRs. The DASD(DT&E) published three formal AOTRs in 2010 which were not specifically summarized in our FY 2010 Annual Report. Two AOTRs were published in FY 2011, and two more were published in the first 3 months of FY 2012. In this summary of AOTRs, the DASD(DT&E) is including all assessments published to date in order to baseline our reporting of AOTRs. Future reports will build on this database. Table 2-1, below, contains a summary of AOTR recommendations published by the DASD(DT&E). For the seven programs assessed, Tables 2-2 through 2-8 display the DASD(DT&E)'s recommendation to enter IOT&E and the program's subsequent performance in IOT&E. Since the first formal AOTR was published in June 2010, the DASD(DT&E) has closely compared system performance during DT and IOT&E. This ongoing comparison has enabled the DASD(DT&E) staff to continually improve the process and accuracy of the assessments. The SAEs have welcomed the data-based and independent assessment of DT performance and recommendation to enter IOT&E. In three of the seven AOTRs to date however, the SAEs chose to proceed into IOT&E despite the DASD(DT&E)'s recommendation not to proceed. The discussion following each table describes that program's results.

Table 2-1. DASD(DT&E) AOTR Recommendations

Program	AOTR recommendation
Multifunctional Information Distribution System Joint Tactical Radio System (MIDS JTRS)	Proceed to IOT&E
RQ-4A/B Unmanned Aircraft System (UAS) Global Hawk Block 20/30	Do not proceed to IOT&E
Stryker Nuclear, Biological, Chemical Reconnaissance Vehicle (NBCRV)	Proceed to IOT&E
Joint Air-to-Surface Standoff Missile–Extended Range (JASSM-ER)	Proceed to IOT&E
Standard Missile-6 (SM-6)	Do not proceed to IOT&E
JTRS Handheld, Manpack, and Small Form Fit (HMS) Rifleman Radio	Do not proceed to IOT&E
C-130 Avionics Modernization Program (AMP)	Proceed to IOT&E

Table 2-2. MIDS JTRS (FY 2010)

MIDS JTRS / USN ACAT 1D				
AOTR Recommendation	Operational Test Agency (OTA) Report		DOT&E Beyond Low Rate Initial Production (BLRIP)	
Proceed to IOT&E	**Not Effective**	**Not Suitable**	**Not Effective**	**Not Suitable**

The DASD(DT&E) assessed that MIDS JTRS met five of seven KPPs, and partially met one KPP. The remaining KPP was not assessed because it was not applicable to the F/A-18E/F per the Capability Production Document (CPD). Accordingly, the DASD(DT&E) recommended proceeding into IOT&E. During IOT&E, Commander, Operational Test and Evaluation Force and DOT&E assessed MIDS JTRS as Not Operationally Effective and Not Operationally Suitable. DOT&E reported in its BLRIP that "although not evident during developmental testing, early results from IOT&E indicated individual manufacturer variances in the reliability of the MIDS JTRS terminals, and this variance skewed the analysis of combined reliability results." This variance in reliability between the different manufacturers was not observed during DT. One of the vendors made hardware changes to the system under test after the AOTR was published and prior to IOT&E, which introduced the system failures observed during IOT&E. DOT&E attributed these failures to poor manufacturing processes and quality control by one of the vendors.

Table 2-3. Global Hawk Block 20-30 (FY 2010)

Global Hawk Block 20-30 / USAF ACAT 1D				
AOTR Recommendation	OTA Report		DOT&E BLRIP	
Do not proceed to IOT&E	**Not Effective**	**Not Suitable**	**Provided 40 percent of requested ISR at low optempo**	**Not Suitable**
			Not Effective for near-continuous, persistent ISR	
			Enhanced Imagery Sensor Suite provide imagery that meets or exceeds operational requirements	
			Airborne Signals Intelligence Payload provides limited utility against some threat radars and communications signals	

The DASD(DT&E) assessed that Global Hawk Block 20/30 met one KPP, partially met two KPPs, and did not meet the remaining two KPPs. The AOTR found that the Global Hawk Block 20/30 was still maturing and would not meet CDD thresholds in several key areas. Accordingly, the DASD(DT&E) recommended not proceeding to IOT&E. The Air Force decided to enter IOT&E,

and subsequently, the Air Force Operational Test and Evaluation Center and DOT&E assessed Global Hawk Block 20/30 as Not Operationally Effective and Not Operationally Suitable. All of the deficiencies discovered during DT&E were observed during IOT&E.

Table 2-4. Stryker NBCRV (FY 2010)

Stryker NBCRV / Army ACAT 1D				
AOTR recommendation	OTA Report		DOT&E BLRIP	
Proceed to IOT&E Ph II	**Effective with Limitations**	**Suitable with Limitations**	**Effective for Recon on Primary Roads**	**Suitable with Slat Armor (Not demonstrated with Stryker Reactive Armor Tile II)**
			Not Effective for Recon on Cross-Country Roads	
			Not Effective for Chem / Bio Surveillance	

The DASD(DT&E) assessed that Stryker NBCRV met 2 KPPs and partially met the remaining 2 KPPs. The assessment highlighted shortcomings associated with certain threats in the areas of Force Protection and Survivability. It also identified limitations with the Double Wheel Sampling System (DWSS) and the Chemical, Biological, Radiological and Nuclear (CBRN) equipment suite subsystem that could affect suitability and effectiveness. Accordingly, DASD(DT&E) recommended proceeding into IOT&E. The Army Test and Evaluation Command (ATEC) assessed the Stryker NBCRV as Effective with limitations and Suitable with limitations. DOT&E assessed the system as Operationally Effective for chemical route and area reconnaissance on primary and secondary roads and Operationally Suitable with slat armor, but Not Operationally Effective for area reconnaissance of cross-country terrain due to DWSS issues, and Not Operationally Effective for chemical and biological surveillance due to poor detection performance.

Table 2-5. JASSM-ER (FY 2011)

JASSM-ER / USAF ACAT 1D		
AOTR Recommendation	OTA Report	DOT&E BLRIP
Proceed to IOT&E	***IOT&E in progress***	***IOT&E in progress***

The DASD(DT&E) assessed that JASSM-ER met three of four KPPs and did not meet the remaining Availability KPP. During DT&E, BIT failures and oil seepage impacted materiel availability (16 of 22 successful events resulted in availability of 73%, short of the 95% threshold requirement). The vendor added in quality control checks for missiles to be delivered for IOT&E. Accordingly, the DASD(DT&E) recommended proceeding into IOT&E. JASSM-ER operational testing is still in progress. A comparison of test results will be included in next year's report.

Table 2-6. SM-6 (FY 2011)

SM-6 / NAVY ACAT 1D		
AOTR Recommendation	OTA Report	DOT&E BLRIP
Do not proceed to IOT&E	***IOT&E in progress***	***Phase I IOT&E (at-sea live missile flight testing) completed July 2011. Phase 2 IOT&E, comprising of extensive modeling and simulation to expand the battlespace, is in progress.***

The DASD(DT&E) assessed that SM-6 partially met 1 KPP, did not meet 3 KPPs, and the remaining KPP was not assessed during DT&E. The magnitude of outstanding issues and risks makes the likelihood of a successful IOT&E low. Many of these issues were a byproduct of decisions made in 2008 to capitalize on a perceived low risk of integrating the Advanced Medium-Range Air-to-Air Missile (AMRAAM) missile seeker to the Standard Missile. The approved testing program of record was based on these low risks, and a very limited DT program was planned. However, the reality is that the SM-6 experienced failures and anomalies based on these legacy components and more DT was recommended by the DASD(DT&E). Significant issues and risks included reliability failures on legacy components and not enough at-sea developmental testing. The discovery rate of deficiencies in late stages of DT was significant and trending up, with 71% of the more recent DT flights having repeated issues and new discovery. Accordingly, the DASD(DT&E) recommended not proceeding to IOT&E. The Navy chose to enter into IOT&E, and conducted 12 at-sea flight tests in July 2011 and is currently conducting M&S runs to assess performance in the entire battle space. As a result of 5 of 12 flight test failures during the at-sea portion of IOT&E, the Navy decided to postpone a scheduled 2012 Full-Rate Production (FRP) and instead conduct a 4th year of LRIP while a series of additional testing are conducted to add to the database prior to the DOT&E BLRIP report. A full comparison of test results will be included in next year's report after the final OTA and DOT&E reports are completed.

Table 2-7. JTRS HMS Rifleman Radio (FY 2012)

JTRS HMS Rifleman Radio / Army ACAT 1D		
AOTR Recommendation	OTA Report	DOT&E BLRIP
Do not proceed to IOT&E	***IOT&E in progress***	***IOT&E completed Nov. 2011 in NIE12.1. BLRIP in progress***

The DASD(DT&E) assessed that JTRS HMS Rifleman Radio met two KPPs, partially met one KPP, and did not meet the remaining KPP. Although the system demonstrated the ability to deliver voice communications and position location capabilities to the Soldier level, the program continued to encounter challenges in growing its reliability to the required level despite aggressive efforts to identify and fix issues as they arose. Additionally, the Army changed the approved TES which further increased the risk by executing IOT&E prior to completion of Government DT. Accordingly, the DASD(DT&E) recommended not proceeding to IOT&E. The Army chose to enter into IOT&E, and analysis of the operational test data is still in progress. A comparison of test results will be included in next year's report.

Table 2-8. C-130 AMP (FY 2012)

C-130 AMP / USAF ACAT 1D		
AOTR Recommendation	OTA Report	DOT&E BLRIP
Proceed to IOT&E	***IOT&E in progress***	***IOT&E is suspended pending resolution of FY 2013 budget***

The DASD(DT&E) assessed that the C-130 AMP met six of six KPPs during DT. Although the mission processor instability demonstrated during DT poses moderate risk to favorably completing IOT&E, sufficient mitigations are in place to warrant proceeding to IOT&E. Accordingly, the DASD(DT&E) recommended proceeding into IOT&E, which is still in progress. A comparison of test results will be included in next year's report.

Next steps. Future annual reports will document progress, as needed.

2.5.10 DoD Instruction (DoDI) 5134.17

Background. The DASD(DT&E) prepared a DoD Instruction (DoDI) that assigns responsibilities and functions and prescribes relationships and authorities for the DASD(DT&E).

In FY 2011, the DASD(DT&E) completed the DoD staffing and coordination process for the Instruction. The DoDI 5134.17 was signed by the Acting USD(AT&L) on October 25, 2011.

Responsibilities of the DASD(DT&E) include:

- Develop policies and guidance for planning, execution, integration and reporting of DT&E within DoD.
- Provide advice to SECDEF and AT&L on DT&E matters.
- Provide guidance on TES / TEMP development & review/approve.
- Monitor and review MDAP and MAIS programs on OSD T&E Oversight List.
- Monitor and review pre-MDAP and pre-MAIS programs.
- Serve as Functional leader for T&E acquisition career field.
- Submit Annual Report to Congress (with DASD(SE)).

Authorities of the DASD(DT&E) includes:

- Review and approve TES/TEMP for each MDAP, MAIS and Special Interest program.
- Develop DoD policy for approval and signature by AT&L.
- Communicate directly with heads of DoD Components.
- Have access to all DoD records and data.

Next Steps. No further action is required on this initiative.

2.5.11 T&E Certification Requirements

Background. In the FY 2010 annual report, the DASD(DT&E) discussed modifying the education certification criterion to be on par with the SE requirement. This modification reflects increasing complexity and a DASD(DT&E) efficiency initiative to develop more scientific and statistically based T&E design methodologies.

In the July 5, 2011 memorandum "Change to the Certification Requirements for the Test and Evaluation (T&E) Acquisition Career Field," the DASD(DT&E) as the Functional Leader of the DoD T&E career field changed the education requirements for the T&E career field. Effective October 1, 2012, the T&E career field will require a baccalaureate or graduate degree in a technical or scientific field such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science. The revision will not apply to acquisition workforce members who are currently T&E certified or those encumbering a T&E-designated position on or before September 30, 2012.

Next Steps. No further action is required on this initiative.

2.5.12 Modeling and Simulation (M&S) Steering Committee

Background. In the January 31, 2011 memorandum "Test and Evaluation (T&E) Representation on the Modeling and Simulation (M&S) Steering Committee," the USD(AT&L) designated the DASD(DT&E) as the T&E representative on the M&S Steering Committee. In doing so, the USD(AT&L) recognized that the majority of DoD M&S activities occur during developmental testing.

Next Steps. The DASD(DT&E) is chartering a T&E M&S Working Group. The working group will have representatives from the Military Services and Defense Agencies with participation from industry T&E organizations. The Working Group will begin by developing the T&E M&S Strategic Plan. Future annual reports will document progress, as needed.

3 DASD(DT&E) COMPONENT ASSESSMENTS

For FY 2011, Army, Department of the Navy (DON), Air Force, DISA, and MDA provided self-assessment reports to the DASD(DT&E) based on responsibility for MDAPs and programs on the OSD T&E Oversight List for DT&E.

The Components provided updates to their FY 2010 reports regarding T&E involvement in early acquisition activities, T&E planning and strategic execution, T&E execution, and T&E personnel. In addition, the Components were asked to provide details of the T&E workforce composition to include all categories of T&E personnel.

3.1 Summary of Component Assessments

Over the past fiscal year, the Components reported improvements across the T&E workforce. Several reports specifically cited the DASD(DT&E) as having positive impacts in the T&E community.

The DASD(DT&E) specifically requested the Components to address how their organizations are involved in T&E across the full acquisition life cycle and their T&E involvement in development and review of RFPs. The DASD(DT&E) requested information on the designation of T&E KLPs for MDAP and MAIS programs, the use of DAWDF Section 852 funding in support of the T&E workforce, and any impact to the T&E organizations based on the March 21, 2011, USD(AT&L) memorandum "Reliability Analysis, Planning, Tracking, and Reporting."

The Components provided details of their efforts to attract, develop, retain, and reward their T&E personnel. Even with all the budgetary constraints, the Components reported successful efforts with hiring, awards, training, and bonuses.

Several Component reports conveyed concern to the DASD(DT&E) on the change in the T&E certification requirements. The change does not impact those already certified in T&E. However, the Components are concerned that the requirement may reduce the pool of potential candidates for future hiring especially military personnel with operations experience, and may have other consequences such as inhibiting the ability of personnel to attend DAU training. There were requests to develop a waiver process for highly qualified candidates who do not meet the education requirements. The current DoDI 5000.66, "Operation of the Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program," does not allow waivers for certification. It is the DASD(DT&E)'s position that the change will positively impact the T&E community and the quality of DT&E.

In order to be able to provide a comprehensive assessment of the T&E workforce, the DASD(DT&E) looks at each Component reports on the recruitment, training, and retention of DoD T&E acquisition personnel. It is the DASD(DT&E)'s position that Components should be able to target and hire interns directly into the T&E acquisition career field. Across the Acquisition Workforce, interns are targeted in the career fields of Systems Engineering, Program Management and Contracting. The Components reported certification rates across the T&E workforce. The DASD(DT&E)'s overall goal for certification is 90 percent of the workforce either adequately certified or within the 24-month

window for certification. The current rates are as from the AT&L Workforce Data Mart as of 4th quarter FY 2011:

- Army, 75 percent certified with 95 percent within the 24-month window.
- Air Force, 47 percent certified with 89 percent within the 24-month window.
- DON, 60 percent certified with 86 percent within the 24-month window.
- 4th Estate (includes MDA and DISA), 64 percent certified with 98 percent within the 24-month window

The overall certification rate across the T&E workforce is at 60 percent with 90 percent within the 24-month window. Although this rate meets the overall goal for certification within the 24-month window, it is slightly lower than last year's rate of 93 percent. The DASD(DT&E) will continue to monitor the certification rates and encourage each Component to meet and maintain the 90-percent goal.

The composition of the T&E workforce by Certification Level is shown in Table 3-1. This is based on data provided in the Component Self Assessment Reports and Briefings to the DASD(DT&E). It includes only the T&E coded positions at the Military Departments, MDA and DISA. The majority of the T&E coded positions across the T&E workforce are coded at Level III. The Components, with the exception of the Air Force, described their goals to achieve Level III certifications across their workforce. The Air Force has over 70% of their positions coded at Level II. It is the DASD(DT&E)'s position that achieving Level III training and certification should be a goal for the Components in the management of their T&E workforce positions. The DASD(DT&E) recommends that the Air Force reviews the number of Level II coded positions and take actions to increase the certification level of a majority of those positions.

Table 3-1. T&E Acquisition Workforce Certification Levels

Level	Army	Navy	Air Force	MDA	DISA	Total
Level I	3 %	13 %	13%	0 %	0 %	10 %
Level II	37 %	21 %	71 %	42 %	8 %	39 %
Level III	60 %	67 %	16 %	58 %	92 %	51 %

3.2 DASD(DT&E) Assessment of the Components' Reports

3.2.1 Army

The Army's self-assessment report highlighted the use of the Army Test and Evaluation Command (ATEC) System Team in writing and reviewing the TEMP and TES. The report discussed the Army's Center for Reliability Growth (CRG) in support of March 21, 2011, memorandum "Reliability Analysis, Planning, Tracking, and Reporting." The CRG has developed and presented short courses on a variety of reliability topics. The courses have been made available across the Department.

The Army reported on its efforts with Lean Six Sigma to identify efficiencies across the T&E community while maintaining its strategic vision and keeping a strong T&E workforce.

The Army provided a list to the DASD(DT&E) of the T&E Leads for their MDAP and MAIS programs. The Army currently is tracking 17 T&E KLPs, however the AT&L Workforce Data Mart reports show only 12 Army T&E KLPs. The Army is making efforts to properly code the remaining positions. The Army published a September 2011 memorandum on critical acquisition positions (CAPs) and KLPs that stressed the importance of properly filling KLPs and specifically called out the program lead for T&E.

3.2.2 Department of The Navy (DON)

The DON uses its gate review process and tracks T&E areas closely. The DON noted that in this FY, no T&E workforce/resource deficiencies were identified in gate reviews.

Based on the DON Self Assessment Report, the DASD(DT&E) is concerned about the alignment of T&E within DON systems commands (SYSCOMs). Naval Sea Systems Command (NAVSEA), Space and Naval Warfare Systems Command (SPAWAR), and Marine Corps Systems Command (MCSC) have their T&E personnel and functions aligned within SE organizations. In some cases, the personnel conducting DT&E are not properly coded in T&E acquisition positions. This is in contrast to the Naval Air Systems Command (NAVAIR) model for T&E, which reflects a more rigorous training and comprehensive T&E organizational structure. The DASD(DT&E) prefers a model where T&E is distinct from the SE organization.

A highlight in this year's report is that the Deputy DON T&E Executive continues to lead the DON T&E Enterprise Improvement Process (TEIP) and was named the national lead for the T&E career field for the DON Acquisition Career Field Council. The DON TEIP is developing strategic goals for DON T&E by looking at workforce, policy, infrastructure, acquisition support, and operations.

The DON provided a list of the T&E Leads for their MDAP and MAIS programs. The DON currently has 28 designated T&E KLPs and efforts are being made to properly code the remaining positions. The DON published a September 2011 memorandum on T&E Workforce Improvement and Revitalization that specifically addressed the KLP for T&E. This memo had a positive effect in increasing the T&E KLPs.

3.2.3 Air Force

The Air Force used an existing workforce database to compile comprehensive data on its DT&E workforce. In the past, the data collection for the non-acquisition workforce has been a manual process. The method is automated and will allow for consistent, repeatable data from the Air Force for its self-assessment reports.

It is the DASD(DT&E)'s position that the Air Force Space Community should grow their DT&E workforce and training in order for it to provide a robust government DT&E capability.

The Air Force reported that more than 70 percent of their T&E positions are coded at Level II. It is the DASD(DT&E)'s position that the T&E workforce should target Level III training and certification for the T&E workforce.

The Air Force provided a list of the T&E Leads for their MDAP and MAIS programs. The report stated that the Service Acquisition Executive (SAE) approves all KLPs and that there are no functional KLPs below the grade of general officer (GO) and senior executive service (SES). The KLPs are not specifically assigned to MDAP and MAIS programs. The Air Force currently has six designated T&E KLPs.

3.2.4 Defense Information Systems Agency (DISA)

DISA is using DAWDF Section 852 funding and partnering with the University of Memphis to develop training for T&E of IT systems. Six sessions are planned in FY 2012. The DASD(DT&E) will review results of training and look for opportunities to leverage training in support of the overall T&E workforce, and for the future as policy changes emerge for acquisition of IT systems.

DISA provided a list to the DASD(DT&E) of the T&E Leads for the MAIS programs. DISA assigned T&E leads as KLPs for each of their three MAIS programs. DISA will review all positions during their FY 2012 review of all T&E acquisition positions. This review is typically done every three years to ensure that positions are in line with the position classification document for T&E.

3.2.5 Missile Defense Agency (MDA)

MDA completed its base realignment and closure (BRAC) move from the National Capital Region to Huntsville, Alabama, with minimal impact on the T&E workforce. Although MDA did lose some experienced personnel, all vacancies have been filled.

MDA has successfully used DAWDF Section 852 funding to support salaries, recruitment, and student loan repayment benefits. MDA hires interns through the Missile Defense Career Development Program. Although the interns are hired into the SE organization, the MDA T&E organization has been able to convert several interns into T&E positions.

During a re-organization, the analysis and evaluation functions were moved from the T&E organization into the SE organization. It is DASD(DT&E)'s position that T&E functions should be performed by T&E workforce members.

MDA has test functional leads for each of the eight Ballistic Missile Defense System (BMDS) elements; however, these positions are not currently designated as T&E KLPs. MDA is in process of formalizing these positions as T&E KLPs. Currently the personnel filling the positions are T&E Level III certified, and the roles and responsibilities for these positions are already in line with the requirements for the program lead for T&E KLP.

3.3 T&E Workforce

3.3.1 T&E Workforce Summary

Over the last three years, the DASD(DT&E) has requested data on the entire T&E workforce. In previous years, there were limitations to the data. The Components used manual methods to collect the data and the data was not all-inclusive. Particularly in FY 2010, the data did not fully represent the T&E personnel conducting testing at test centers and ranges.

The data collected in FY 2011 represents the most comprehensive and complete data on the T&E workforce to date. The data requested was categorized as follows:

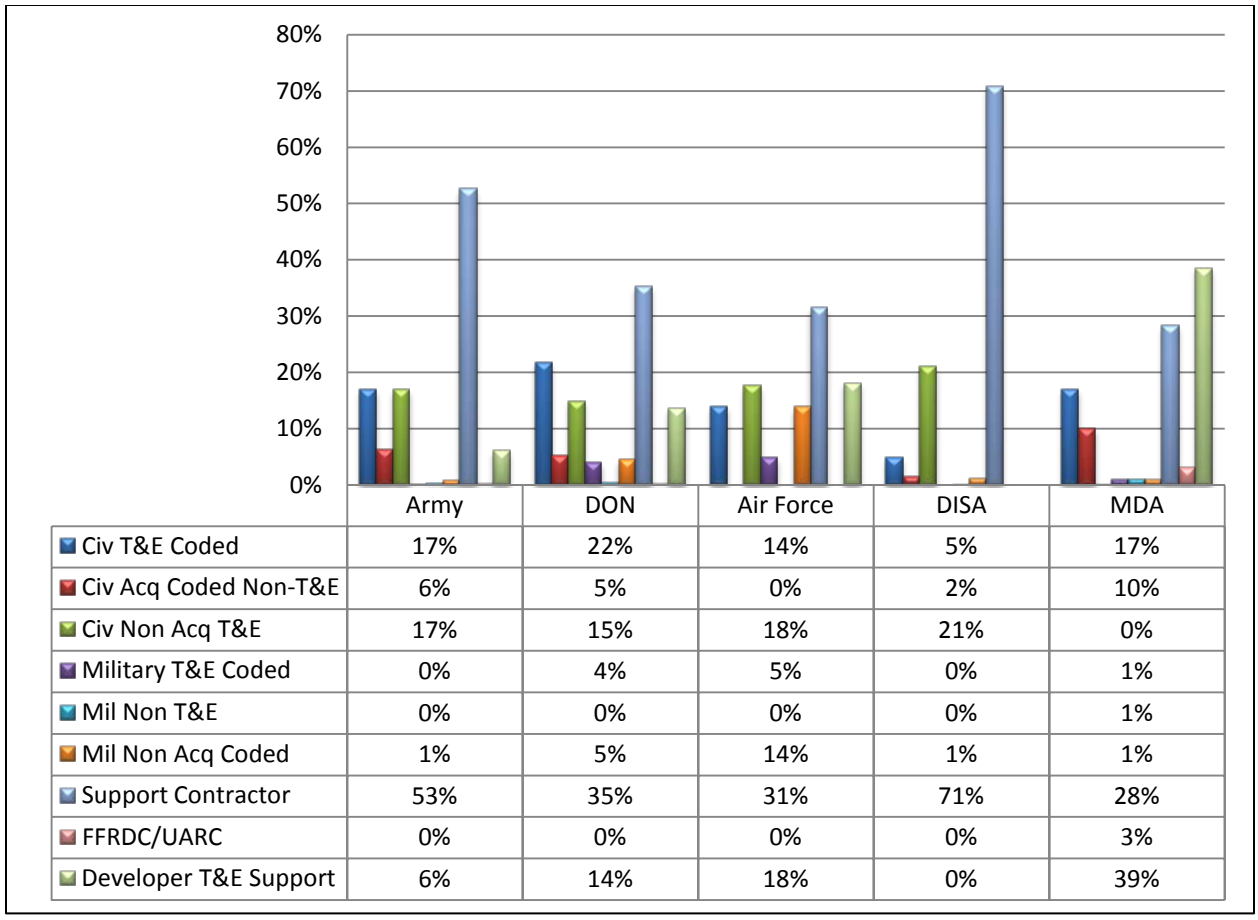
Military and Civilians

- T&E Coded.
- Acquisition Coded Non–T&E.
- Non-Acquisition Coded.

Additional T&E Support

- Support Contractors.
- Federally Funded Research and Development Center (FFRDC)/University Affiliated Research Center (UARC).
- Developer T&E Support.

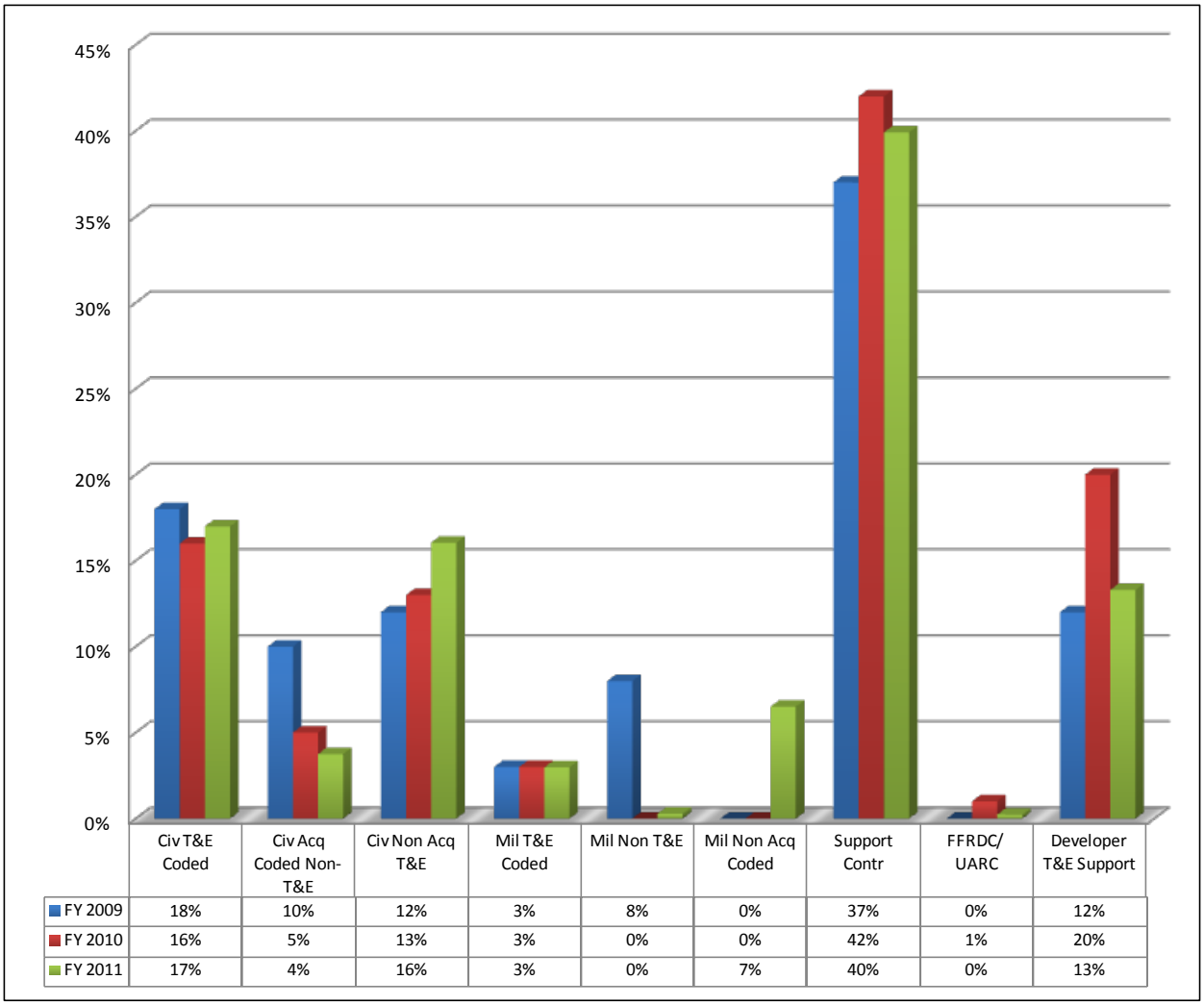
Figure 3-1 shows the composition of the T&E workforce based on the data received for the FY 2011 Component self-assessment reports. With the baseline established, the DASD(DT&E) can evaluate the composition of the T&E workforce and work with the Components in developing short and long strategies for an optimum balance of the T&E workforce. This balance should take into account strategies for enhancing the organic (civilian and military) T&E workforce.



	Army	DON	Air Force	DISA	MDA
Civ T&E Coded	17%	22%	14%	5%	17%
Civ Acq Coded Non-T&E	6%	5%	0%	2%	10%
Civ Non Acq T&E	17%	15%	18%	21%	0%
Military T&E Coded	0%	4%	5%	0%	1%
Mil Non T&E	0%	0%	0%	0%	1%
Mil Non Acq Coded	1%	5%	14%	1%	1%
Support Contractor	53%	35%	31%	71%	28%
FFRDC/UARC	0%	0%	0%	0%	3%
Developer T&E Support	6%	14%	18%	0%	39%

Figure 3-1. FY 2011 T&E Personnel Breakdown

The data shows a reliance on support contractors and developer T&E support. It shows that non-Acquisition coded and non-T&E coded personnel are still the major contributors to the T&E activities. For FY 2011, the DASD(DT&E) requested the Components to provide data in several additional categories and the data receive for this report represents the most comprehensive data to date on the full T&E workforce.



	Civ T&E Coded	Civ Acq Coded Non-T&E	Civ Non Acq T&E	Mil T&E Coded	Mil Non T&E	Mil Non Acq Coded	Support Contr	FFRDC/ UARC	Developer T&E Support
FY 2009	18%	10%	12%	3%	8%	0%	37%	0%	12%
FY 2010	16%	5%	13%	3%	0%	0%	42%	1%	20%
FY 2011	17%	4%	16%	3%	0%	7%	40%	0%	13%

Figure 3-2. Comparison of T&E Workforce Data FY 2009–FY 2011

The comparison (Figure 3-2) across the past three FYs shows consistency in the percentages across the T&E workforce. In FY 2011, the percentage of organic T&E resources (civilian and military T&E coded) is down to 20 percent of the overall T&E workforce while support contractors and developer T&E support are over 50 percent.

The DASD(DT&E) will continue to assess the full complement of DT&E resources. As noted in the FY 2010 annual report, the DASD(DT&E) is responsible for DT&E, and the full DT&E workforce is much larger than the acquisition-coded T&E personnel. The full T&E workforce includes personnel supporting all aspects of the DT&E mission beyond the acquisition-specific areas. The personnel provide critical expertise in support of the DT&E mission and the success of DT&E across the Department but are not currently part of the acquisition workforce but are not currently part of the acquisition workforce because their position is not in the defined criteria for the acquisition workforce.

Table 3.2. T&E Acquisition Workforce Comparison, FY 2010 and FY 2011

	FY 2010			FY 2011			Difference
	Civilian	Military	Total	Civilian	Military	Total	
Army	2,285	19	2,304	2,253	45	2,298	-6
DON	2,542	458	3,000	2,550	472	3,022	22
Air Force	1,592	1,246	2,838	1,691	1,245	2,936	98
4th Estate*	304		304	317		317	13
TOTAL	6,723	1,723	8,446	6,811	1,762	8,573	127

* Includes T&E at Components other than the Military Departments. Military personnel are tracked by their parent Military Department.

Table 3.2 shows the T&E workforce comparison between FY 2010 and FY 2011. During FY 2011, there was an increase of 127 T&E positions. T&E workforce data was extracted from the AT&L Workforce Data Mart. This data corresponds to the data provided in the Component Self Assessment reports.

3.3.2 Key Leadership Position (KLP)

Background. In the August 25, 2010, memorandum "Government Performance of Critical Acquisition Functions," the USD(AT&L) identified KLPs for all MDAP and MAIS programs. The Program Lead for T&E was included in the mandatory list of positions when the function is required based on phase or type of acquisition program. In FY 2010, the Components reported that they were implementing the memorandum at the Component level. Table 3.3 shows the number of KLPs by Component as of the 1st quarter of FY 2012, per the AT&L Workforce Data Mart.

Table 3.3. T&E Key Leadership Positions

4th Estate*	Army		DON		Air Force		Total
Civilian	Civilian	Military	Civilian	Military	Civilian	Military	
3	10	2	27	1	3	3	48

* Military personnel are tracked by their parent Military Department.

In FY 2011, the DASD(DT&E) found that not all MDAP and MAIS programs have assigned T&E KLPs. Based on the data from the Components, there are KLPs assigned to less than 30% of MDAP and MAIS programs at this time. The DON and the Army published memorandums in September 2011 to address KLPs across the acquisition workforce. This guidance is expected to result in higher numbers of T&E KLPs in these Components. The Air Force stated that KLPs are managed at the Component Acquisition Executive level and are only assigned to GO and SES. MDA is working to properly code the test functional leads for the BMDS appropriately as KLPs. DISA has coded the KLPs for their MAIS programs.

Subsequently, the FY 2012 NDAA mandated support of MDAPs by Chief Developmental Tester. The Chief Developmental Tester is responsible for:

a) Coordinating the planning, management and oversight of all developmental test and evaluation activities for the program;
b) Maintaining insight into contractor activities under the program and overseeing the test and evaluation activities of other participating government activities under the program; and
c) Helping program managers make technically informed, objective judgments about contractor developmental test and evaluation results under the program.

The Program Lead for T&E will be referred to as the Chief Developmental Tester in all future reports.

Next Steps. The DASD(DT&E) will continue to monitor the progress of the Components in designating Chief Developmental Testers as T&E KLPs for MDAP and MAIS programs. The DASD(DT&E) will update requirements and training curriculum to ensure that Chief Developmental Testers are properly qualified. Future annual reports will document progress, as needed.

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4 DASD(DT&E) PROGRAM ASSESSMENTS

The DASD(DT&E) is reporting on 39 MDAP, MAIS, and special interest programs that have reached a significant milestone or had significant DT&E activities in FY 2011. Significant test events include AOTRs, first flight, completed system integration lab testing, completed ground testing, and initiation of DT&E. Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011).

The assessments are organized by military department (Army, Department of the Navy, and Air Force), followed by DoD programs.

None of the programs reported in this report has requested a deviation or a waiver from the TEMP. Assessments of the organization and capabilities of the military departments, DISA, and MDA for developmental test and evaluation are reported in Section 3, DASD(DT&E) Component Assessments.

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4.1 DASD(DT&E) Assessments of Army Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries on the following 11 programs:

- Apache Block III (AB3)
- Global Combat Support System–Army (GCSS-A)
- Increment 1 Early–Infantry Brigade Combat Team (E-IBCT)
- Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)
- M109 Family of Vehicles, Paladin Integrated Management (PIM) Self-Propelled Howitzer and Carrier, Ammunition, Tracked Vehicle
- MQ-1C Increment 1 Gray Eagle Unmanned Aircraft System (UAS)
- Nett Warrior (NW)
- PATRIOT
- Stryker Family of Vehicles – Double-V Hull (DVH)
- Stryker Mobile Gun System (MGS)
- Warfighter Information Network–Tactical (WIN-T) Increment 2

Apache Block III (AB3)

Executive Summary: The Apache Block III (AB3) is a twin engine, four bladed, tandem seat attack helicopter with 30mm cannon, 2.75" rockets, laser and Radio Frequency (RF) Hellfire missiles. It is intended to provide the capability to simultaneously conduct (or quickly transition between) close combat, mobile strike, armed reconnaissance, security and vertical maneuver missions across the full spectrum of warfare from Stability And Support Operations (SASO) to Major Combat Operations (MCO) when required in day, night, obscured battlefield and adverse weather conditions.

The program entered the Production and Deployment phase in September 2010 with IOT&E scheduled for March 2012. The AB3 program continued developmental testing in FY 2011 in preparation for IOT&E. Several critical test events were delayed until FY 2012 but should be complete in time to support IOT&E. The DASD(DT&E) will conduct an AOTR during FY 2012 to provide an independent readiness assessment for IOT&E.

Summary of FY 2011 DT&E Activities

- OSD approved the TEMP in August 2010 and the AB3 developmental test plans were developed consistent with the approved TEMP.
- The program completed nearly 300 Flight Hours in FY 2011 and key developmental testing activity included environmental, avionics, and performance.
- The program tracked developmental flight hours and implemented corrective actions consistent with their reliability growth plan. Reliability data was used to prepare for the final scoring conference in 1st quarter FY 2012.
- Live Fire Test and Evaluation in support of the Force Protection and Survivability KPPs was completed in FY 2011.
- In response to problems with fit, cord placement, and field of view, the program redesigned and tested the Integrated Helmet and Display Sight System.
- The program conducted testing with the weapons systems including the gun, rockets, and Fire Control Radar.
- Testing for handling qualities, helicopter performance, and interoperability certification were delayed into FY 2012 for various reasons but the majority should be executed in early 2012 prior to IOT&E.
- Interoperability testing between AB3 and the Gray Eagle Unmanned Aircraft System (UAS) was completed in two phases culminating in early FY 2012 with dynamic in-flight testing of all tasks up to weapons launch.
- Due to development issues with the capability in both the AB3 and Gray Eagle programs, the final piece of interoperability testing with the Gray Eagle UAS (end to end engagement with weapons launch) was delayed until IOT&E.

Summary of FY 2011 DT&E Assessments

- The DASD(DT&E) assesses that AB3 is currently meeting 2 of 5 KPPs, but due to test delays the program is at risk of not fully demonstrating the remaining KPPs prior to IOT&E.
- Performance testing to date shows the desired increase in power and capability and AB3 has realized improvements in reliability.
- The AB3 reliability point estimate is slightly below the reliability growth curve with a demonstrated reliability of 16.7 hours Mean Time Between Failure (Mission). The threshold KPP reliability requirement is 17 hours; but this requirement is not required to be fully satisfied until Lot 4 (2014). A supporting measure, and an IOT&E entrance criteria, Mean Time Between Essential Maintenance Actions (MTBEMA), has realized significant improvement. The AB3 MTBEMA increased to a total combined value of 2.36 hours, meeting the IOT&E entrance criteria of 2.3 hours. This recent improvement trend should continue as many of the failure modes in the MTBEMA measure are driven by legacy components and should improve with the production aircraft. Given the improvement in reliability, the AB3 system is at low risk of not meeting the availability requirements or reliability KPPs during the IOT&E
- Due to the schedule slip to Phase II UAS interoperability testing the program will not demonstrate an end to end engagement with weapons launch prior to IOT&E.

Global Combat Support System–Army (GCSS-A)

Executive Summary: Global Combat Support System–Army (GCSS-A) is a Major Automated Information System and critical enabler of the Army's logistics domain IT transformation. The system is being delivered in a series of increments that use Enterprise Resource Planning (ERP) software products. The enterprise system uses Web-based capability to provide users with access to tactical maintenance, materiel management, property accountability, tactical financial management, and other related operational data to improve situational awareness and facilitate decision-making. GCSS-A will allow the Army to replace 11 Logistics Information Systems (LIS)/Standard Army Management Information Systems (STAMIS) applications, distributed in tactical and garrison environments across the Army, with a single, integrated system to modernize tactical logistics processes. GCSS-A successfully completed DT for Release 1.1 and the EMD phase in 4th quarter FY 2011. The program entered the PD phase with an OT phase beginning in 4th quarter FY 2011.

Summary of FY 2011 DT&E Activities

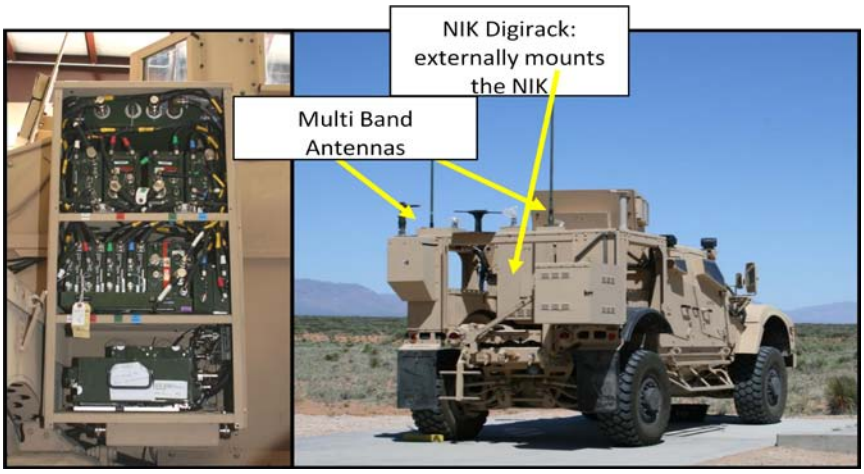
- The program completed all DT of Release 1.1 of Increment 1 in support of the MS C decision in August 2011.
- The Product Management Office conducted an independent Government test of the GCSS-A solution during September and October 2010. Soldiers and military technicians skilled in diverse areas of Army logistics performed on-site test duties.
- ATEC conducted an independent limited user test (LUT) in August - November 2010 followed by a DT to resolve issues.

Summary of FY 2011 DT&E Assessments

- DT&E execution is on track in accordance with the OSD-approved TEMP.
- Independent Government Test (IGT). The system demonstrated a 94 percent pass rate of the 96 business process (BP) test cases conducted during the IGT. The BP test cases covered six critical mission threads, 100 percent of the applicable 24 critical mission functions, and 102 critical BP models associated with those threads.
- Post-LUT Contractor and Government Testing. The program demonstrated improved usability, training, and information assurance (IA); fixed numerous software issues; and developed plans to mitigate the satellite latency issue and compliance certifications for the Business Enterprise Architecture, Standard Financial Information Structure, and Federal Financial Management Improvement Act.
- The DASD(DT&E) recommended approval of the MS C acquisition decision and entrance to IOT&E in 1st quarter FY 2012.
- The DASD(DT&E) assessed the test strategy post-MS C as moderate risk to support the full-rate production (FRP) decision in 3rd quarter FY 2012.

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

(Formerly Known as Spin Out 1 from Future Combat Systems (FCS))



Executive Summary: Increment 1 E-IBCT contained multiple systems designed to support tactical operations—offensive, defensive, stability, and support—conducted by light infantry forces. Unmanned remote ground sensors, an unmanned air sensor, and a small unmanned ground surveillance vehicle extend the range of current soldier capabilities without placing soldiers at risk, and a vehicle-borne network integration system enhances communications between company commanders and the various operators and sensors. The Army intended the Increment 1 systems to enhance brigade intelligence, surveillance, and reconnaissance, precision indirect fires, and command and control capabilities.

In January 2011, the Army decided to cancel 3 of the 5 Increment 1 E-IBCT systems (the two unmanned ground sensors and the unmanned aerial sensor) and requested approval for continued Low Rate Initial Production (LRIP) of the Small Unmanned Ground Vehicle (SUGV) and the Network Integration Kit (NIK). A February 2011 Acquisition Decision Memorandum approved continued LRIP for two additional brigade sets of the SUGV and directed the Army to consider any additional SUGV production under a separate Army program. The ADM also approved continued LRIP for one additional brigade set of the NIK recognizing the NIK would be subjected to additional testing and should only be fielded if testing showed it could improve current BCT capabilities. The NIK completed developmental and operational test events in preparation for a fielding decision in July 2011.

The DASD(DT&E) reviewed the developmental test plan for the NIK, identified multiple risks areas, and made several recommendations to improve the testing; the program adopted many prior to test execution. DASD(DT&E) reviewed and analyzed developmental test data and identified risk areas for operational test and fielding. Test results supported entering a Limited User Test (operational testing), but highlighted several limitations. As a result of the testing, the Army decided to cease LRIP and directed that previously produced units remain with the 2d Brigade, 1st Armor Division at Ft Bliss, Texas, in order to support further requirements definition and testing of network capabilities.

Summary of FY 2011 DT&E Activities

- Increment 1 E-IBCT systems completed developmental testing in October 2010, followed by a Limited User Test (LUT), using developmental systems, operational units and realistic operational scenarios) in November 2010. Results of the testing indicated improvement in reliability, but with the exception of the SUGV, they also indicated poor military utility and little contribution to operational task success.
- In February 2011, OSD directed that the NIK complete additional developmental and operational testing using OSD-reviewed plans, and report test results to OSD before fielding.
- The DASD(DT&E) reviewed the E-IBCT integrated test plan, and identified multiple issues with the overall robustness of the NIK testing (voice testing ranges and mobility, NIK startup realism, network mobility, and data collection similarity to previous testing). The Army updated test plans and execution, incorporating many of the DASD(DT&E) recommendations and completed testing in May 2011.
- The DASD(DT&E) reviewed and analyzed the test data, and provided an assessment of those results to the Army prior to the NIK LUT.

Summary of FY 2011 DT&E Assessments

- The DASD(DT&E) review and analysis of the test data identified risks to LUT success and operational fielding. Primary issues included:
  - Network success relied on very specific and benign conditions of network operations
  - Potential unresolved issues in network radio or component performance (indicated by contradictory performance in packet completion rates during otherwise strong message completion)
  - Conditions when voice radios might not achieve the same performance as legacy voice radios
  - Incomplete resolution of startup issues, with a potential for 20% of the startups to experience failures
  - Lagging development and implementation of NIK software components provided by other programs, such as the waveform, radio software, and network manager

- The Army completed the NIK LUT in July 2011. Results were similar to those identified by the DASD(DT&E) assessment; the Army elected to cancel remaining LRIP, and not field the NIK. The remaining radios will be retained in the Brigade Modernization Command at Ft Bliss, TX to support ongoing network development, requirements review, network integration exercises and other program developmental and operational testing.

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

Executive Summary: The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) is to provide elevated, persistent, over-the-horizon surveillance and fire control quality data on Army and joint networks to enable protection of U.S., allied, and coalition forces as well as critical geopolitical assets from cruise missiles and aircraft, unmanned aerial vehicles (UAVs), tactical ballistic missiles (TBMs), large caliber rockets, and surface moving targets. JLENS is a part of the Army's future integrated air and missile defense (IAMD) architecture and is a joint Service interest program.

The JLENS DT&E program experienced further delays in 2011 and was descoped. Current and future T&E is affected by the uncertainty in the future of the JLENS program. One scenario is completion of the program of record resulting in low-rate initial production (LRIP), FRP, and full operational capability. The second scenario eliminates program funding starting in FY 2012, and the third scenario is to enter an operational exercise prior to an LRIP decision. Each scenario represents different optimal T&E strategies.

Summary of FY 2011 DT&E Activities

- October 2011, completed contractor functional verification T&E of the surveillance radar system (SuS) and fire control radar system (FCS).
- November 2011, initiated Government DT&E.

Summary of FY 2011 DT&E Assessments

- The JLENS program has been without a current TEMP since 2008. A draft TEMP is in development that, if executed, will provide adequate information to assess readiness to enter LRIP, IOT&E, FRP, and full operational capability. However, it is unlikely JLENS will execute to the TEMP.
- The initial phase of Government DT&E slipped another 5 months from June 2011 to November 2011 due to system performance. This DT&E phase was not performed as planned. The DT&E duration was reduced from 12 to 5 weeks, had extremely limited schedule flexibility, and did not assess system-level capability of a JLENS orbit (FCS and SuS). Only the FCS capability was assessed. The SuS is being used to develop secondary mission capability in support of acceleration.
- The system entered DT&E with reliability less than the goal to meet reliability growth requirements. The estimated reliability prior to entering DT&E was approximately 15 hours mean time between system abort (MTBSA). The goal was to enter DT&E with 70 hours MTBSA.

M109 Family of Vehicles, Paladin Integrated Management (PIM) Self-Propelled Howitzer and Carrier, Ammunition, Tracked Vehicle

Executive Summary: The PIM program consists of two individual platforms, a Self-Propelled Howitzer (SPH) and a Carrier, Ammunition, Tracked (CAT) vehicle. The SPH is an aluminum armored, full-tracked 155mm self-propelled howitzer, capable of carrying a minimum of 39 projectiles and a minimum of 31 Modular Artillery Charge System (MACS) canisters. The CAT supplies the SPH with ammunition as it provides tactical and operational fires during both offensive and defensive operations. The CAT will be capable of carrying a 12,000-pound (5,454 kg) ammunition payload, and can be configured for various ammunition needs and specifications. Both the SPH and CAT incorporate a newly designed hull, a modified Bradley Fighting Vehicle (BFV) power train and suspension system, the future BFV track, a modernized 600 volt electrical system, and an improved microclimatic conditioning system (MCS) intended to improve sustainability over the current Paladin/FAASV fleet. The SPH also includes an automated fire control system

The primary mission area for PIM is Force Application-Engagement. PIM supports Combined Arms Maneuver (CAM), Wide Area Security (WAS), and other full spectrum operations as part of the land component of a Joint Task Force (JTF). PIM is normally employed as part of a Fires Battalion in the HBCT and the Fires Brigades (FiB) but is fully capable of supporting any BCT. Targets include full range of materiel, personnel, and structures.

As an ACAT II program, the Army Acquisition Executive approved entry into Engineering and Manufacturing Development in September 2009. As a result of program restructure and cost increases, USD(AT&L) designated PIM an ACAT ID program in April 2011. Requirements changes necessitated modifications to the SPH design as well as the test strategy in the TEMP. In FY 2011, the program completed most of the first phase of a three phase DT plan in accordance with the draft TEMP.

Summary of FY 2011 DT&E Activities

- As a result of the April 2011 DAB, the program continued to update the draft TEMP to account for changes to the survivability and force protection Key Performance Parameter. These KPP changes drove design modifications to the SPH hull and the test strategy. As a result, TEMP development and subsequent OSD approval was delayed until 2nd quarter FY 2012.
- DT started in May 2011 at Yuma Proving Ground and Aberdeen Proving Ground in accordance with the draft TEMP and Army Test and Evaluation Command Detailed Test Plans.

- During FY11, the program completed most of its first phase of DT. This phase used five prototype SPH platforms and two prototype CAT platforms to conduct the first of a five segment SPH reliability growth program, SPH firing performance, 4000 miles of automotive operations on the prototype SPHs and a 2,400 mile RAM demonstration conducted on the prototype CATs.

Summary of FY 2011 DT&E Assessments

- During FY 2011, the program completed the first of a five segment SPH reliability growth program where the SPH demonstrated reliability of 45 hours Mean Time Between System Abort versus the 50 hours projected on the Reliability Growth Curve. We expect that the program will be able to make up the shortfall between the demonstrated and projected reliability in subsequent segments of the reliability program.
- To date, the program has executed an aggressive test program driven by concurrency in prototype design and development, testing, and changes in user requirements.
- The program's Production and Deployment (P&D) phase has an aggressive, highly concurrent program schedule leading to IOT&E in FY 2016 and the FRP decision in January 2017. The P&D test strategy includes concurrent test activities across the First Article Test (FAT), Production Qualification Test (PQT), and IOT&E . This overlap impacts the test data available from FAT and PQT to inform the readiness of the program to enter IOT&E as well as the ability of the program to respond to test incidents.
- The DASD(DT&E) recommends that the Army develop a lower risk P&D test schedule that minimizes concurrence such that results from FAT and PQT are available to inform the IOT&E readiness reviews. The Army should include this update as part of the MS C TEMP.

MQ-1C Increment 1 Gray Eagle Unmanned Aircraft System (UAS)

(Formerly known as the MQ-1C Extended Range / Multi-Purpose UAS)

Executive Summary: The MQ-1C Gray Eagle UAS consist of Unmanned Aircraft (UA), each equipped with multi-mission payloads, ground control stations, portable ground control stations, and the appropriate communication systems and data terminals. It is intended to provide dedicated mission configured UAS support to assigned Division Combat Aviation Brigade, Fires Brigade, Battlefield Surveillance Brigade, Brigade Combat Teams, and other Army and Joint Force units. The MQ-1C Gray Eagle UAS company executes Reconnaissance, Surveillance, Security, Attack, and Command and Control missions. The UA threshold payload is an Electro-Optical/Infrared sensor with a Laser Range Finder / Laser Designator. Each UA may be equipped with up to four HELLFIRE missiles.

The MQ-1C Gray Eagle program entered the Production and Deployment Phase in February 2010 resulting in LRIP for two MQ-1C Gray Eagle systems. Poor reliability across all major subsystems led to delays in the IOT&E and resulted in a second LRIP decision in March 2011 for two additional systems. Continuing program delays coupled with an air vehicle crash in March 2011 resulted in another delay to IOT&E from October 2011 to August 2012 and a third LRIP decision is scheduled for 3rd quarter FY 2012. The DASD(DT&E) will prepare an AOTR to support the IOT&E.

Summary of FY2011 DT&E Activities

- The Army is updating the TEMP to support the IOT&E and the Full Rate Production decision. It is scheduled for completion in February 2012.
- Gray Eagle continued developmental testing during FY 2011 including software Formal Qualification Test (FQT) and Engineering Development Test (EDT) to support Production Prove-out Test – 2 (PPT-2). The program also completed Electromagnetic Effects testing (January 2011), communications demonstration testing (January 2011), transportation & mobility testing (July to November 2011) and Functional Verification Test (October 2011).
- As a result of an UA crash in March 2011, flight testing was suspended. Flight testing resumed in June 2011, but resulted in fewer flight hours available to demonstrate system level performance. A combination of test delays and delays in system development led to a further delay in IOT&E to 4th quarter FY 2012.

Summary of FY 2011 DT&E Assessments

- The DASD(DT&E) assess that Gray Eagle is currently meeting 3 of 7 KPPs. In addition, Gray Eagle system reliability continues to fall short of predicted growth.
- To support the second LRIP decision in March 2011, the DASD(DT&E) assessed system performance and identified that the system was not on path to meet the sustainment and reliability requirements prior to IOT&E. The DASD(DT&E) recommended that IOT&E be conducted only when the system demonstrates adequate readiness and satisfies IOT&E entrance criteria.

- The most recent phase of developmental testing, PPT-2, showed that system reliability continues to fall short of the predicted growth; the Ground Control Station demonstrated reliability of 27 hours Mean Time Between System Abort (MTBSA) versus the required 300 hours; the Unmanned Aircraft demonstrated 25.1 hours MTBSA versus the required 100 hours; and the sensor payload demonstrated 133.8 hours MTBSA versus the required 250 hours.
- Software and hardware changes implemented to improve reliability have not been fully demonstrated and the DASD(DT&E) remains concerned that there is not adequate time between test events to implement corrective actions needed to achieve the required reliability.
- The transportation mobilization testing revealed problems with the UA and other Gray Eagle ground support equipment shipping containers resulting in one UA to be non-mission capable when unpacked. The testing has not fully demonstrated the ability to transport the Gray Eagle System in a combat simulated terrain environment on its projected vehicle platform with B-kit armor package added.
- Anomalies were noted during the Electromagnetic Effects testing and highlighted that antenna emplacement on the UA and electromagnetically noisy tail servos may interfere with the ARC-201 radios.
- During the Communications Demonstration Test, the ARC 231 and 201 radios continue to demonstrate problems with transmission / re-transmission of communications over distance in standard and relay modes while using secure voice and video.
- The Gray Eagle acquisition strategy includes concurrent development, testing, and fielding. This concurrency precludes the program from conducting developmental testing on a stable configuration, identifying deficiencies, and implementing corrective actions needed to improve reliability and system performance.
- The DASD(DT&E) recommends that the IOT&E be conducted only when the system demonstrates adequate readiness and satisfies the IOT&E entrance criteria.

Nett Warrior

Executive Summary: The Nett Warrior soldier ensemble (formerly Ground Soldier System, GSS) is intended to support soldier teams in all tactical operations—offensive, defensive, stability, and support—that are currently conducted by light infantry forces. The Army intends the Nett Warrior system to enhance small-unit effectiveness, and allow leaders to apply combat power more efficiently. Nett Warrior systems originally included a handheld radio using the Enhanced Position Location Reporting System (EPLRS) waveform, associated batteries and software, a headset, eyepiece and display device, a processor, a handheld device for display/information changes, a GPS receiver and all associated cabling, antennas and software. The program also included all necessary support equipment (battery chargers, vehicle integration equipment, software and programming data transfer devices, etc).

Following Developmental Test completed in October 2010, Net Warrior conducted a Limited User Test (LUT) in November 2010 on three competing systems. This testing identified some situational awareness capabilities, but also identified multiple deficiencies, including poor reliability, poor voice communication, and weight and light emissions limitations. The testing included significant limitations in assessing KPPs (see DASD/DT&E memorandum dated July 5, 2011), due to limitations in total system employment. The DASD(DT&E) recommended the program complete additional DT&E to correct the deficiencies prior to production source selection (MS C LRIP) planned for August 2011. The program office developed a sound DT&E plan across all competing vendors which addressed the deficiencies and would have completed the testing prior to source selection. However, before the testing completed, the Army directed the program away from the EPLRS-based system to a Rifleman Radio (a Joint Tactical Radio System handheld radio using the Soldier Radio Waveform, SRW), headset, and a commercially-available Smartphone.

The Smartphone uses cables and "back-end" software developed by the Joint Battle Command-Platform (JBC-P) program to connect to the Rifleman Radio and adds Soldier applications in order to provide position and display capabilities; the new configuration also allows hands-free operations using a soft-sided chest pouch. Moving to the Smartphone eliminated multiple components and cables; the reduced overall weight allows the soldier to carry an extra Rifleman Radio battery that extends the life of the Smartphone, while still achieving significant weight savings. The Army included the newly-designed Nett Warrior system in the November 2011 Network Integration Evaluation (NIE) and assessed system capability using soldier interviews. The DASD(DT&E) is concerned that there will be insufficient information to support a LRIP decision (tentatively scheduled for February 2012), and therefore recommends completion of more robust testing on the new system design prior to the LRIP decision.

Summary of FY 2011 DT&E Activities

- Following DT completed in October, the program completed a LUT in November 2010 (using developmental systems, operational units and operationally realistic test scenarios) and reported system capabilities and deficiencies in February 2011.
- The program TEMP was signed in November 2010, with updates planned for January 2012.
- From February to June, the Nett Warrior vendors completed their corrective action analysis and recommendations, implemented design changes, and planned for Contractor Verification System Testing (CVST) to be conducted in July – August 2011.
- CVST began as scheduled in July, and the DASD(DT&E) observed the first of three contractors conducting their testing.
- Before completion, the Army cancelled CVST and announced that the program would be pursuing new requirements, as well as changing their approach to achieving the system capabilities.
- In August 2011, the Army approved changes to the requirements document and the new configuration (Smartphone and Rifleman Radio), documented in a memorandum on October 5, 2011. Due to the significant cost savings associated with the changes, the Army plans to request delegation of acquisition authority to the Service as a projected ACAT II program.
- In October 2011, the Army briefed the Test & Evaluation Working Integrated Product Team (T&E WIPT) on program changes and updates, including requirements updates, an outline of the new system and a proposed new test and acquisition strategy. The briefing included plans for NIE participation in November 2011, a TEMP update in December 2011, TEMP approval in January 2012, and a proposed LRIP decision in February 2012. Future events would include developmental testing in FY 2012, followed by IOT&E in early FY 2013.

Summary of FY 2011 DT&E Assessments

- To support the original MS C decision, the DASD(DT&E) assessed the test data and recommended the program complete additional DT&E to correct noted deficiencies including problems with voice communications, reliability, and light discipline prior to LRIP source selection.
- CVST planning and testing in July 2011 included solid and stressing test conditions to prove out the fixes to previously identified deficiencies.
- The move from a multi-component ensemble to a Smartphone and Rifleman Radio appears to be promising as it reduces complexity, cabling and weight (all of which detracted from soldier mobility during previous testing).
- The program does not have an approved T&E strategy to support the new system configuration and emerging acquisition strategy.
- Assessing Nett Warrior systems in the NIE (via Soldier interviews and observations) has value in determining the utility of the new configuration, but is inadequate on its own to support a crucial decision such as LRIP.
- The program plans to augment the Nett Warrior NIE feedback with data from other events on Nett Warrior components in similar configurations.
- The Army's proposed strategy for developmental and operational testing in 2012-2013 to support the Full-Rate Production (FRP) Decision appears reasonable, at least to the extent that such planning has been accomplished. The T&E WIPT has significant work ahead to turn the concept into a detailed T&E strategy properly documented in a TEMP.
- The DASD(DT&E) recommends the Nett Warrior program proceed with 2012 development, DT and OT planning. DASD(DT&E) recommends a delay in the LRIP decision until sufficient information concerning Rifleman Radio and Nett Warrior capabilities is determined using objective test results and analysis.

PATRIOT

Executive Summary: The PATRIOT program consists of software and hardware upgrades to respond to the evolving threat, component obsolescence, and deficiencies identified in the field. Software upgrades are being accomplished incrementally in a series of post-deployment builds (PDBs). The PATRIOT Missile Segment Enhancement (MSE) program is a hardware subprogram that was within the PATRIOT/ Medium Extended Air Defense System (MEADS) Combined Aggregate Program (CAP). The United States is limiting MEADS activities to a "proof of concept" effort and not procuring MEADS. The PATRIOT program completed all DT&E planned in support of MSE of the PDB-7 efforts. However, approximately nine out-year MSE flight tests were lost due to the MEADS decision, and appropriate replanning is being accomplished to assess the Patriot Advanced Capability-3 (PAC-3) MSE capability.

Summary of FY 2011 DT&E Activities

- December 16, 2010, successfully completed solid rocket motor (SRM) qualification.
- January 2011, contractor verification T&E identified deficiencies in PDB-7 software development requiring disposition prior to entering Government DT&E.
- March 2, 2011, successful PAC-3 MSE intercept of a TBM target in the extended battle space.
- May 2011, completed contractor verification T&E of the PDB-7 software development requiring disposition prior to entering Government DT&E.
- July–November 2011, executed DT&E of PDB-7.

Summary of FY 2011 DT&E Assessments

- A TEMP update for PDB-7 was approved in September 2011. This update provides adequate T&E planning up to the MSE LRIP decision. The Army is required to provide an update identifying the required PDB-8 and MSE T&E to support an MSE FRP decision. PDB-8 and MSE T&E were originally planned to be executed as part of the PATRIOT/MEADS CAP, but the descoping of the MEADS program leaves a gap in PATRIOT MSE missile flight T&E.
- The SRM qualification - T&E validated root cause analysis and test item corrective actions. The successful completion provides confidence in survivability of the SRM across the full spectrum of PATRIOT environments. However, the long-term corrective action will focus on incorporating modifications to existing tooling prior to fabricating MSE SRMs. DT&E is required to validate fabrication processes in future MSE SRMs.
- Initial contractor verification - DT&E identified deficiencies in PDB-7 software development that required disposition prior to entering Government DT&E. The software reentered development and completed verification DT&E prior to entering Government DT&E. This is considered an appropriate use of both contractor and Government DT&E programs.
- Initial PDB-7 software performance - DT&E identified software test incident reports, which are currently undergoing determination review and will be reassessed as entrance criteria for the DT/OT LUT scheduled for 3rd quarter FY 2012. Missile flight tests for PDB-7 are scheduled to begin 1st quarter FY 2012.

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

Executive Summary: The Stryker DVH program is intended to provide improved survivability against Improvised Explosive Devices (IEDs) and blast threats, beyond the protection provided by current Stryker vehicles with Operation Enduring Freedom (OEF) armor kits. The DVH configuration consists of a redesigned lower hull, energy attenuating seats, and an up-armored driver's station. An upgraded suspension, driveline, and steering systems are incorporated because of the additional weight associated with the redesigned hull. The Stryker DVH Infantry Carrier Vehicle (ICVV) is the base variant for seven additional configurations: the Anti-Tank Guided Missile Vehicle, the Commander's Vehicle, the Engineer Squad Vehicle (ESVV), the Fire Support Vehicle, the Mortar Carrier, the Medical Evacuation Vehicle, and ICVV with installed Scout Kit. At present, the Army does not plan to field Stryker DVH versions of the Nuclear, Biological, Chemical Reconnaissance Vehicle, the Reconnaissance Vehicle, or the Mobile Gun System in the OEF Theater of Operation.

The DVH-equipped Stryker Brigade Combat Team (SBCT) has the same mission profile as a non DVH-equipped SBCT. Beginning with the ICVV variant, the Army began deploying Stryker DVH vehicles for OEF in 3rd quarter FY 2011.

The DVH DT program was tailored to support the OEF Operational Needs Statement. DVH DT began in 3rd quarter FY 2010 and will conclude in 3rd quarter FY 2012. DT includes Reliability, Availability, and Maintainability (RAM), Manpower and Personnel Integration (MANPRINT), automotive performance, and tactical mobility. Modeling and Simulation supplements automotive performance and tactical mobility testing. The evaluation of DVH includes a comparison to Stryker variants configured as currently operated in OEF.

Summary of FY 2011 DT&E Activities

- The Army is executing DT to a three phased test program designed to support the multiple decision points in the DVH acquisition strategy. Phase 1 (3rd quarter FY 2010 to 2nd quarter FY 2011) supported DVH production decisions in 3rd quarter FY 2011. Phase 2 (2nd quarter FY 2010 to 3rd quarter FY 2011) supported the fielding decision in 3rd quarter FY 2011 for the high

density ICVV. Phase 3 (4th quarter FY 2010 to 3rd quarter FY 2012) is supporting the fielding decisions in FY 2012 for follow on low density variants.

- DASD(DT&E) focused on assisting the Program Office and Army Test and Evaluation Command (ATEC) in developing adequate test strategies to support a DVH production decision in May 2011, an ICVV fielding decision in May 2011, and an ESVV fielding decision in November 2011. There will be follow on fielding decisions for each of the remaining six Stryker DVH variants.

Summary of FY 2011 DT&E Assessments

- The Program Office and ATEC are effectively executing a medium risk test strategy driven by concurrency in production and testing to support the urgent operational need. The program mitigated schedule risk by increasing the number of test vehicles and intensive management/coordination of testing at the Yuma Proving Grounds, Aberdeen Proving Grounds, the Electronic Proving Ground, and White Sands Missile Range.
- Test results supported the Army fielding decision for the ICVV in May 2011. The DASD(DT&E) assessed that the ICVV affords greater force protection against IEDs in Afghanistan than the Stryker OEF kitted baseline Infantry Carrier Vehicle (ICV). The ICVV DVH modifications provide significantly improved protection to the driver and crew over OEF kitted baseline ICV Stryker vehicles currently deployed to Afghanistan. It is important to note that in previous testing, the ICV was assessed as partially meeting its overall force protection and survivability requirements. ICVV testing was scoped to support the urgent material release and did not fully readdress these requirements. The additional weight and increased axle spacing of the ICVV cause minor trafficability degradation in comparison to the OEF baseline (fully kitted and combat-ready) ICV.
- Test results also supported the Army fielding decision for the ESVV in November 2011. The DASD(DT&E) assessed that the ESVV also affords greater force protection against IEDs in Afghanistan than the Stryker OEF kitted baseline Engineer Squad Vehicle (ESV). The ESVV DVH modifications provide significantly improved protection to the driver and crew over OEF kitted baseline ESV Stryker vehicles currently deployed to Afghanistan. In previous testing, the ESV was assessed as partially meeting its force protection and survivability requirements and not meeting reliability and maintainability requirements (with mission equipment package). ESVV testing was scoped to support the urgent material release and did not fully readdress these requirements. The additional weight and increased axle spacing of the ESVV cause minor trafficability degradation in comparison to the OEF baseline (fully kitted and combat-ready) ESV.
- For both the ICVV and ESVV, the driver's energy-absorbing seats (common to all DVH vehicles) require corrective action to address failures and other issues identified during testing. The Army is conducting root cause analysis and plans to take the appropriate action. In addition, the Army plans a redesign to the driver's station to improve comfort. This redesign will provide the driver with more room by relocating the seat and intrusive components of the vehicle, provide a better driving posture, address seat back lowering mechanism failures, and improve seat comfort. Testing of these changes has not been defined but will likely require additional DT.

Stryker Mobile Gun System (MGS)

Executive Summary: The Stryker MGS is designed to provide rapid and lethal direct fires to support assaulting infantry and ensure mission success and survivability of the Stryker Brigade Combat Team. It employs a M68A2 105-mm cannon system with an Ammunition Handling System (AHS). In addition to the primary cannon, the MGS employs a coaxial 7.62-mm machine gun and a secondary M2HB, .50 caliber machine gun. The system also has a full solution Fire Control System with two-axis stabilization. The basic load for primary on-board weapons is 18 rounds of 105-mm main armament ammunition, 3,400 rounds of 7.62-mm and 400 rounds of .50 caliber ammunition. The system has a low-profile turret intended to provide survivability against specified threat munitions. The MGS supports a three–man crew with varying levels of protection against small arms, artillery fragmentation, mines, and hand held high explosive anti-tank grenades.

The MGS is designed to provide the capability to rapidly and, in succession, engage and destroy stationary and mobile threat personnel, infrastructure (walls, bunkers, machine gun nests), and materiel targets (up to T-62 tanks). It is intended to apply a broad spectrum of munitions with lethal effects under all weather and visibility conditions.

The Army delayed the MGS FRP decision until FY2012 pending corrections to 23 noted deficiencies. In response to the deficiencies, the Army conducted testing in three Engineering Change Order (ECO) Validation Blocks to validate fixes. The last block, ECO Block III, was conducted May 2010 – September 2011. In December 2010, the Army decided not to seek a FRP decision for the current MGS "Flat Bottom" configuration. A total of 142 MGSs have been produced and fielded. MGS Live Fire testing with Stryker Reactive Armor Tile – II (SRAT II) add on kit was delayed due to a slip in delivery of the SRAT II tiles, SRAT II integration issues with the armor tiles on the rear doors, and conflicts with the higher priority Stryker Double V Hull program. MGS SRAT II automotive, RAM, and Live Fire testing is planned to begin in 2nd quarter FY 2012.

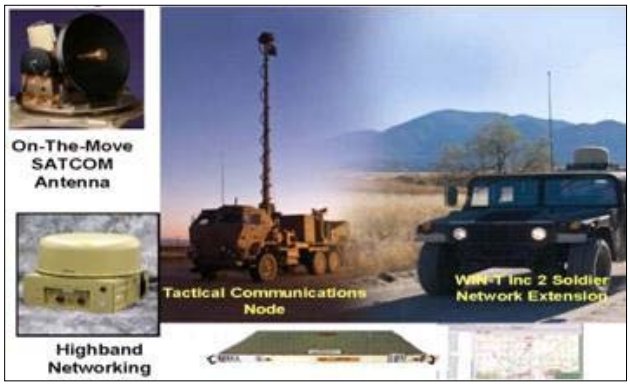
Summary of FY2011 DT&E Activities

- The Program postponed MGS ECO Block III RAM testing on extended LRIP vehicles from August 2010 to January 2011 to address continuing production / process quality control issues that surfaced during the ongoing DT and prior contractor testing.
- When ECO Block III DT resumed, the frequency of quality failures decreased but the system continued to experience reliability issues associated with production / process quality control. In April 2011, the Program paused ECO Block III DT RAM testing again and slipped the ECO Phase III DT/OT soldier event from June 2011 to August 2011. In May 2011, the Program resumed DT RAM testing and continued executing to the TEMP through the completion of the DT/OT event in September 2011.
- The program conducted cold weather testing at the Cold Regions Test Center in 2nd quarter FY2011. Follow-on testing is planned at Aberdeen Proving Grounds in FY 2012 to verify design changes required to close out deficiencies identified during the cold weather testing.

Summary of FY2011 DT&E Assessments

- The Program completed all major elements of the planned DT strategy in FY 2011. Follow on testing in FY2012 is required to close out deficiencies noted in the 2008 Secretary of Defense letter to Congress and those identified during the cold weather testing.
- ECO RAM testing demonstrated that the program was able to correct production/process quality control issues experienced in FY 2010 and early FY 2011. The MGS demonstrated reliability of 2688 Mean Miles Between System Abort versus the required 1000 miles (1256.4 miles with 80% confidence). The MGS also demonstrated reliability of 146 Mean Rounds Between System Abort versus the required 81 rounds (79.4 rounds with 80% confidence).
- The DASD(DT&E) assesses that the MGS partially meets its force protection and survivability KPPs. Force Protection and Survivability have been demonstrated with shortcomings associated with certain small arms and hand held high explosive anti-tank threats. The program is developing the SRAT II as a near-term solution to partially mitigate the shortcomings, and additional ballistic hull and turret, armor coupon, and full-up system level testing is planned in FY 2012.
- The DASD(DT&E) will continue to monitor MGS testing in FY 2012 with the SRAT II add on tiles in order to assess the impact of SRAT II on Force Protection and Survivability as well as characterize any degradation the added armor weight may have on vehicle RAM and automotive performance.

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



Executive Summary: Warfighter Information Network–Tactical (WIN-T) is the primary backbone communications system linking divisions, brigades, battalions, and companies. WIN-T Inc 2 provides the capabilities to communicate on the move (OTM) to support the full spectrum of tactical operations and provides commercial and military band satellite OTM communications down to company level. It also enables the initial planning, monitoring, controlling, and prioritization of the tactical backbone. WIN-T Inc 2 achieved a MS C decision in February 2010 and is in LRIP leading to an FRP decision in August 2012.

WIN-T Inc 2 completed production qualification test–contractor (PQT-C), logistics demonstration, Joint Interoperability Certification, and production qualification test–Government (PQT-G) during FY 2011 in preparation for IOT&E in May 2012. The system is meeting its performance objectives although transmission through foliage continues to be a problem. WIN-T Inc 2 did not yet meet all reliability targets during PQT-G, though a corrective action period following that test led to improved reliability in an early FY 2012 follow-on test.

Summary of FY 2011 DT&E Activities

- The WIN-T Inc 2 Product Manager submitted an update to the MS C TEMP to OSD in July 2011. The Army has resolved all DT&E issues but is still working to resolve OT&E issues.
- General Dynamics–Taunton, Massachusetts, conducted PQT-C at its facilities during February–March 2011.
- An Army Forces Command unit conducted the logistics demonstration during June–July 2011.
- JITC issued a Joint Interoperability Certification following testing at Fort Huachuca in June 2011.
- The Army Developmental Test Command conducted PQT-G at Aberdeen Proving Ground, Maryland, during July-August 2011. DASD(DT&E) representatives observed the testing and received information on the system under test. Testing continued in September 2011 at White Sands Missile Range, New Mexico.
- The Central Technical Support Facility initiated Army interoperability testing at Fort Hood, Texas, in September 2011,and testing was scheduled to run until December 2011.

Summary of FY 2011 DT&E Assessments

- Initial results of the PQT-G at Aberdeen Proving Ground indicate WIN-T Inc 2 successfully validated KPPs, but some reliability areas require additional focus. There is continuing refinement on doctrinal employment for line of sight aspects. The system operates adequately within clear line of sight conditions per its requirements, but may experience issues in the presence of foliage obstruction given its frequency band. The PM plans to implement a comprehensive Failure Mode Closure Plan and additional reliability test during 1st quarter FY 2012. All other DT&E indicated positive results.

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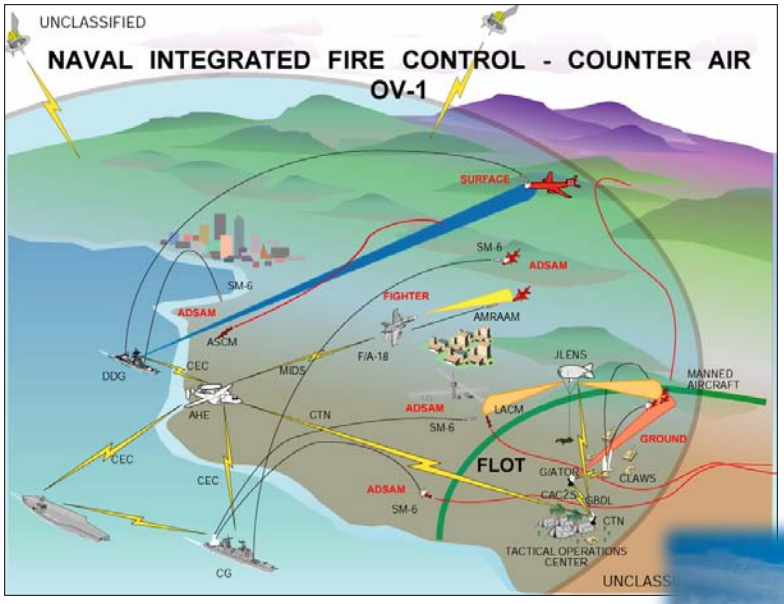
4.2 DASD(DT&E) Assessments of Navy Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries of the following 12 programs:

- Aegis Modernization and Standard Missile-6 (SM-6)
- Common Aviation Command and Control System (CAC2S) Increment 1 Phase 1
- DDG 1000 ZUMWALT Class Destroyer
- E-2D Advanced Hawkeye (AHE)
- GERALD R. FORD Class Nuclear Aircraft Carrier (CVN 78)
- Littoral Combat Ship (LCS) Mission Modules (MM)
- Littoral Combat Ship (LCS) Seaframes
- Multi-Mission Maritime Aircraft (P-8A Poseidon)
- Remote Minehunting System (RMS)
- Ship-to-Shore Connector (SSC)
- Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle (VTUAV) Fire Scout
- VIRGINIA Class (SSN 774) and OHIO Replacement Class Submarines

Aegis Modernization and Standard Missile (SM-6) Programs



Executive Summary: The Aegis Modernization program and Standard Missile-6 (SM-6) program are two key components of the Navy's "From the Sea" concept to provide Air Directed Surface to Air Missile capability using the Naval Integrated Fire Control - Counter Air (NIFC-CA) architecture. The current NIFC-CA architecture relies on multiple pillars (Aegis Modernization in the form of ACB12, SM-6, CEC, and E-2D) to be successful. .

Aegis Modernization

The Aegis Modernization program is a consolidation of numerous post-IOT&E programs into a single TEMP for testing purposes and is not, by itself, an acquisition program. The significant portion of Aegis Modernization efforts is focused on upgrades to the Aegis Weapon System (AWS) MK 7 which is the automated segment of the Aegis Combat System (ACS). There are various AWS upgrades in the test planning, test execution, and test analysis cycle at any one time. Currently Advanced Capabilities Build (ACB) 08 is undergoing operational test and ACB12 is in the initial developmental testing phase. The summary below concentrates only on the ACB12 portion of the Aegis upgrade.

The ACB 12 upgrade, which will provide 19 CGs and DDGs with a comprehensive modernization of their combat system between 2012 and 2015, satisfies the Anti-Air Warfare (AAW) and Ballistic Missile Defense (BMD) mission requirements, and will be designated as Baseline 9 (B/L 9). B/L 9 consists of 3 configurations: 9A for CGs with SPY-1B and SPY-1B(V), (will not have BMD capability); 9C for DDGs with SPY-1D; and, 9D for DDGs with SPY-1D(V).

B/L 9 will include computer program and signal processor upgrades for the AN/SPY-1. These capability upgrades will vary based on ship class due to the differences in hardware configurations.

All variants will benefit from the ACB12 COTS insertion by capturing the Radar Control Open Architecture (RCOA) computer program code improvements initially fielded in the ACB 08 program. In addition to the RCOA improvements, B/L 9C will receive the Multi-Mission Signal Processor (MMSP), in conjunction with transmitter modifications.

The MMSP is a combination of the BMD Signal Processor (BSP) and the functional equivalent of the SPY-1D(V) Anti- Air Warfare (AAW) Signal Processor. While AAW or BMD missions can still be carried out as dedicated, single purpose events, the MMSP allows IAMD to be accomplished with a single piece of integrated radar signal processing equipment. MMSP will bring further capabilities to the modernized radar by providing improved performance in littoral environments, improved performance against sea skimmers, Dual Beam Operation, Improved BMD Search, Enhanced BMD LRS&T performance and Aegis BSP Enhanced Range Resolution, Discrimination and Characterization.

Standard Missile 6
SM-6 combines the tested legacy of the SM-2 propulsion and ordnance with a repackaged AMRAAM active seeker, allowing for over-the-horizon engagements and enhanced capability at extended ranges. The SM-6 Block I program will provide a single ship Aegis combatant organic engagement and/or an engage-on-remote (EOR) capability. Baseline extended range (ER) AAW defense engagements are currently limited by the firing ship's Aegis fire control radar illuminator and the horizon. The SM-6 Block I missile will be able to increase the battle space to the horizon using its autonomous active seeker mode either with Aegis in a stand-alone configuration or beyond the horizon with a cooperative engagement capability (CEC) EOR configuration. When the firing ship is employed with an integrated fire control architecture (e.g., NIFC-CA), SM-6 Block I will provide ER AAW defense to the full extent of the missile's kinematic limit both above and below the radar horizon. The program is currently post MS C and in the IOT&E phase. An AOTR was conducted on SM-6 prior to entering the IOT&E phase.

Summary of FY 2011 DT&E Activities

Aegis Modernization
- Developmental Test. Aegis Modernization conducted DT-C2A, a test phase utilizing multiple land based test sites (LBTS) in multiple tactical and non-tactical hardware/software configurations for the combat system, during FY 2011. This phase of testing leveraged testing results from the Combat System Engineering Development Site (CSEDS) and the Navy's Surface Combat Systems Center (SCSC).
- At CSEDS in Moorestown, NJ, there is a single SPY-1D(V) live face (Port side) and two array simulators to simulate the other 3 array faces. SCSC, which is located on a barrier island on the Eastern Shore of Virginia and is a tenant of the NASA's Wallops Flight Facility, provides a maritime environment on the edge of the Virginia Capes Operating Area and is a NAVSEA field activity managed through the PEO IWS. SCSC provides live combat system suites with platform specific radars and sensors and supports the following functions: combat system lifetime support engineering, in-service engineering, combat system training, interoperability testing, and at-sea exercises. SCSC provides a high-fidelity representative combat system of almost every ship in the Aegis fleet today and those planned for the near future. At SCSC there is both a SPY B and a SPY-1D(V) radar interface.
- The objective of DT-C2A was to provide an early evaluation of the AWS and ACS, and to identify risk to mission areas and possible deficiencies for OT. Air Defense (AD) testing at this

phase consisted of functional verification of design primarily at the CSEDS. The testing was led by the I&T IPT and results were maintained in a common T&E results database. The primary purpose of this phase was to ensure that the system is on track to meeting key CTPs. In addition, the test team characterized the performance of B/L 9 hardware and software against suitability requirements. System performance and functionality testing were leveraged off of current tests already being conducted at LBTS to assess the suitability of the system. A formal JAM for AWS equipment was conducted to assess the ability for the ORTS to successfully fault-detect and fault-isolate malfunction events when they occur on AWS equipment. The majority of the testing was performed as the system (particularly software) was maturing; therefore results from this area will be analyzed for reliability growth through the use of the Duane model as described in MIL-HDBK-189C—Reliability Growth Management.

Standard Missile 6

- SM-6 testing to date has been to primarily test legacy capability (primarily longer range/speed) that was provided by the SM-2 Blk 4 missile. Completed testing has been on the current Aegis Baseline (only a few DDGs have it and it has yet to be operationally tested) which is limited in its capability to support full SM06 performance and therefore only a subset of the full capability of the missile has been tested.
- Testing of full capability is not planned until 2014 and beyond. SM-6 will ultimately need to be integrated with the ACB12 upgraded combat system and NIFC-CA to showcase its expanded capabilities. Some added capabilities such as new counter-EA capability have been tested but testing of the significant added capability of this missile (primarily overland cruise missile defense) has not yet been tested and will not be able to be tested until the Navy Aegis ACB-12 upgrade and the NIFC-CA capability are in place to fully test the new capability (not available until 2014).
- Developmental Test. SM-6 conducted a final phase of DT/OT during January 2011 consisting of four flight tests to complete the DT/OT conducted in May 2010, which was suspended due to mission failures. The four flight tests consisted of two re-do flight tests and the completion of two flight tests that had not been attempted in May. Of these four flights in January 2011, two were successful, one was a failure, and one was not completed.

Assessment of Operational Test Readiness (AOTR)

- An AOTR was conducted to review the SM-6 DT&E program and to provide an independent assessment of the readiness of the SM-6 weapon to proceed to IOT&E in June/July 2011. Based on this review, the DASD(DT&E) recommended not proceeding to IOT&E. The SM-6 program was assessed at high risk for favorably completing IOT&E based upon demonstrated performance in DT and integrated test (DT/ OT). Specifically, the following issues or risks were identified:
  - Not enough at-sea DT had been planned, approved or performed. The discovery rate was significant and trending up: 54 percent of the total missions flown (land-based and at-sea) and 71 percent of the more recent at-sea flights had discovery.
  - Multiple reliability failures and anomalies occurred with legacy components which were supposed to be low risk.
  - The IOT&E scenarios were significantly more challenging than the scenarios conducted in DT.
  - Flight software was still immature with software still being modified 5 weeks before IOT&E with first verification of the changes during the IOT&E flight tests.
  - A Failure Review Board (FRB) for the IMU failure (DT-4) was still outstanding.

- Initial Operational Test and Evaluation (IOT&E). The IOT&E for SM-6 was scheduled for 2 phases: an at-sea phase consisting of 13 flight tests against various threats and scenarios, and a modeling and simulation phase which would use the data collected from the at sea phase to populate models to assess the performance of the missile across the entire battle space. The at-sea phase of IOT&E was conducted in June/July of 2011 and the program had 5 of 12 failures (some repeated from DT), which included 3 new items of discovery and discovered issues with the existing Aegis baseline integration with the missile. The conclusion from COTF is still pending completion of the 2nd phase of the IOT&E but the results have caused the Navy to ask for another year of LRIP in place of the scheduled Full Rate Production decision in 2012.

Summary of FY 2011 DT&E Assessments

Aegis Modernization

- Developmental Test
- Aegis Modernization conducted a series of testing designated as DT-C2A during the summer of 2011. The purpose of this testing was to test the ACB12 program with a SPY-1D radar and MMSP in an Electronic Attack (EA) and clear environments with representations of threat-like scenarios utilizing live aircraft. Testing was conducted at CSEDS during the Jamming Exercise (JAMMEX) of the DT-C2A event.
- During the testing, a SPY-1D(V) radar was used instead of a SPY-1D radar due to fleet scheduling constraints. Additionally, no Cooperative Engagement Capability (CEC) or Tactical Data Link (TADL) was available. Further limitations to the testing consisted of inherent limitations to the high power radiation in Low Elevation due to CSED radar constraints and the type and complexity of threat representations was limited by number of tracks allowed and number of engagements allowed.
- KPPs.
- Basic ACB12 B/L 9 functionality was demonstrated during this test event. The tracking performance of ACB12 as well as detect-to-engage performance in EA and clear environments was as expected and comparable to the previous Aegis Baselines. These results were consistent with the KPP requirements as described in the Naval Capabilities Document (NCD) and DDG-51 Operational Requirements Document (ORD).

Test and Evaluation Master Plan

- A TEMP revision is required for Aegis Modernization to describe all testing required for ACB12. Currently this TEMP is in revision since the resources required are still being defined and full funding is not yet in place.
- The Navy's "From the Sea" concept to provide Air Directed Surface to Air Missile (ADSAM) capability using the Naval Integrated Fire Control –Counter Air (NIFC-CA) architecture relies on multiple pillars to be successful. These pillars are Aegis Modernization in the form of ACB12, SM-6, CEC, and E-2D. The test program for the NIFC-CA concept appears to be individually stovepiped in each of these programs and there appears to be little integration across their TEMPS. With 3 of these TEMPs currently in development/review (Aegis Modernization, SM-6, and CEC) it is difficult to determine if the individual program TEMP is sufficient and complete since the other "integrated" TEMPs are incomplete. The Navy needs to develop and present these TEMPs in a coherent and integrated manner to ensure the proper level of testing, resourcing, and demonstration of ADSAM capability is accomplished. One would expect that a NIFC-CA TEMP would be an ideal place to accomplish this as an integrated program but the Navy has been reluctant to develop this integrated TEMP. In the absence of one place to approve

the overall test program, the DT&E will be required to ensure each program TEMP focuses on the testing and resources required for the entire integrated ADSAM program and will require this level of detail before approving these TEMPs.

Standard Missile 6

- The testing to date for SM-6 has been executed in a very professional manner with excellent Range and Test Team execution. The results highlight that the improved guidance resulting from integration of SM-2 and AMRAAM is a significant added capability. Another high point from SM-6 testing is the 24 hour turn-around of analysis which is a significant T&E tool that allows the test team to know issues before committing to the next test missile in the test phase.
- However, most of the flight tests were optimized to ensure data was collected for the M&S phase of the IOT&E and therefore optimized trajectories, intercept points, and ship placement were the norm and a fully trained and prepped crew with available techreps on standby with a fully groomed combat system ship lead us to conclude that the results exceed what can be expected from a normal crew during normal ops.
- KPPs. Most SM-6 KPPs have not been demonstrated. The A_L and Max Range KPP were deferred by OPNAV 091 prior to commencing IOT&E and are scheduled for test in FOT&E. The P_{SSK} and Min RCS KPP are still being assessed as part of the IOT&E M&S and significant issues discovered in IOT&E will possibly impact the ability to assess these KPPs in IOT&E M&S and will require ACB12 to properly demonstrate. Interoperability KPP is at moderate risk since it requires ACB12 and early testing is showing an interoperability issue.
- TEMP. The TEMP requires updating to reflect additional SM-6 developmental and operational testing. A new SM-6 test program needs to be developed that incorporates existing planned tests and additional new testing is required to demonstrate corrections to existing failures and to incorporate testing of SM-6's new capabilities using Aegis ACB12 and NIFC-CA when available. Actual number and type of flight tests required will need to be determined after fixes are finalized and a determination of whether these fixes will require regression testing in other scenarios because of second order impacts.

Common Aviation Command and Control System (CAC2S) Increment 1, Phase 1

Executive Summary: CAC2S Increment 1 replaces aviation command and control (C2) equipment of the Marine air C2 system and the aviation combat element (ACE). Phase 1 includes upgrading fielded, mature equipment and technologies, while Phase 2 integrates sensor data systems for ACE battle management and C2 requirements. CAC2S Increment 1 began FY 2011 with a MS C decision and ended FY 2011 with a Phase 1 full deployment decision.

CAC2S successfully completed performance, transportability, IA, and interoperability testing in FY 2011. DASD(DT&E) conducted a formal DT assessment and assessed the system as ready for IOT with moderate risk due to suitability concerns.

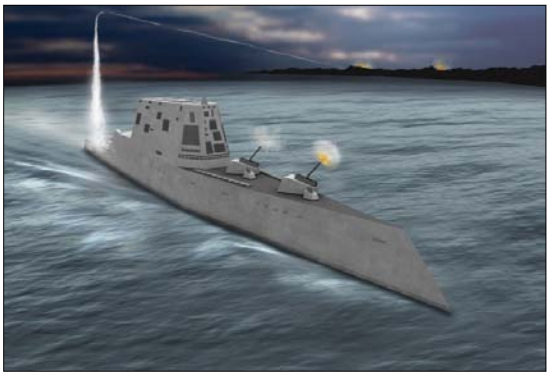
Summary of FY 2011 DT&E Activities

- The program conducted DT 2, December 9–17, 2010, at Naval Surface Warfare Center, Dahlgren, Virginia. The test objective was to determine whether the CAC2S Increment 1, Phase 1 system met the System/Subsystem Specification requirements that previously failed, were unresolved, or were untested in DT 1.
- Transportability and environmental testing was conducted from December 2010 through May 2011 at Aberdeen Proving Grounds, Maryland.
- Service-level testing in support of joint interoperability test (JIT) certification was conducted in January 2011 at Marine Corps Tactical Systems Support Activity (MCTSSA), Camp Pendleton, California.
- IA penetration testing was conducted January 30–February 4, 2011.
- Naval Service Acquisition Executive approved the TEMP for the CAC2S Increment 1, Phase 1 program on March 2, 2011. Because the program completed all planned DT prior to receipt of the TEMP, DASD(DT&E) did not sign the TEMP.
- DASD(DT&E) provided a test readiness assessment for IOT&E on March 2, 2011.
- The CAC2S Increment 1, Phase 1 IOT&E was conducted at Yuma Arizona, as part of the Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) Exercise, from February 28 to April 30, 2011.

Summary of FY 2011 DT&E Assessments

- DASD(DT&E) monitored the Service-level testing in support of JIT certification, which was conducted in January 2011 at the MCTSSA, Camp Pendleton, California. JIT certification was completed to support IOT&E. DASD(DT&E) assessed the certification results as sufficient for IOT&E.
- Transportability and environmental testing was conducted from December 2010 through May 2011 at Aberdeen Proving Grounds, Maryland. DASD(DT&E) assessed all transportability testing criteria as passed, except for a transportability limitation noted for the Joint Range Extension-Data Link Transport personnel capacity (less than 4 personnel). Electromagnetic environmental effects (E3) and high-altitude electromagnetic pulse requirements were partially addressed, with completion planned as part of Increment 1, Phase 2 DT testing in FY 2013.
- IA penetration testing was conducted January 30–February 4, 2011. Testing results cannot be addressed in an unclassified report.
- CAC2S satisfied 85% of requirements during DT2 with significant discovery in late stages of the test.
- DASD(DT&E) assessed potential of success of CAC2S in IOT&E as moderate based on two risks:
  - System Reliability: DT data collected to date only supported a 50% confidence the system will meet its threshold reliability requirement.
  - Operational Suitability: User-representative operator may be challenged if any of the 93 non-major open technical issues require additional training and/or the execution of additional TTPs.

DDG 1000 ZUMWALT Class Destroyer



Executive Summary: The DDG 1000 Zumwalt Class Destroyer program completed a Nunn-McCurdy certification in FY 2010, and the Acquisition Decision Memorandum (ADM) directed the following T&E related actions: (1) Remove the Volume Search Radar (VSR) hardware from the ship baseline design (leaving space and weight reservation for possible future inclusion) in order to reduce cost for the program. The Navy shall complete the VSR testing. (2) Revise testing and evaluation requirements for the program in the next update to the TEMP.

The VSR was removed from the DDG 1000 baseline via the June 2010 Nunn-McCurdy Review. Program Executive Officer, Integrated Warfare Systems (PEO IWS) is preparing to modify both the DDG 1000 Multi-function Radar (MFR) in order to achieve a volume search (VS) capability, and the T&E strategy for both the MFR VS and the CVN 78 Dual Band Radar (DBR). PEO IWS briefed the DASD(DT&E) regarding the T&E strategy for the MFR VS modification and the DBR T&E for CVN 78, and the DASD(DT&E) concurs with the top level concept. A follow-on briefing addressing the capabilities and limitations of the modified MFR has yet to be scheduled.

PMS 500 plans to release a TEMP update for approval in February 2012 to document the MFR VS development and T&E strategy. The DASD(DT&E) will assist PMS 500, DOT&E, and other stakeholders in the T&E WIPT to develop the TEMP revision. Details regarding funding and equipment for the Self Defense Test Ship (SDTS) and land-based test sites (LBTS) must be resolved in order to determine the adequacy of the TEMP update.

Summary of FY 2011 DT&E Activities

- The DASD(DT&E) observed the first DDG 1000 Integrated Power System (IPS) DTB2-210 full power DT&E event at the IPS LBTS in Philadelphia on May 11, 2011. The DDG 1000 propulsion plant uses gas turbine engines to turn electrical generators, which power direct-drive Advanced Induction Motors to turn the propellers. The test consisted of two scenarios. In the first, the Main Turbine Generator (MTG) was driven to 100% of the main propulsion load and the Auxiliary Turbine Generator (ATG) to 100% of the Integrated Fight Through Power (IFTP), or non-propulsion equipment load. In the second, the IFTP load was increased beyond the capacity of the ATG, and power was diverted from the MTG to make up the difference, slightly reducing the power available for main propulsion. Both tests were successful; no anomalies were observed.

Summary of FY 2011 DT&E Assessments

- The IPS full power DT&E event was an example of the risk reduction value of land-based test sites in shipbuilding programs. Without a LBTS, such testing would have to wait until the ship can get under way during builders' trials and acceptance trials. Any deficiencies found at that time could cause serious delays and increased costs to the Navy. The preparations and testing at the IPS LBTS were exemplary and undoubtedly resulted in avoiding cost and delay.
- DDG 1000 program is executing to the current approved TEMP. The TEMP is inadequate in that it lacks details of the MFR VS T&E. Revision E, on schedule for submission for approval in FY 2012, will contain details of the MFR VS test program.

E-2D Advanced Hawkeye (AHE)

Executive Summary: The E-2D AHE aircraft, an ACAT-ID program, equipped with the APY-9 radar, provides a significant capability improvement over the E-2C with substantial increases in transmit power and advanced processing techniques to improve small target detection and tracking in the littoral and maritime environments. The program has completed its development and test phase to include two operational assessments and three at-sea periods, and following release of an AOTR report, the program will enter IOT&E in February 2012.

Summary of FY2011 DT&E Activities

- The E-2D AHE DT program is nearly 100 percent complete, with 3,300 flight hours of testing to support entering IOT&E in 2nd quarter FY 2012. Also, 100 percent of the required air vehicle testing is complete, with remaining tests focused on mission systems.
- The program completed its second operational assessment in November 2010 and development flight tests to further evaluate mission systems performance. The program completed a final series of verification flights in November 2011 to assess system stability. The DASD(DT&E) completed its AOTR and recommended proceeding to IOT&E while understanding that some performance shortfalls exist. All four planned IOT&E aircraft have been delivered.

Summary of FY 2011 DT&E Assessments

- The program has met its KPPs and CTPs with limitations to warrant entering IOT&E. Radar performance meets KPPs on average, but performance shortfalls are likely to be seen in IOT&E in stressing environments that will have to be addressed as part of a long-term effort.
- Aircraft reliability is adequate and radar reliability is currently at 63 hours, which is sufficient to meet mission requirements. Prior concerns over computer instability have been addressed with resets reduced to less than one per flight. Built-in test performance has also improved to acceptable levels.
- The program successfully completed a final series of verification flights to further characterize radar performance in complex clutter environments.
- DT&E has demonstrated that system performance is stable and predictable in key areas with limitations and that system reliability has improved sufficiently to enter IOT&E.

GERALD R. FORD Class Aircraft Carrier (CVN 78)

Executive Summary: Construction of CVN 78 is ongoing at Huntington Ingalls Industries (HII) in Newport News, VA with approximately 63 percent of the ship's structure erected in the drydock. Development of the CVN 78 TEMP 1610, Revision C is in progress and is expected to start the signature cycle in 2nd quarter FY 2013. The DASD(DT&E) is supporting PMS 378 in this effort by ensuring that the traceability of requirements to T&E data collection is properly documented in the Evaluation Framework in the TEMP 1610.

Adequate T&E for CVN 78 is dependent upon the T&E that is being performed by the Participating Acquisition Resource Managers (PARMs), which are not under the direct control of PMS 378. While this strategy is cost and schedule efficient, it does increase the risk of adverse impact due to changes in the other test programs. The acquisition strategy for CVN 78 does not include platform-level DT&E, but instead depends upon shipbuilding industrial tests and trials to discover and correct integration deficiencies among systems. The lack of shipboard DT&E is being mitigated by the use of land-based test sites (LBTS) for major subsystems, such as Electromagnetic Aircraft Launch System (EMALS), Advanced Arresting Gear, combat systems, and Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance.

Summary of FY 2011 DT&E Activities

- Phase I of Aircraft Compatibility Testing is ongoing at the EMALS LBTS. During FY 2011, a number of live launches were conducted, which resulted in a total of 133 successful aircraft launches, including the Navy's F/A-18E/F (with and without external stores), T-45, C-2A, and E-2D aircraft. A successful risk mitigation launch of a F-35C was also conducted in FY 2011.
- A majority of the EMALS Electromagnetic Interference (EMI) testing was completed in FY 2011. The remaining EMALS EMI tests will address EMALS hardware susceptibility and shielded hangar tests for aircraft that haven't been launched from EMALS yet (i.e., E/A-18G, F/A-18C and E-2C). Once the tests are completed and the analysis is finalized, there may be some changes to EMALS to mitigate EMI, such as adjustments to cable configurations and wireway paths, shielding, changes to equipment location or orientation, and increased standoff distances.

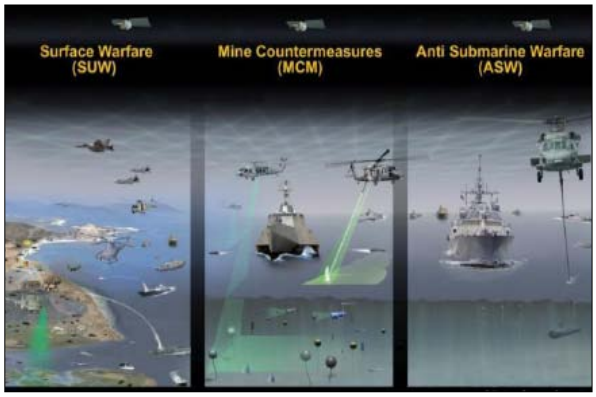
Summary of FY 2011 DT&E Assessments

- The CVN 78 TEMP is in the midst of an update to reflect schedule and test strategy changes and is expected to start the signature cycle in 2nd quarter FY 2013. The DASD(DT&E) is actively engaged with PMS 378 and members of the T&E WIPT to help the program meet with statutes and regulations brought about by WSARA, and to help the program succeed. The DASD(DT&E), with support from the Institute for Defense Analysis and MITRE Corporation, are working directly with PMS 378 to develop the Evaluation Framework (EF) which resides in the TEMP. The EF traces the system performance requirements to the planned testing and data

collection requirements. This test tool ensures that all data required to validate system design and performance will be collected in the course of testing and trials.

- The current approved CVN 78 TEMP calls for leveraging DDG 1000 T&E of the Dual Band Radar (DBR), which consisted of the Volume Search Radar (VSR) and the Multi-function Radar (MFR). In June 2010, the VSR was deleted from the DDG 1000 design as a cost savings measure due to a Nunn-McCurdy breach. Since VSR is the primary air search radar and the primary sensor for air traffic control (ATC) aboard CVN 78, the completion of the DBR developmental testing will be borne by the CVN 78 Program.
- DBR development is managed by PEO IWS (IWS 2.0). The DASD(DT&E) requested and received a briefing regarding the plan for the completion of the DT&E of DBR for CVN 78. Development of DBR is complicated by the requirement to modify the software for MFR aboard DDG 1000 in order to give MFR a volume search (VS) capability. Testing of the DDG 1000 MFR VS will occur primarily aboard the Self Defense Test Ship (SDTS) in Pt. Hueneme, CA. The CVN 78 DBR DT&E and integration with SSDS and other elements of the combat system will be performed at the LBTS in Wallops Island, VA.
- The current concern for the Wallops Island LBTS is the availability of a production MFR array. An array is available in FY 2012-FY 2014, but that array must be shipped for installation on the SDTS late in FY 2014. The majority of SSDS-DBR integration DT&E is scheduled for FY 2014, thus identification of a replacement MFR array is imperative. There is currently no Navy funding programmed to procure an additional MFR array. The DASD(DT&E) recommends that PEO Carriers and PEO IWS identify DBR hardware and resources required for the CVN 78 land-based testing, and finalize plans for SSDS-DBR integration and ATC DT&E.

Littoral Combat Ship (LCS) Mission Modules (MM)



Executive Summary: Mine Countermeasures (MCM): MCM MP is still maturing and has four increments planned to resolve all KPPs by FY 2018. The Remote Minehunting System (Remote Multi-Mission Vehicle and AN/AQS-20A mine hunting sonar) is executing a Reliability Growth Plan to achieve an acceptable Mean Time Between Operational Mission Failure that completes in FY 2014. The Organic Mine Counter-measure System, which includes the Airborne Laser Mine Detection System, the AN/AQS-20A Variable Depth Sonar, and Airborne Mine Neutralization System has lacked sufficient time for integration on LCS for realistic operations. Future increments still under development in need of MM integration are the Vertical Take-off Unmanned Air Vehicle, Coastal Battlefield Reconnaissance and Analysis, Organic Air and Surface Influence Sweep, Surface Mine Countermeasures Unmanned Undersea Vehicle, and the Unmanned Surface Vehicle. A detailed concept of operations, requested by the DASD(DT&E), is being completing development for review.

Anti-Submarine Warfare (ASW) MP: Navy is in early development and has not integrated it into LCS MM for formal DT evaluation. This will begin in FY 2014 and complete OT in FY 2016.

Surface Warfare (SUW) MP: This MP lacks a surface-to-surface missile component. One has been identified (Increment III, FY 2017) as an interim capability, but does not meet KPPs. An upgrade (Increment IV) is planned to achieve mission and range requirements but no date has been determined for MM DT. A Maritime Security Module has been identified for upcoming SUW DT-B12 testing during Spring-Summer 2012 on LCS 1. Other upgrades are planned.

The MM program's TEMP is combined with the Seaframe Program's TEMP. The TEMP will be ready for approval about May 2012. In summary, LCS MM is immature and needs more operational integration with seaframes before going to TECHEVAL to simulate final operational testing.

Summary of FY 2011 DT&E Activities

- DT-B2 - first effort to integrate seaframe, MCM modules, and aviation elements for an at-sea test. It was initiated September but halted in October 2011 for a Chief of Naval Operations directed port visit. This allows the test ship (LCS 2) and the MCM MM time for repairs and improvements before testing continues January 6 – March 14, 2012.
- Airborne mission modules have been tested from shore in FY 2011, but require a shipboard environment to replicate a realistic test environment.
- No significant DT occurred on LCS 1.

Summary of FY 2011 DT&E Assessments

MCM DT-B2 findings will require further test-analyze-fix-test again to verify correction of deficiencies before the program is ready for TECHEVAL. Aircraft and Mission Modules support procedures need to be operationally stressed from LCS seaframes to provide an accurate assessment of integration, timing, effectiveness, and suitability.

Littoral Combat Ship (LCS) Seaframes

Executive Summary: The Littoral Combat System (LCS) Seaframes (SF) Program has two high speed hulls: the USS FREEDOM (LCS 1), a steel mono-hull with an aluminum superstructure, and the USS INDEPENDENCE (LCS 2), an all-aluminum tri-hull. Combined diesel and gas turbine water jets propel each ship.

Both SFs have yet to complete post-delivery tests and trials and both are dealing with first-of-class issues being resolved during shipyard availability periods.LCS 1 has superstructure cracking issues and LCS 2 has excessive corrosion. Test events relate to assigned mission packages (MP). LCS 1 will commence DT-B1 with a Surface Warfare (SUW) MP beginning about May 2012. LCS 2 initiated Mine Countermeasures (MCM) DT-B2 in September and plans to complete this test phase during the 2nd quarter FY 2012. For each SF, individual DT-B efforts represent the first time SFs and Mission Modules (MM) are integrated for end-to-end, at-sea testing. SF Anti-Submarine Warfare MP testing is yet to be determined.

SF Program is actively working with the MM program to develop a TEMP; they have worked closely with the T&E IPT and expect to forward a TEMP to OSD in May to support Milestone C for the SF and Milestone B for MM about FY13. The challenge is significant because each SF has a TECHEVAL and IOT&E to support each MP. MP systems, missions, procedures, and requirements are each vastly different from the others and each has incremental growth efforts.

Summary of FY 2011 DT&E Activities

- LCS 1 operations in FY 2011 focused on completing the core seaframe testing and the Post Shakedown Availability (PSA), and will conduct TECHEVAL and IOT&E employing the SUW MP.
- LCS 2 conducted early DT to support MCM components over the summer and launched into DT-B2 in September 2011. The event was well planned and has uncovered significant areas for further work for seaframe and MM enhancement, which is the foundational purpose of DT&E. Phase II of testing resumes 2nd quarter FY 2012. After a phase of test-analyze-fix-verify correction of deficiencies, the ship will conduct TECHEVAL, scheduled for early FY 2014. TECHEVAL will present an opportunity to verify end-to-end performance of the seaframe and MM, as a rehearsal for OPEVAL (IOT&E) scheduled for mid FY 2014.

- The DASD(DT&E) observed the first swap of MM equipment aboard LCS 1. The ship was initially configured with the SUW MM, which was swapped for the MCM MM.
- Both SFs have yet to demonstrate they meet the full range of key performance parameters. Both SFs will need to conduct TECHEVALs and IOT&Es with the other two MPs.

Summary of FY 2011 DT&E Assessments

- Discovery of deficiencies has inhibited completion of DT&E. Examples include launch and recovery systems, shipboard casualties to cargo elevators, and antenna locations that restrict communications. The SF program has been active in working through these types of problems.
- While the MM swap aboard LCS 1 was completed within the threshold time period, the stability limitations and tight quarters aboard the mono-hull seaframe became evident. In order to maintain the allowable list angle during movement of the 15,000 lb Remote Multi-Mission Vehicles (RMMV), the ship's force needed to balance the ship by emptying a JP-5 fuel tank on the port side of the ship, and by placing a weight equal to that of an MH-60S helicopter on the starboard side. Changes have reportedly been incorporated into the LM design for LCS 3 and beyond that will increase stability and should eliminate the need for adding weight to accommodate mission packages.
- Underwater corrosion due to dissimilar metals has been evident in both LCS 1 and LCS 2. The impressed current cathodic protection system in LCS 1 was ineffective, and using special coatings and passive cathodic protection was inadequate in LCS 2. PMS 501 is investigating options to ensure that an adequate impressed current cathodic protection system is incorporated into LCS 3 and higher, and that it is back fitted into LCS 1 and 2 at the earliest opportunity.
- The DASD(DT&E) has emphasized the Navy needs to provide detailed operations concepts for each SF and MP. Navy has not yet complied but is developing detailed CONOPS as DT proceeds. Having a CONOPS while developing the TEMP or test plans allows the systems to be tested as they are to be employed and not to the boundaries of the possible.

Multi-Mission Maritime Aircraft (P-8A Poseidon)

Executive Summary: The P-8A is a derivative of existing Boeing aircraft; namely, the fuselage of a 737-800 with 737-900 ER wings that incorporates design changes to support the maritime patrol mission. The P-8A is designed to have sufficient cabin volume, load-carrying capacity, attendant electrical power, and environmental control to accommodate six tactical crew and five workstations. The test program has been structured to address the balance necessary between a modified commercial variant and military mission systems. The aircraft itself continues to mature in testing and to execute its DT&E plan, having completed about 50 percent of its test points. Maintenance, manpower shortages, and other issues have placed the test program about 8 weeks behind schedule. This resulted in slipping IOT&E by about 8 weeks in FY 2012 but still well short of its threshold date.

Summary of FY 2011 DT&E Activities

- The program completed its clean configuration flutter testing and captive carriage testing of the Mark 54 torpedo. The primary mission systems test article successfully completed its acoustics checkout, as well as communications, data link, radar, navigation, and fire suppression systems ground tests. The P-8A successfully tracked undersea targets off the Atlantic coast and completed its sonobuoy positioning characterizations.
- The aircraft successfully released sonobuoys, flares, smoke, and underwater sound signal device stores and successfully dropped a Mark 54 torpedo. The first production-representative aircraft joined the DT&E program briefly and successfully conducted missions against a noncooperative diesel submarine.
- The Software Integration Lab finished construction and entered operation at Naval Air Warfare Center, Patuxent River, Maryland. It simulates the full mission suite/crew, including the cockpit, and has been found to correlate well with actual flight data. The test team uses it to test new software builds, fly complete virtual missions including operational assessments, as well as prepare crews for complex missions, thus increasing flight test efficiency.

Summary of FY 2011 DT&E Assessments

- The P-8A program is executing DT&E according to the TEMP but has modified the schedule to account for delays leading to an 8-week slip in the test program. Some of this delay was to accommodate a 7-month slip in completion of structural testing while an additional 2-month delay was due to maintenance of test aircraft.
- At the end of FY 2011, the program had completed about 50 percent of its test points but slipped the start of IOT&E from its objective date of April 2012 to June 2012 to account for the remaining 8 weeks of delays. This schedule still leaves margin before the Acquisition Program Baseline (APB) threshold IOT&E start date of October 2012.

Remote Minehunting System (RMS)

Executive Summary: As a result of a Nunn-McCurdy breach, Navy initiated a Reliability Growth Program (RGP) to improve its Remote Multi-Mission Vehicle (RMMV) Mean Time Between Operational Mission Failure (MTBOMF) from 46 hours to 75 hours. The Nunn-MCurdy ADM directed the program to conduct critical system reviews, design reviews, and a three phase in-water testing program to upgrade the reliability of the RMMV. The first phase of testing using the version 4.1 (v4.1) configuration is underway and the program is expected to proceed to a version 4.2 configuration, and a version 4.3 configuration, if necessary, to meet the 75-hour goal threshold or 150-hour objective. The program is to complete the RGP in FY 2014. Navy due to AN/AQS-20A Variable Depth Sonar obsolescence and engineering change proposals, has upgraded version, the Dash 9, which is being tested and evaluated to improve its reliability for operations with the RMMV.

RMS completes RGP testing for version 4.1 in December 2011. Testing indicates the threshold goal of 75 hours MTBOMF will not be met in version 4.1. The second test event in FY 2011 was with the Littoral Combat Ship Mine Countermeasures Mission Package, DT-B2, conducted September through early October 2011 in the Gulf of Mexico. Tests revealed problems launching and recovering RMS and deploying the AN/AQS-20A. These will be retested in the January-mid March continuation of DT-B2. The RMS TEMP is nearing completion but was delayed in order to define the perceived ADM definition of MTBOMF and the method the OT community will use to evaluate mission success.

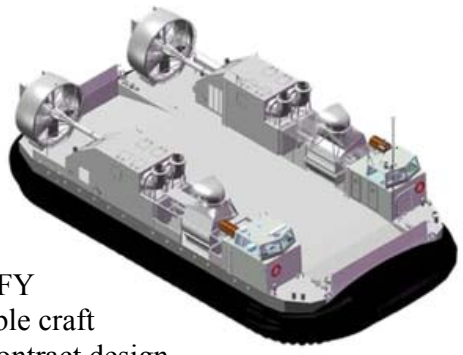
Summary of FY 2011 DT&E Activities

- Reliability Growth Plan testing - PMS 403 and Lockheed-Martin identified and prioritized past deficient areas to incorporate upgrades that became v4.1 RMMVs. By December 2011 the prime contractor was to complete 500 mission time hours for insight on software and hardware components needed for a critical systems review and design upgrades for RMMV version 4.2.
- AN/AQS-20A Variable Depth Sonar (Dash 9 configuration) is being separately tested to extend its MTBOMF, although it has exhibited improvements, further modifications and testing are planned to raise its reliability from 19.41 hrs. PMS 403 implemented a FRACAS process to identify and correct root causes.
- During DT-B2, RMS was launched and recovered aboard LCS 2 at sea. Navy directed a DT-B2 temporary halt, with continuation planned for January through mid-March. Considerable experience is being gained by this hands-on activity in a realistic environment, successes were noted in system integration, but also noted were numerous areas for correction and the need for hands-on training.

Summary of FY 2011 DT&E Assessments

- Testing indicates the threshold goal of 75 hours MTBOMF will not be met in version 4.1 and possibly not in version 4.2. The AN/AQS-20A (Dash 9) will need to demonstrate increased MTBOMF to support RMS reliability. Overall, RMS is a difficult and complex system in shipboard operations for normal crews.

Ship-to-Shore Connector (SSC)



Executive Summary: The Ship-to-Shore Connector (SSC) is a potential Acquisition Category (ACAT) ID program currently in the Technology Development phase. As outlined in its approved Capability Development Document (CDD), SSC meets the need for a follow-on replacement system to the existing Landing Craft, Air Cushion (LCAC) craft, which begins to reach end of service life in late 2014. The SSC program plans to deliver a total of 72 operational production craft beginning in FY 2016 and continuing through FY 2029. The program reaches IOC in FY 2020 with five deployable craft and one training craft. Of significance, SSC is a Government contract design, with a Shipbuilder detail design. The intent of this design approach is to broaden competition and lower craft performance risk. SSC retains the same footprint as LCAC for embarkation aboard amphibious ships but will have major components redesigned for improved reliability, added payload, additional range, easier maintainability, and greater automation. The program received MS A approval on May 21, 2009. A PDR was conducted June 22, 2011. A MS B DAB decision is scheduled for Spring 2012. A Detailed Design and Construction award will follow. MS C is planned for 1st quarter FY 2015 and the SSC Program will obtain incremental LRIP approval to exercise craft construction options through planned DAB reviews.

Summary of FY 2011 DT&E Activities

- At the recommendation of the DASD(DT&E), PDUSD(AT&L) directed ASN(RDA) to accelerate the first production to reduce risk in the at-sea test program. While the initial Test and Training (T&T) craft will remain as the primary test asset, the first production craft will serve as a potential risk mitigation should a backup craft be required during IOT&E.
- The SSC program completed competitive prototyping on the subsystem level for systems not previously prototyped. The objective of these prototyping efforts was to demonstrate increased performance, reduced weight, improved maintainability or improved reliability depending on the system being prototyped. Prototype testing was also completed on the Advanced Skirt (AS), which is currently being evaluated as a "Should Cost" item for incorporation at a later date.

Summary of FY 2011 DT&E Assessments

- In support of the upcoming MS B DAB, the T&E WIPT completed a TEMP, which is currently in Navy staffing. While testing as described in the TEMP is considered adequate, the program schedule timeline is inadequate to support a MS C decision in 1st quarter FY 2015 because full-up system level testing does not start until 2nd quarter FY 2016. DASD(DT&E) considers SSC as moderate to high risk because it is a complete redesign of the LCAC, which has a legacy of reliability, corrosion and performance issues. All major SSC systems are new and some have not been used in a marine environment. The Navy has identified SSC drive train integration; command, control, communications, computers and navigation (C4N) control system development; and main engine development as moderate probability of risk occurrence with significant consequences if the risk occurs, and DASD(DT&E) agrees. The SSC is a complex new design with all new components that should have full-up system level testing to support craft production decisions.

- The DASD(DT&E) developed and presented a compromise solution to the Navy addressing the lack of system level data at MS C. Because the Navy estimated a $15M cost to alter the production schedule of SSC crafts 2 and 3, DASD(DT&E) has proposed allowing those craft to begin production but add an IPR DAB coinciding with conclusion of the Production Acceptance Test & Evaluation (PAT&E) events that support the delivery of the T&T craft to the Navy. The PAT&E period will be the first full-up system level testing that includes 240 hours of on-cushion craft testing and will partially demonstrate seven of eight Key Performance Parameters. Additionally, the IPR DAB will be scheduled at least six months prior to the start of construction of SSC craft 4 so that any significant design modifications identified during PAT&E can be incorporated prior to the start of fabrication of craft 4. Any areas found to be low risk during PAT&E will be allowed to begin production immediately. The T&T craft and crafts 1-3 have funds budgeted to accommodate defects and deficiencies for craft delivered and change order funds for craft still under construction. SSC is scheduled for a MS B DAB in 3rd quarter FY 2012 at which time this issue should be resolved.

Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle (VTUAV) Fire Scout

Executive Summary: The Fire Scout, or VTUAV system, provides a maritime reconnaissance, surveillance, and target acquisition capability to support any air-capable ship including LCS. The VTUAV program is preparing for IOT&E and an FRP decision in 2012.

The VTUAV program is at moderate risk for meeting the program schedule because of performance issues. Capability development continued in FY 2011 and IOT&E has been delayed until 2012, primarily because of suitability and voice communications relay issues. The system continues to experience operational mission reliability less than the requirement, interoperability issues with LCS ships, and link issues.

Summary of FY 2011 DT&E Activities

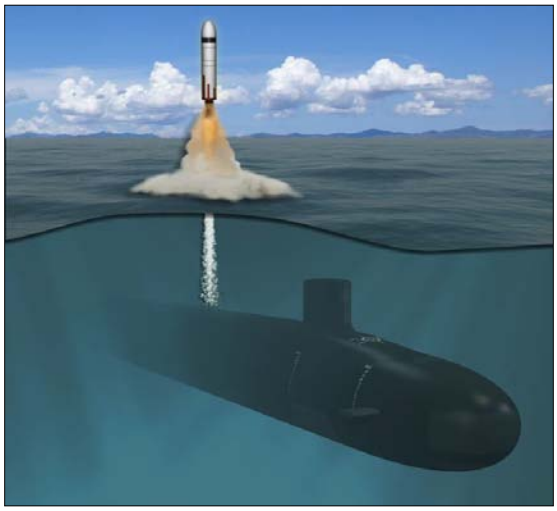
- The VTUAV program continued with software development and T&E throughout FY 2011 and supported several operational deployments including shipboard operations aboard USS HALYBURTON and expeditionary deployment to Afghanistan. The USS HALYBURTON deployments supported antipiracy operations and the North Atlantic Treaty Organization (NATO) mission in Libya.
- DT&E activities focused on software regression, additional envelope expansion to increase maximum allowed airspeed and gross weight, concurrent dual-air vehicle operations, extended time-on-station operations, and voice communication relay tests.
- IOT&E was delayed until 2012.

Summary of FY 2011 DT&E Assessments

The VTUAV program is at moderate risk for meeting the latest program schedule because of continuing performance issues. The 2007 TEMP remains adequate to support remaining DT&E except for the schedule. The T&E schedule is optimistic, assuming a high fix efficiency and no new problems. The VTUAV is meeting the target identification range KPPs and operational availability KPP and is partially meeting the net ready and automatic launch and recovery KPPs. The deck pitch angle threshold for auto launch and recovery has been demonstrated to 2 degrees at sea, versus a 3-degree requirement. Launch and recovery has been demonstrated up to 5 degrees pitch during previous land-based DTs; however, the sea states have not been rough enough to reach the required pitch conditions at sea. The VTUAV has demonstrated 10 hours reliability during DT&E and approximately 18 hours during deployment – both significantly less than the 30-hour requirement. Based on prior field tests and the at-sea demonstrations, there are lingering performance issues with voice communication relay, target location errors, and data link persistence that are being addressed but whose corrections must be verified in testing in 2012.

VIRGINIA Class (SSN 774) and OHIO Replacement Class Submarines

SSN 774



SSBN OHIO Replacement

Executive Summary: This summary covers both the VIRGINIA and OHIO Replacement (OR) Class submarines.

SSN 774 VIRGINIA Class Submarine
VIRGINIA class fast attack submarine was awarded MS III and Full Rate Production in September 2010. The class is being built in blocks. Block I (hulls 1-4) is complete, Block II (hulls 5-10) is under construction and Block III (hulls 11-18) is also under construction with the first of the block scheduled for commissioning in FY15. Block III has a number of changes from Blocks I and II in a design for affordability effort. The major changes in this effort are:

- Replacing the spherical array sonar with a Large Aperture Bow (LAB) array sonar which changes the system from an air backed array of transducers to a water backed array of separate passive receive hydrophones and active transmitters.
- Replacing the 12 Vertical Launch system tubes with 2 Virginia Payload tubes (6 missiles per tube).
- A number of other design features which have resulted in the cost per unit being lowered to the level required in order to approve the build rate of 2 per year.

A revised TEMP has been submitted by the Program Office that documents the agreed to testing to ensure the KPPs affected by these changes are still met. VIRGINIA class completed IOT&E in 2009 with the platform being found effective and suitable. Tests have been scheduled in the current revision of the TEMP to address remaining Follow-on requirements.

OHIO Class Replacement Submarine
The OHIO Replacement Program which is the follow-on submarine class to the current fleet of Trident II ballistic missile submarines received MS A approval at a December 2010 DAB and is executing the Technology Development phase in accordance with the MS A January 2011 ADM. The Navy completed all action items from the Navy R3B Service CDD review in December 2011 and is in the process of routing the OR Service CDD to the Chief of Naval Operations. The OR

Service CDD is being used to guide and focus the Technology Development phase as the program works to mature technologies and mitigate risk for MS B. The OR program is preparing for a MS B decision in FY15. The OR acquisition strategy is to use a "state of the force" concept for the majority of the non-propulsion and non-strategic subsystems such as sonar, fire control, radio, etc. As a result, the OR program will reduce risk and cost by using systems already in use on VA Class submarines. This concept also enables a reduction in the Operating and Sustainment costs across both programs. Additionally, the OR program utilizes the TRIDENT II D5 Missile currently in the force to reduce OR program risk.

Both programs remain on track for successful completion of testing.

Summary of FY 2011 DT&E Activities

SSN 774 VIRGINIA Class Submarine

- The following tests were completed: DT-IIIA1 (Arctic environment testing) and DT-IIIB (Post IOT&E NPES Modernization Testing). Arctic FDT&E addressed the ability to operate in near and under ice environments and was completed during a Fleet Under Ice Exercise. NPES modernization testing included combat system certification testing, TOMAHAWK Flight Tests (Combined DT/OT), ASW mission scenarios and minefield detection. Also, information assurance and joint interoperability certifications were leveraged. Early indications from each test were positive. Each of these tests supported proceeding to follow-on operational test and evaluation (FOT&E) for both Arctic (OT-IIIA1) and NPES Modernization (OT-IIIB) testing. FOT&E has completed and the final report is pending. Multiple tests for early discovery of items related to upcoming Block III changes were also completed.
- The Program Office has submitted TEMP Rev G for signature to address the testing required for Block III changes. Expect final approval in early CY12.

OHIO Class Replacement Submarine

- Working on an update to the Test and Evaluation Strategy (TES) as directed in the 12 November 2010 MS A TES approval memorandum. The TES update adds fidelity to the test and evaluation events planned in the OR Technology Development phase based on the OR Service CDD requirements. TES update approval is planned for 3rd quarter FY 2012.
- Completed a number of tests to advance or verify technology or manufacturing maturity levels to ready the program for moving forward to MS B. The OR program successfully completed the two year Common Missile Compartment (CMC) Integrated Tube and Hull Prototyping effort in December 2011. This effort was done to mature the manufacturing readiness level of the submarine missile tube vendor base (which has not been exercised in 15 years) and to prototype and verify the design and fixturing of a faster, better, and cheaper manufacturing assembly process planned for the OR CMC. DASD(DT&E) has participated in high priority DT&E events and is successfully monitoring and reviewing the OR DT&E activities. The OR T&E WIPT regularly reports the status of completed and planned DT events.

Summary of FY 2011 DT&E Assessments

- VIRGINIA class submarine completed IOT&E in 2009 and was reported as effective and suitable by both COTF and DOT&E. All outstanding KPP/COIs are addressed in the TEMP to be tested as the capability becomes available. The major test issue for this program has been a lack of an agreed upon surrogate with which to conduct testing to verify the program meets the diesel submarine (SSK) requirements. Over the past year, there has been a great deal of work put into this problem as the program office worked to find a solution to test this outstanding Measure of Effectiveness (MOE). Personnel from OSD, COTF, and Navy have developed a mitigation plan that is acceptable to all stakeholders and is contained in the TEMP that is in the signature cycle. The program completed a Systems Engineering Plan (SEP) and Reliability Growth Plans for the major changes to the platform from Block I/II to Block III. These plans have been agreed to by all parties and are referenced in the upcoming revision to the TEMP. The SEP is being staffed for approval and the Reliability Availability and Maintenance Plan (RAMP) has been approved.
- OR has been a well run program with respect to T&E. This program aggressively works to provide information to all stakeholders. The TES is focused on testing the portions of the program under the purview of NAVSEA PMS397. Agreements are in place with both NAVSEA 08 (Naval Reactors) and Director, Strategic Systems Program (SSP) for the conduct of technology information exchanges in conjunction with key test events to share performance results regarding propulsion plant development, and the strategic missile systems. DASD(DT&E) has developed working relationships with SSP and NAVSEA 08 to ensure the entire ship is delivered ready for operational testing. The OR T&E WIPT meets regularly to provide all the OR T&E stakeholders OR Program status as it executes the Technology Development phase and prepares the MS B TEMP.
- Across the spectrum of his programs, Program Executive Officer, Submarines is working on a system wide reliability process with a focus on mining information from the maintenance system to determine which systems and/or parts need to be improved to improve overall system reliability. The first round of results from this effort are expected in March 2012 and will help focus the submarine force on improvements required to reduce the overall operating and sustainment costs of the platforms. DASD(DT&E) will monitor the process and analyze the results to determine if early program testing in any area could have uncovered any of the discovered issues. If so, this will be fed back into the OHIO Replacement program and shared across the Naval Warfare division for potential improvement of the testing community focus throughout program life cycles.
- Currently, there are no major DT&E issues with either VIRGINIA or OHIO Replacement Class submarine programs.

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4.3 DASD(DT&E) Assessments of Air Force Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries of the following 10 programs:

- C-130 Avionics Modernization Program (AMP)
- C-27J Spartan
- C-5 Reliability Enhancement and Re-engining Program (RERP)
- Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)
- Global Positioning System IIIA (GPS IIIA) and Next Generation Operational Control System (OCX)
- Joint Air-to-Surface Standoff Missile–Extended Range (JASSM-ER)
- KC-46A Tanker Modernization Program
- MQ-9 Unmanned Aircraft System (UAS) Reaper
- RQ-4B Unmanned Aircraft System (UAS) Global Hawk
- U.S. Nuclear Detonation (NUDET) Detection System (USNDS)

C-130 Avionics Modernization Program (AMP)

Executive Summary: The C-130 AMP provides a comprehensive cockpit modernization of the C-130 fleet by replacing aging, unreliable avionics and integrating additional equipment as necessary. These aircraft span multiple models purchased by the Air Force over a 30-year period. The key features of the program include improvements in:

- configuration standardization
- reduced manpower
- communication, navigation, surveillance/air traffic management (CNS/ATM)
- navigation/safety
- reliability, maintainability, and sustainability

The aircraft flight systems will now be operable by a cockpit crew of two pilots and one flight engineer for worldwide cargo delivery missions, eliminating the navigator position.

The program completed DT&E except for the Integrated Maintenance Information System (IMIS) 5 software testing. The C-130 AMP met all KPPs and KSAs, including the reliability and maintainability requirements, with the exception of false alarm rate. Reduction of the false alarm rate is anticipated. The DASD(DT&E) began its analysis for its AOTR report and will likely recommended proceeding to IOT&E. C-130 AMP is scheduled to start IOT&E in January 2012.

Summary of FY 2011 DT&E Activities

- The C-130 AMP completed DT&E in September 2011 except for the IMIS 5 software testing. The single formal DT&E flight that evaluated aircrew workload during a low-level, formation airdrop mission in December 2009 indicated an unacceptable aircrew workload level. Four follow-on flights in April 2010 indicated that the issues were manageable but should be addressed with a follow-on software build.
- The software build for IOT&E completed flight testing in May 2011. The production Tactical Aircraft Special Mission (TASM) Aircraft/Weapons/Electronics (AWE) 4040 software completed flight test in September 2011.

Summary of FY 2011 DT&E Assessments

- The C-130 AMP successfully demonstrated all KPPs and KSAs, including the reliability and maintainability requirements with the exception of the false alarm rate.
- In August 2011, the Responsible Test Organization recommended additional software testing, improved planning and management of the flight plan during low-level flights, and resolving mission processor instabilities. All areas have been addressed in varying degrees.
- IMIS 5 testing is complete, with the final software to be delivered in November 2011, and conditionally released for IOT&E. Because IMIS 5 tested well in disconnected mode, it is an option to revert back to that mode if necessary during IOT&E.
- The C-130 AMP portion of TASM/AWE 4040 was cleared for IOT&E. However, Air Mobility Command has not approved it for fleet use at this time.
- Software build 0.1.2 addressed some of the workload issues associated with low-level formation airdrops. Software build 0.2 is anticipated to resolve the rest of the issues and will be tested after IOT&E but before the FRP decision. Adequate mission planning also mitigates the in-flight workload issue.
- System instability still adversely affects the C-130 AMP mission. Procedural work-arounds have been implemented in the flight manual to support IOT&E. About 80 percent of software-related instabilities will be addressed in software build 0.2, which delivers after IOT&E but will be tested before the FRP decision. Even with procedural work-arounds and memory card updates, the C-130 AMP will carry a moderate risk into IOT&E.

Assessment of Operational Test Readiness

- The DASD(DT&E) is completing its review of the C-130 AMP T&E program and provided an independent assessment of the readiness of the C-130 AMP to proceed to IOT&E. Based on the results to date, the DASD(DT&E) will likely recommend proceeding to IOT&E as scheduled in January 2012. Although C-130 AMP mission processor (MP) instability demonstrated with software build 0.1.2 poses a moderate risk to favorably completing IOT&E, sufficient mitigations are in place to support the recommendation to proceed to IOT&E.

C-27J Spartan

Executive Summary: The C-27J is a multifunction aircraft able to self-deploy to perform logistical resupply, casualty evacuation, troop movement, and airdrop operations. The primary mission is to move time sensitive/mission critical cargo to forward tactical units in remote and austere locations. The C-27J successfully completed qualification test and evaluation (QT&E) and multi-Service operational test and evaluation, attaining all KPPs. It fell short of its reliability requirement but is executing a planned and funded approach to attain the requirement by the end of 2012.

Summary of FY 2011 DT&E Activities

- The C-27J successfully completed QT&E in CY 2010, demonstrating threshold or better performance in all KPPs.
- FY 2011 DT&E activity involved work on the required TEMP for the FRP decision. Follow-on testing will be required for system fixes, including the flight management system, which does not support non-precision and lateral navigation/vertical navigation instrument approaches.

Summary of FY 2011 DT&E Assessments

- Changes to the bleed air and de-ice boot systems have put the aircraft on the verge of meeting its reliability criteria as of this writing. However, the improvements must be validated by a joint reliability and maintainability evaluation team in 2012. The DASD(DT&E) anticipates that the aircraft will meet the mission reliability requirement of a 90 percent probability of completing a 5.6-hour mission without a system abort by the time this report is published.

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

Executive Summary: The C-5 RERP is the second phase and completes the modernization of the C-5B/C aircraft. RERP replaces the existing TF39 engines with commercial General Electric (GE) CF6-80C2-L1F engines (military designation F138-GE-100) and implements several other reliability enhancements. RERP modification requires that aircraft first be AMP-modified under a separate program. C-5 aircraft that complete the RERP modification are re-designated C-5M, including the modified C-5A that was part of the RERP SDD program.

The program finished QT&E in 2009 with six significant discrepancies and did not achieve its reliability KPP. The program is scheduled to complete its follow-on testing in December 2011.

Summary of FY 2011 DT&E Activities

- The program executed the plan to fix the six major discrepancies discovered in QT&E and carried over into qualification operational test and evaluation (QOT&E). The six issues are:
  - training system/devices
  - auto throttles
  - environmental control system
  - in-flight thrust reversing
  - built-in test system
  - CNS/ATM capabilities.
- In addition, two key system attributes – air refueling breakaway and emergency descent – were not tested in QOT&E and hence required verification in post-FRP testing with completion anticipated in 2nd quarter FY 2012. AMC eliminated the use of thrust reversers during air refueling breakaways from the flight manual, so AMC will decide if they wish to retain this attribute and/or test it. AMC also eliminated the use of thrust reversers for emergency descents from the flight manual, but their use for rapid descents remains so this capability will be tested in FOT&E.

Summary of FY 2011 DT&E Assessments

- Follow-on testing has proceeded in accordance with the approved FRP TEMP. Although testing has not yet completed as of this writing, preliminary results indicate that three of the six discrepancies will be cleared in the first round of FOT&E with software build 3.5, two more in the second FOT&E round with software build 3.5.2. Testing has proceeded on schedule and on budget. The training systems/devices are on contract and will be evaluated when ready.
- The reliability KPP must be met at initial operational capability (IOC) plus 2 years (at approximately 30,000 flight hours in FY 2016). QT&E and QOT&E showed the system's reliability during testing to be at a 66-percent mission capable rate (MCR) vice the requirement of 75 percent. Changes planned or implemented to attain the required MCR include fixes, inspections and periodic depot maintenance, landing gear improvements, further AMP improvements, and system maturity. The success of these efforts has not yet been assessed.
- The two remaining deficiencies, built-in test and CNS/ATM, are being addressed in a software update entering DT&E in FY 2012.

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

Executive Summary: The Family of Advanced Beyond-Line-of-Sight Terminals (FAB-T) Program will develop and provide a family of multi-mission capable terminals built on an open architecture with the capability to move large amounts of voice, data, imagery, and video to and from ground and airborne platforms using the Milstar extremely high frequency and advanced extremely high frequency (AEHF) waveforms. The terminals will be essential components of the strategic nuclear execution system, installed on various military platforms enabling strategic and conventional bombers; intelligence, surveillance, and reconnaissance (ISR) aircraft; and strategic airlift platforms to maintain connectivity with rear and deployed forces.

In 2011, the FAB-T Program implemented a new system integration approach intended to increase efficiency and software productivity. System integration and test cases (2,272) were grouped into 49 functional capabilities referred to as "Boulders" and further grouped into five incremental capabilities. Although the test case completion rate increased since the implementation of the new SI&T approach, functional capability and complexity at each incremental capability have increased. Consequently, completion of test cases still lags behind the baseline schedule. One flight test was conducted to demonstrate integration of the terminal onto an aircraft platform and to demonstrate the capability to communicate with a Milstar satellite.

Summary of FY2011 DT&E Activities

- In April 2011, the FAB-T Block 6 terminal was integrated onto the RC-135 aircraft test bed. Ground tests were subsequently conducted and culminated with a flight test that successfully demonstrated the integration of the terminal onto the aircraft and successfully demonstrated low data rate (LDR) communication from the RC-135 on the ground and in flight with the Milstar satellite.
- Flight tests are being planned with the FAB-T Block 8 terminal, which will be fielded.
- The FAB-T program is planning to support on-orbit checkout with the AEHF satellite, beginning in November 2011, to verify LDR and extended data rate compatibility and demonstrate interoperability with other terminals and required interfaces.

Summary of FY2011 DT&E Assessments

- FAB-T requires a TEMP update to reflect the new acquisition strategy, provide additional definition and detail for remaining test events, and include information on the FAB-T alternate source strategy.
- The following FAB-T KPPs are still to be tested and assessed: network ready, strategic service, terminal survivability, capacity, and sustainment. KPPs that are dependent on over-the-air AEHF will be tested during terminal Functional Qualification Testing.
- SDD schedule remains aggressive as software integration complexities increase at each level of system integration. Although test case productivity has improved since May 2011, the program must continue to dedicate resources to test and address the extremely challenging system integration and to accelerate discovery of potential system issues.

Global Positioning System IIIA (GPS IIIA) and Next Generation Operational Control System (OCX)

Executive Summary: The Global Positioning System (GPS) modernization programs executed one transition exercise (TE), three GPS-level system integration demonstrations (SI DEMOs), three software integration events, and one integrated system test (IST). GPS IIF executed pre-launch checkout and early orbit testing on Space Vehicle 2 (SV 2). The GPS has used DT to demonstrate progress and reduce risk in its modernization and constellation sustainment efforts.

Summary of FY 2011 DT&E Activities

- TE 7, executed October 11–November 20, 2010, was a live demonstration of selective availability/anti-spoofing module (SAASM) over-the-air distribution and over-the-air rekey capabilities to demonstrate their use and compatibility with fielded user equipment.
- Navigation warfare (NAVWAR) ground to Joint Space Operations Center mission planning SI DEMO was executed March 10–April 26, 2011, to identify operational impacts associated with the NAVWAR mission planning.
- State vector propagation SI DEMO was executed October 22, 2010–February 2, 2011, to compare and determine whether space segment and control segment (CS) solutions are within defined tolerances when compared to the National Geospatial-Intelligence Agency's "truth source."
- Command and measurement list (CML) data exchange SI DEMO was executed March 5–April 11, 2011, to validate the ability of the CS to process the GPS-defined CML delivery media used to populate the CS databases.
- GPS III executed three software integration events to check out functionality between three SV processors: onboard computer, mission data unity, and the thin communications unit.
- GPS executed IST 2-4 from late March until mid-July 2011 to demonstrate that SAASM functions operate as intended and GPS performance is not degraded due to SAASM implementation.
- GPS executed pre-launch checkout and early orbit testing of GPS IIF SV (launched a satellite on July 16, 2011, and it was set usable on October 14, 2011).

Summary of FY 2011 DT&E Assessments

- All GPS developmental testing in FY 2011 continued to reduce risk through the TEs, SI DEMOs, software integration events, ISTs, and pre-launch checkout. The GPS testing program demonstrated key progress in GPS modernization program and SAASM ability to operate as intended without degrading GPS performance. The GPS Next Generation OCX, GPS III, and Military GPS User Equipment programs are all modifying their test programs to account for changes in the acquisition strategies. These changes need to be incorporated in the next upgrade of the GPS Enterprise TEMP.

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

Executive Summary: The JASSM-ER is an upgrade to the fielded (baseline) JASSM which provides even greater standoff range against fixed and relocatable high-value targets. The outer mold lines and systems interfaces are identical and components are approximately 70 percent common to the baseline. The extended range upgrade consists primarily of a new engine and new intake and fuel systems. The weapons weight has increased by 200 pounds primarily due to the additional fuel capacity. Flight control systems and sensors are essentially the same as the baseline missile. The program has passed MS C and based on a December 2010 AOTR recommendation has entered IOT&E. FRP should occur upon completion of IOT&E in FY 2013.

Summary of FY 2011 DT&E Activities

- IOT&E began in July 2011 utilizing the B-1 bomber as the launch platform. To date, five IOT&E missions have been concluded with nominal flights. The remaining IOT&E flight tests to fully characterize missile performance are on track to support a FY 2013 FRP decision.

Summary of FY 2011 DT&E Assessments

- Reliability concerns in the baseline JASSM system led to a revised flight test strategy requiring JASSM-ER to demonstrate a minimum reliability of 80 percent. Five integrated DT/OT tests with production-representative missiles demonstrated a point reliability of 0.80. The reliability growth curve indicates that JASSM-ER will achieve its threshold reliability of 0.85 by JASSM-ER Lot 4.
- Due to the small flight test sample size, the availability threshold was not demonstrated during developmental and integrated testing; however, successful completion of IOT&E should demonstrate the availability KPP.

The Air Force certified readiness for OT in May 2011.

Assessment of Operational Test Readiness

- The DASD(DT&E) conducted an AOTR in December 2010 and recommended proceeding to IOT&E. Testing demonstrated three of four KPPs were met with material availability not fully assessed at this time. The corrective actions taken for availability failures should support a successful IOT&E. Given the small sample size, availability was between 0.49 and 0.98 with an 80-percent confidence. Failures experienced in DT were corrected prior to integrated testing without recurrence.

KC-46A Tanker Modernization Program

Executive Summary: As the initial phase of a comprehensive aerial refueling recapitalization strategy, the KC-46 program will replace approximately one-third of the warfighting capability provided by the current aerial refueling fleet with 179 aircraft. The KC-46 also supports other mission areas to include; airlift, communications gateway, aero medical evacuation, combat search and rescue as well as treaty compliance. The program is currently in the early phases of DT&E planning with no test aircraft having been delivered and no testing conducted to date.

Summary of FY 2011 DT&E Activities

- There has been no significant test activity. The aircraft has not had its PDR, so no test aircraft have been delivered and no testing has been conducted to date. First flight and the beginning of flight testing should occur in 2014.

Summary of FY 2011 DT&E Assessments

- The current draft TEMP proposes a test program of adequate scope but with an aggressive flight test schedule. Based on the DASD(DT&E)'s analysis, the program reworked the flight test program for commercial Federal Aviation Administration certification to reduce risk. However, the planned military-specific test schedule is still more aggressive than historical experience. Additional program schedule would be required should flight test execution be realized closer to historical norms.
- Specific concerns are:
  - The planned flight-hours-per-aircraft-per-month average and the average test efficiency for military test points exceeds that for similar aircraft like the P-8A, C-17, C-130J, C-27J, and C-5.
  - The proposed schedule allots little if any calendar time for the correction of discrepancies and/or deficiencies discovered during DT prior to the planned start of OT.
  - The Air Force tester's estimate of schedule time required for qualification of all air refueling receivers is about three times as long as that allotted by the contractor. The inclusion of this additional flight time would extend the test schedule by 6 to 8 months.
  - Air refueling operators require up to a year to build the required experience levels. The Air Force is now moving to deactivate the unit specifically used to train operators, which will affect the Air Force’s ability to execute the flight test schedule.

MQ-9 Unmanned Aircraft System (UAS) Reaper

Executive Summary: The MQ-9 UAS Reaper is a multi-mission hunter-killer and ISR weapon system with a timely and persistent capability to find, fix, track, target, engage, and assess time-sensitive targets. The program is in production for Increment 1, Block 1 aircraft and preparing for a MS C decision for Increment 1, Block 5 aircraft. The program continues development of Increment 1, Block 5 capabilities along with incorporation of new, unplanned capabilities to support overseas contingency operations. The MQ-9 system meets the killer KPP and partially meets the hunter and net-ready KPPs. A TEMP update to address Block 5 T&E is expected in 2012.

Summary of FY 2011 DT&E Activities

- MQ-9 Block 5 hardware and software development and T&E continued throughout FY 2011. Discovery and correction of deficiencies in Block 1 software delayed the completion of testing of Block 1 capabilities and the start of Block 5 software testing by six months. The development delays also resulted in a program decision to not field an intermediate software build in favor of focusing on a subsequent software version.

Summary of FY 2011 DT&E Assessments

- The Block 1 system has demonstrated operational capability in the killer role and is currently in sustainment.
- The previously approved 2007 MQ-9 TEMP does not address current Block 5 T&E, although an update is expected in 2012.
- The program continues development of Increment 1, Block 5 capabilities along with incorporation of new, unplanned capabilities to support overseas contingency operations. Developmental issues are causing unplanned software changes and extending the schedule.
- The Block 5 configuration for MS C has been established, along with an understanding of the subset of capabilities able to be evaluated prior to the milestone decision.
- The system meets the killer KPP and partially meets the hunter and net-ready KPPs due to sensor limitations with medium vehicle-sized moving targets and some imagery transmission issues.
- The aircraft reliability, mean time between critical failures, is 105 hours versus a requirement of 500 hours.
- The program has deferred 12 Capability Production Document (CPD) requirements that the system will not meet or only partially meet, including the reliability requirement.

RQ-4B Unmanned Aircraft System (UAS) Global Hawk

Executive Summary: The RQ-4B UAS Global Hawk is a high-altitude, long-endurance system with an integrated sensor system that provides ISR capabilities. The Global Hawk program was restructured in 2011 into three subprograms: a baseline Block 10/20 with legacy aircraft and sensors, a Block 30 with enhanced imagery and signals intelligence sensors, and Block 40 with the Multi-Platform Radar Technology Insertion Program (MP-RTIP) synthetic aperture radar (SAR) sensor. The baseline Block 10 aircraft have been retired from operational use, and the Block 20 systems are in sustainment. The Global Hawk program declared a critical Nunn-McCurdy breach in 2011. Block 30 is preparing for a MS C and FRP decision, and Block 40 is preparing for a MS C in 2nd quarter FY 2012.

Block 30 completed IOT&E in December 2010 and is continuing development of operational capabilities. Blocks 30 and 40 are making progress in developing and delivering ISR capability, but challenges remain with T&E planning and execution. The Block 30 and 40 subprograms lack documented strategies for guiding current T&E and continue to experience system performance issues.

Summary of FY 2011 DT&E Activities

- The Global Hawk program conducted Block 30 IOT&E in 1st quarter FY 2011. In the second quarter, the program resumed developmental and operational testing for software updates to enable operational imagery intelligence missions at forward operating locations.
- The Air Force completed the MP-RTIP sensor risk reduction testing on its Proteus test bed aircraft in December 2010. In June 2011, the Global Hawk Block 40 completed the flight-envelope expansion tests and in July 2011 began flight tests for MP-RTIP sensor integration with the Block 40 aircraft.

Summary of FY 2011 DT&E Assessments

- Overall, Global Hawk T&E strategy is outdated and does not address current DT&E or T&E beyond Block 20/30 IOT&E. TEMP updates are under way for both Block 30 and Block 40. However, the lack of approved user requirements continues to drive uncertainty into the T&E planning process.
- The DT&E Block 20/30 AOTR, conducted in FY2010, recommended against proceeding to IOT&E because of moderate risk of completing IOT&E and the expectation of an unfavorable result. The Block 20/30 IOT&E concluded that the system was not operationally effective for conducting near-continuous, persistent ISR operations and not operationally suitable. Delivery of additional Block 30 operational capability has been delayed due to operational concerns with a control-related human-machine interface deficiency. System performance is meeting KPP requirements for endurance and partially meeting the other four approved KPP requirements. The system does meet all of the draft, updated KPPs.
- The MP-RTIP SAR ground mapping and ground moving target indicator operating modes met nearly all system performance specifications based on Proteus test bed results, supporting readiness to integrate the sensor onto the Block 40 aircraft. Envelope expansion testing has demonstrated full flight envelope capabilities with the Block 40 aircraft modifications.

U.S. Nuclear Detonation (NUDET) Detection System (USNDS)

Executive Summary: The USNDS conducted a connectivity test in preparation for an evolutionary technical upgrade with DT&E starting in August 2012.

Summary of FY 2011 DT&E Activities

- In November 2010, USNDS executed a connectivity test from the NDS Analysis Package Ground Station (NAPGS), located at Sandia National Laboratories, to the Integrated Correlation Analysis and Display System (ICADS).

Summary of FY 2011 DT&E Assessments

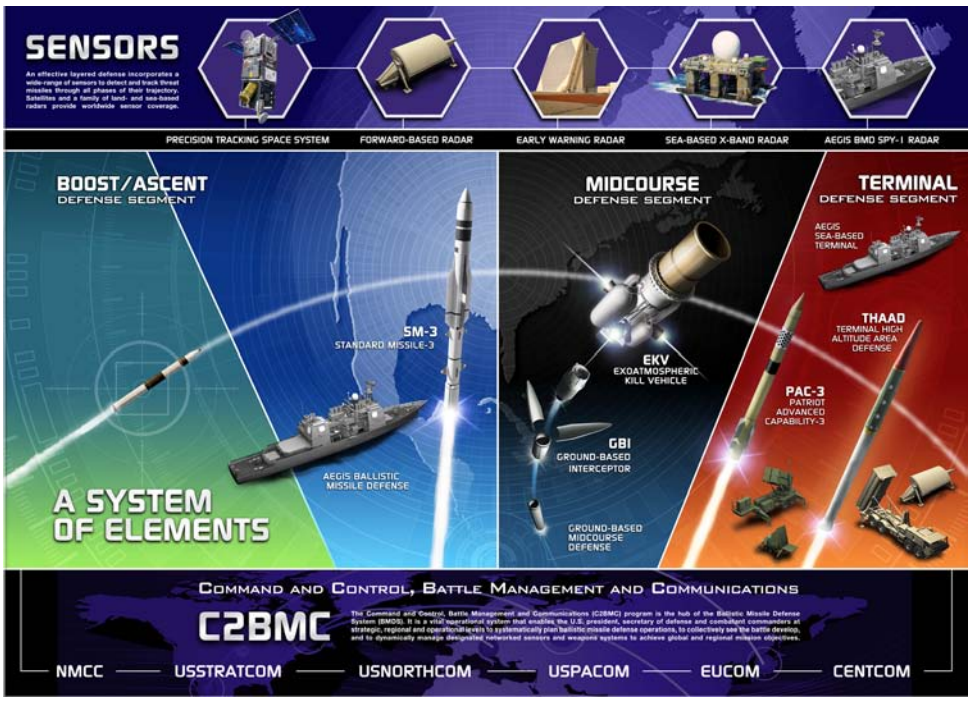
- The NAPGS successfully tracked the GPS IIF SV 2, collecting the S2 state-of-health data (USNDS sensor data) and passed the data via wide-area network to ICADS. This is a risk reduction effort to ensure connectivity and data transfer in preparation for the DT&E scheduled to start in August 2012.

4.4 DASD(DT&E) Assessments of DoD Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries of the following 6 programs:

- Ballistic Missile Defense System (BMDS)
- F-35 Joint Strike Fighter (JSF)
- Joint Lightweight Tactical Vehicle (JLTV)
- Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)
- Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) Rifleman Radio (AN/PRC-154)
- Key Management Infrastructure (KMI) Increment 2

Ballistic Missile Defense System (BMDS)



Executive Summary: The Ballistic Missile Defense System (BMDS) is designed to counter ballistic missiles of all ranges - short, medium, intermediate and intercontinental. The BMDS is an integrated, "layered" architecture that provides multiple opportunities to destroy missiles and their warheads before they can reach their targets. The system's architecture includes: networked Overhead Persistent Infrared sensors and ground- and sea-based radars for target detection and tracking; ground- and sea-based interceptor missiles for destroying a ballistic missile; and a command, control, battle management, and communications network providing the warfighter with the needed links between the sensors and interceptor missiles.

The BMDS executed the following test events: 1 of 1 Ground-based Midcourse Defense (GMD) flight tests, 1 of 1 Aegis Ballistic Missile Defense (BMD) tracking exercises, 2 of 2 Aegis BMD flight tests, 1 of 1 Terminal High Altitude Area Defense (THAAD) flight test, 1 of 1 targets program flight test, and initiated a major BMDS ground test series during FY 2011.

Summary of FY 2011 DT&E Activities

- October 18-22, 2010 the BMDS completed hardware in-the-loop Ground Test and Evaluation using short and medium range threats to support future capability deliveries.
- December 15, 2010, the GMD System was unsuccessful in intercepting an intermediate-range ballistic missile target.
- March 9, 2011, the Aegis BMD successfully conducted a simulated engagement against a separating short-range ballistic missile.
- April 14, 2011, the Aegis BMD System was successful in intercepting an intermediate-range ballistic missile target using a remote sensor.
- July 8, 2011, the targets program was successful in demonstrating the performance of the Short Range Air Launched Target.

- July 15-29, 2011, the BMDS completed Integrated Ground Test and Evaluation against short, medium, intermediate and intercontinental range threats in Southwest Asia engagement scenarios.
- August 24 and September 12-16, 2011, completed Distributed Ground Test and Evaluation demonstrating European Phased Adaptive Approach capability against short, medium and intercontinental range ballistic missile threats and integration with the NATO Active Layered Theater Ballistic Missile Defense Program.
- September 1, 2011 the Aegis BMD System was unsuccessful in intercepting a separating ballistic missile target
- October 4, 2011 the THAAD System was successful in intercepting concurrent short and medium range targets

Summary of FY 2011 DT&E Assessments

- The Ground-based Interceptor (GBI) failed to intercept an intermediate-range ballistic missile target during the December 2010 flight test. This event was a repeat of an intercept failure earlier in FY 2010. Since 1999, GBI flight tests have resulted in eight successes out of 17 attempts. The nine unsuccessful attempts, including the last two events, have required MDA to purchase additional interceptors for T&E, purchase additional targets, and delay or eliminate other critical T&E events. It is recommended that MDA re-evaluate the resources necessary for GBI T&E.
- In support of Command, Control, Battle Management, Communications and associated sensor capability upgrades, successfully conducted BMDS Distributed Ground T&E to exercise Single Stimulation Framework against short, medium, intermediate and intercontinental range threats in Northeast Asia and Southwest Asia engagement scenarios.
- In support of the European Phased Adaptive Approach the BMDS successfully demonstrated Aegis engage-on remote capability to intercept a medium-to-intermediate-range ballistic missile with an SM-3 Blk IA missile using the AN TPY-2 radar for up-range track data processed by the BMDS Command, Control Battle Management Communications.
- In support of Phased Adaptive Approach Phase 1 the BMDS successfully conducted a system-level BMDS hardware-in-the loop T&E using Southwest Asia scenarios with short, medium and intercontinental range ballistic missiles.
- The successful demonstration of the Short Range Air Launched Target re-establishes the potential to provide more threat representative scenarios for BMDS T&E.
- In support of the European Phased Adaptive Approach successfully conducted system integration and BMDS Distributed Ground T&E demonstrating capability against short, medium and intercontinental range ballistic missile threat.
- The Aegis BMD System failed to intercept a separating ballistic missile target. The T&E program is on hold until the Failure Review Board (FRB) completes the root cause analysis. The FRB results are expected in April 2012.
- The THAAD System successfully demonstrated closed loop operations, engagement functions while intercepting concurrent short range target and a target exhibiting medium range characteristics.
- MDA developed and documented two updates to the BMDS Integrated Master Test Plan (IMTP). The six-month review and revision process continues to produce a justified set of tests that accounts for policy changes (Presidents Phased Adaptive Approach for missile defense in Europe), T&E results (including unsuccessful intercepts) and fact-of-life changes in budgetary resources. This process has worked well but the IMTP should present better the strategic level integrated T&E plan for obtaining the quantitative test information needed to assess BMDS capabilities and limitations. The February 2012 update to the IMTP should address this improvement.

F-35 Joint Strike Fighter (JSF)

Executive Summary: The Joint Strike Fighter is the nations' next fifth generation Air Force, Navy and Marine Corps fighter providing stealth capability with unprecedented sensor fusion. The F-35 is in the early stages of testing with the development test program extended about 2 years due to the June 2010 Nunn McCurdy program restructure. As a result, concurrency of production, development, and testing increased significantly in FY 2011. To date, fourteen test aircraft have been delivered to the test sites; 6 Air Force F-35A CTOL variants (includes the 2 LRIP 1 aircraft) to Edwards Air Force Flight Test Center, and 5 Marine Corps F-35B STOVL variants and 3 Navy F-35C CV variants to Naval Air Warfare Center - Patuxent River. The program completed its Technical Baseline Review and a Schedule Risk Assessment to add to and adjust the scope and duration of the test program. In addition, DASD-DT&E conducted an assessment of DT&E progress as part of an AT&L directed quick-look review on concurrency.

The program is early in test execution with roughly 19% of the nearly 60,000 planned flight test points flown mainly in the conservative regions of the test space. Full government approval of test point closure is a significantly lesser percentage. Less than 5% of the total 10,260 mission systems test points planned have been flown. There is significant opportunity for discovery. Of particular interest, there has been very limited testing on the F-35C to date (2,000 out of 14,300 test points), and none of the variants have completed any significant high angle of attack testing or weapons clearance work. Wing loads, flutter, and buffet testing are limited to 80% allowable design loads until the 2014-2015 timeframe. The full-scale ground durability testing is also in the very early stages with F-35A furthest ahead, having completed 3,000 of 16,000 test hours, while F-35C tests will not begin until early 2012.

Summary of FY 2011 DT&E Activities

- While test execution at the two primary test sites is meeting planned fly rates, flight sciences and mission systems testing is 10% behind that expected by this time. This is mainly due to discovery and needed design changes as well as aircraft availability due to shortfalls in reliability and spare parts. For example, F-35A maturity flight tests and other activities to resolve issues have delayed mission systems tests. F-35B lift fan door actuator failures delayed vertical landing envelope expansion and initial sea trials.
- During 2011 the test program accomplished:
  - Open up a very limited envelope for F-35A training at Eglin AFB.
  - Conducted the initial F-35A wet runway testing.
  - Continued flight envelope expansion.
  - Conducted F-35B initial sea trials with 72 vertical landings and takeoffs onboard USS Wasp.
  - Conducted the initial F-35C ship suitability testing.
  - Conducted initial arresting gear compatibility tests.
  - Conducted the initial mission systems software (Block 0.5 and Block1A, 1B) testing.
  - Started F-35A and B 1st life durability testing; F-35C is scheduled to start in early 2012.
  - Conducted 256 F-35B vertical landings.

Summary of FY 2011 DT&E Assessments

- While the test program is early in the test execution and discovery phase, the program is meeting the projected fly rates for this stage of execution with roughly 19% of the nearly 60,000 planned flight test points flown mainly in the conservative regions of the test space, but flight sciences and mission systems testing is about 10% behind that expected by this time. The test program and flight test schedule has been revised to better reflect new test scope and span times that will be incorporated into the revised Test and Evaluation Master Plan (TEMP). The program is early into testing, so a statistical assessment of key performance measures based on flight test data cannot be made. Nevertheless, the limited test data and analysis indicate little to-no margin in the ability to meet the F-35A and C combat radius, F-35B vertical landing bring back, and short takeoff distance.
- While testing has revealed a number of issues, many of them consistent with this level of maturity, the following are key issues that are being addressed by the program:
  - Helmet Mounted Display System – The Generation II Helmet Mounted Display System (HMDS) has deficiencies in three areas which currently detract from mission tasks and its use as a certified primary flight reference: display jitter, night vision acuity, and Electro-Optical Distributed Aperture System (EO DAS) image display latency.
  - Fatigue Life – Fatigue testing on the F-35B was unexpectedly suspended following discovery of cracks in a key bulkhead. The subsequent rework and additional analysis identified other life-limited parts that must now be changed out and limits placed on delivered aircraft. Testing is not scheduled to restart until March 2012 and not complete until 2014. The F-35A will complete its first-life (8000 Hours) fatigue testing the end of 2012 and F-35C variants not scheduled to complete until 2014. While an additional 40 failures are predicted before the end of durability testing, based on historical precedence, there is a likelihood of future failures that are not yet identified.
  - Buffet – The aircraft are experiencing higher than predicted buffet during flight test, and tests have not reached the areas of highest predicted buffet loads. High buffet loads can produce higher-than expected airframe loads, particularly on the vertical tail surfaces, as well as poor ride quality and associated workload distractions. It can also interfere with use of the helmet mounted display system (HMDS).
  - Arresting Hook System (CV variant) – Initial arresting system testing has shown the current F-35C design to be inadequate. A retest of the redesign is not scheduled until fall 2012. This delay will likely affect future carrier qualification tests.
  - Fuel Dump Subsystem – The current fuel dump design has shown to be ineffective in dumping fuel clear of the aircraft surfaces, resulting in pooling and wetting aircraft surfaces with the potential risk of fire. This situation will affect future flight test and certification activities until a long-term solution is developed and tested.
  - Integrated Power Package – This system has demonstrated reliability and maintainability issues and has become a key test pacing item. Low reliability, prolonged maintenance actions and a catastrophic failure resulted in prolonged grounding of test aircraft.

Joint Lightweight Tactical Vehicle (JLTV)

Executive Summary

The JLTV Family of Vehicles is expected to modernize the light tactical vehicle fleet and provide the joint war-fighter with a mobile, lightweight tactical vehicle capable of being transported on rotary wing aircraft and other lift assets. The JLTV should provide increased force protection over the current up-armored High Mobility Multi-purpose Wheeled Vehicle. It will consist of two Mission Role Variants: the Combat Tactical Vehicle and the Combat Support Vehicle, expected to possess maximum commonality and a set of mission-specific components to meet the requirements of all Mission Packages. Mission Packages were to include the General Purpose, Heavy Guns Carrier, Close Combat Weapons Carrier, Command and Control on the Move (C2OTM), Special Purpose (SP), Utility/Prime Mover, and Shelter Carrier.

JLTV is intended to support rapid deployment and offensive operations across the full spectrum of Army and USMC military operations. The JLTV is expected to interoperate in units with other tactical vehicles and weapon systems to provide maneuver, combat power, support, and sustainment at key decision points; and disperse to conduct subsequent operations. It is expected to provide increased force protection, reliability, maintainability, availability, and fuel efficiency over current light tactical wheeled vehicles, while at the same time provide similar mobility, net centricity, transportability, and reduced logistical footprint.

The JLTV program entered the Technology Demonstration (TD) phase in December 2007 and underwent Developmental Test (DT) from May 2010 through June 2011. The program modified their Engineering and Manufacturing Development (EMD) test program based on the results of the TD phase and the DASD(DT&E) recommendations designed to lower test program risk. The program received approval to release their EMD request for proposal in January 2012 and is preparing to enter the EMD phase in the 3rd quarter FY 2012.

Summary of FY 2011 DT&E Activities

- During the TD phase, three vendors developed seven prototypes each that underwent limited DT and a Limited User Evaluation.
- The testing was adequate to provide information to assess the key capabilities and limitations of several vendor prototypes, reduce technology risk, and support refinement of system-level requirements.

Summary of FY 2011 DT&E Assessment

- The testing provided adequate information for the assessment of 5 of 8 draft KPPs.
  - The prototype variants did not satisfy the mobility KPP as none of the prototypes tested satisfied the soft soil or sand slope mobility requirements.

  - The prototype variants partially satisfied the transportability, net ready, force protection, and payload KPPs.
  - No testing was conducted to assess survivability (vehicle roll-over), sustainment, or training.
- The prototype variants satisfied the draft fuel efficiency requirement.
- The prototype variants were unable to satisfy the draft reliability requirement. The prototype variants demonstrated reliability point estimates ranging from 72 to 1,265 Mean Miles Between Operational Mission Failure (MMBOMF) versus a draft reliability requirement of 4,500 miles. As a result the Army reduced the reliability requirement to 3600 miles.
- Given the performance achieved during the TD phase, the DASD(DT&E) recommended that the Army develop a lower risk EMD test and reliability growth program by adding reliability test miles and reviewing the reliability requirement.
- The Army responded to this recommendation by eliminating the most complex mission packages (C2OTM and SP) and adding two Combat Support test vehicles and 40,000 test miles during reliability growth testing to lower the risk of the EMD test program. The Army also further reduced the reliability requirement to 2400 miles which is more in line with the predicted growth potential based on the TD results.

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

Executive Summary: The Joint Tactical Radio System, Ground Mobile Radio (JTRS GMR) is designed to enable the Military Services to acquire and field a family of affordable, scalable, high capacity, interoperable radio sets based on a common set of JTRS Application Programming Interfaces (APIs) developed in accordance with a common JTRS Software Communications Architecture (SCA). The JTRS GMR is a key enabler of the Department of Defense and Army Transformation, and would provide critical communications capabilities across the full spectrum of operations in a Joint environment. The JTRS GMR supporting the Wideband Networking Waveform is intended to be a Mobile Ad hoc Network (MANET) capability.

The JTRS GMR program completed Milestone B in June 2002 following a full and open competition and awarded a single Cost Plus Award Fee contract was awarded to Boeing. The Army officially reduced the GMR quantity requirement from 86,209 to 10,293 units in April 2011 causing a Nunn-McCurdy breach due to critical unit cost growth for Program Acquisition Unit Cost (PAUC) and a significant cost growth for Average Procurement Unit Cost (APUC) against the current and original APBs. The Secretary of the Army provided notification to Congress of the JTRS GMR critical Nunn-McCurdy breach in May 2011. The Under Secretary of Defense (Acquisition, Logistics & Technology) led a Nunn-McCurdy review and notified Congress of the termination of the JTRS GMR program in October 2011.

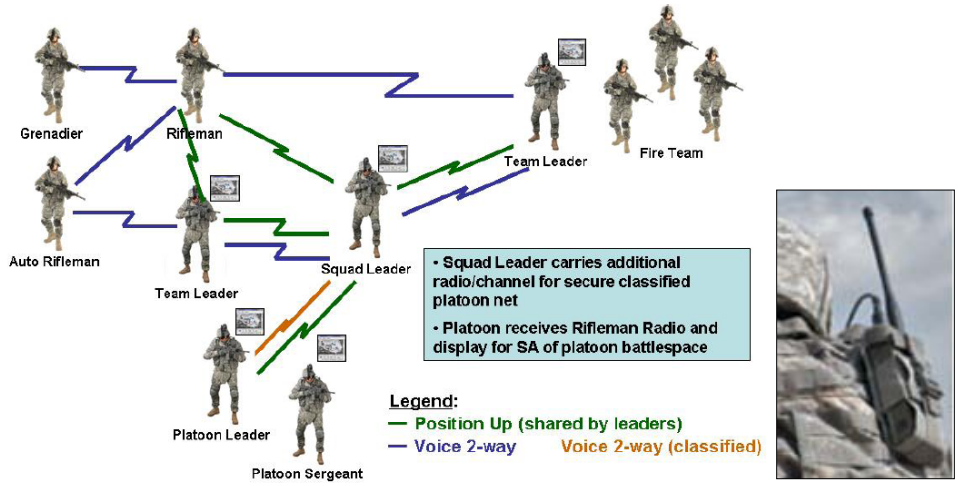
Summary of FY 2011 DT&E Activities

- The Test and Evaluation Master Plan (TEMP) for the JTRS Ground Domain, GMR Increment 1, version 1.2, was approved 12 December 2008. Following the Acquisition Service lead change to the US Army, a TEMP update for revisions in testing began in January 2010, and remained in staffing until program termination.
- PM GMR extended Developmental Testing (DT) activities into FY11, in coordination with DASD(DT&E), due to poor performance results from DT conducted in FY 2010. The PM GMR conducted Field Experiment 5 (FE 5) February – March 2011 at the Electronic Proving Grounds, Fort Huachuca, Arizona. FE 5 focused primarily on performance improvements for the Wideband Network Waveform (WNW). FE 5 intent was to address the GMR LUT entrance criteria.
- Department of the Navy (DoN), Operational Test and Evaluation Force (OPTEVFOR) conducted DT for the GMR Network Enterprise Domain (NED), Joint WNW Network Manager (JWNM) concurrent with FE5 February – March 2011. The JWNM is intended to be the primary network

management software for the JTRS Family of Radios (FoR) and is tested concurrently with, though funded separately from, the JTRS FoR programs.
- The GMR completed a Customer Test (CT) as part of the Army Network Integration Evaluation (NIE) June – July 2011. The CT was conducted in lieu of a Limited User Test (LUT) due to the PM decision to downgrade pending the Nunn-McCurdy breach. DT&E early assessment of GMR technical maturity identified an inability to meet system performance entrance criteria for the LUT.
- Planned FY 2011 Security Verification testing for NSA Type 1 certification and DIACAP compliance is incomplete.
- A Logistics Demonstration was planned in FY 2011 to demonstrate maintainability, but not conducted as part of the PM decision to suspend future test events pending the Nunn-McCurdy breach.

Summary of FY 2011 DT&E Assessments
- FE 5 results indicated significant improvement for WNW functionality issues that were identified in previous FY 2010 testing: System Integration Test Phase I and Phase II, as well as the Enhanced –Infantry Brigade Combat Team Limited User Test. GMR effectively demonstrated all Operational Requirements Document (ORD) waveforms (WNW, SRW, SINCGARS, EPLRS, High Frequency (HF), and Satellite Communications [SATCOM]). FE 5 only demonstrated, but did not test, Ultra High Frequency SATCOM, HF, and SINCGARS performance. GMR did demonstrate utility with the Advanced Field Artillery Tactical Data System (AFATDS) and other host devices, such as the Incremental Battle Command Extension (IBEX). FE 5 results did not meet the GMR LUT entrance criteria. WNW, SRW, and EPLRS tested Message Completion Rates were not met. A static operations demonstrated a maximum of 30 networked GMR nodes running the WNW. However, range performance was not performed realistically.
- OPTEVFOR prepared a Letter of Observation assessing the GMR NED JWNM performance in DT conducted as part of FE 5. The JWNM had significant improvements in functionality, although not all functions worked as expected, particularly the Over-the-Air WNW Subnet Frequency changeover and updating Internet Protocol (IP) user accounts.
- The JTRS GMR Customer Test conducted as part of NIE June – July 2011 revalidated performance issues. Forty-seven (47) GMR systems were involved in the event: 22 stand-alone Program of Record GMRs, and 25 as a part of Network Integration Kits. Major issues included low reliability, frequent system reboots, high touch temperature, and lengthy setup times that impacted operational tempo. As a result, GMR was a second choice for voice communication during the LUT. Additionally, there were size, weight, and power issues for integration of GMR into some combat platforms, including Bradley and Abrams. Test units reduced silent watch operations in order to keep GMR-equipped vehicles running to maintain vehicle battery power and keep GMR (and other systems) cool to reduce failures. Since Log Demos had not occurred for either NIK or GMR, primarily due to slower development of BIT/BITE, NET training did not emphasize maintenance, troubleshooting procedures were not mature and soldiers defaulted to requesting FSRs to perform most maintenance. A review of the FSR trouble tickets showed that a majority of the failures did not require parts placements (no evidence of failure).
- A Delta Security Verification Test was conducted to address the National Security Agency identified software issues in the August – September 2011 timeframe. Operational environment patches, Waveform optimization, and asymmetric timing tests are examples of changes that required re-verification of security test elements. Testing also focused on security related functionalities on the GMR Operating Environment, WNW (with JWNM), and SINCGARS.

Joint Tactical Radio System (JTRS) Handheld, Manpack, and Small Form Fit (HMS) Rifleman Radio (AN/PRC-154)



Executive Summary: Phase 1 of the Rifleman Radio (RR) program focuses on a one-channel, National Security Agency (NSA) Type 2 radio that provides military commanders with the flexibility to command, control and communicate with platoon level squads, via voice, video, and data media. Rifleman Radio comes with a Receiver-Transmitter (RT), antenna, battery, headset or handset, and associated cables. The system includes an embedded Global Positioning System (GPS) that provides Position Location Information (PLI) either audibly through the headset upon user request or visually through integration of an external display device.

Rifleman Radio was approved to enter LRIP at a June 2011 MS C Decision based on early FY11 Government DT&E and completion of a February 2011 Verification of Corrected Deficiencies (VCD) from the 2010 Limited User Test (LUT). The system then completed additional DT in late FY11 to support entry into an FY 2012 Initial Operational Test (IOT). DASD(DT&E) published an Assessment of Operational Test Readiness in October 2011 prior to the start of IOT.

Summary of FY 2011 DT&E Activities

- RR conducted independent Government DT&E on the improved post-LUT radio (both SW and HW) during December of 2010.
- Rifleman Radio (RR) successfully completed Verification of Corrected Deficiencies tests in February 2011.
- RR tested the production representative radio in Government Developmental Test and Evaluation 2.2 at the Electronic Proving Ground, AZ and Aberdeen Proving Ground, MD.
- DASD(DT&E) published an Assessment of Operational Test Readiness (AOTR) in October 2011 prior to the start of the IOT.

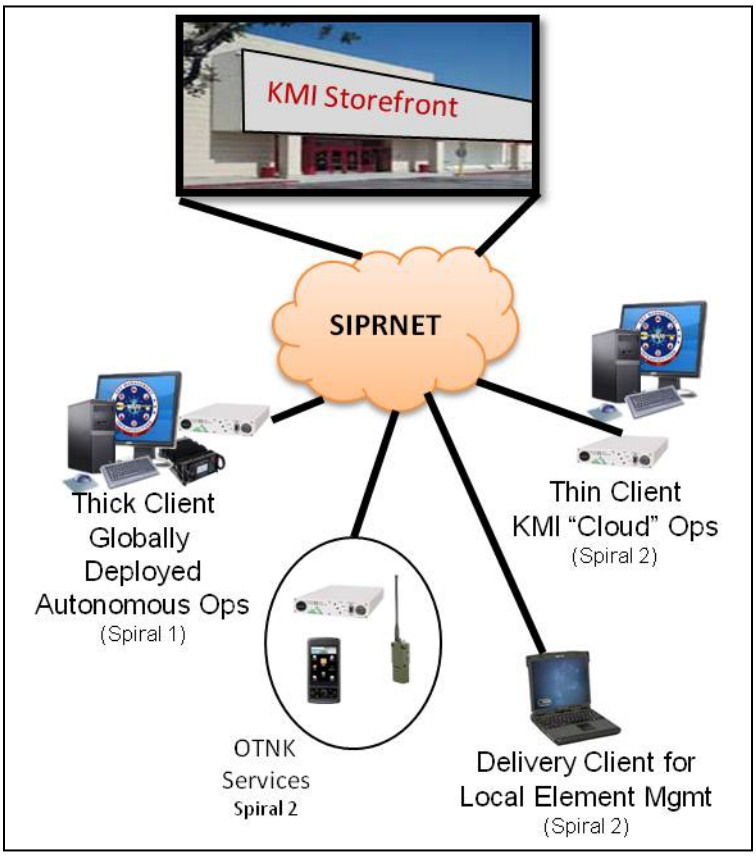
Summary of FY 2011 DT&E Assessments

- U.S. Army Test & Evaluation Command reported in April 2011 that RR enhanced the ability to execute mission across scenarios based on results of the VCD.
- DASD(DT&E) assessed the RR as low risk for Milestone C approval in June 2011 due to the favorable performance of the updated radio in Verification of Corrected Deficiencies testing. RR

met its KPPs and COIs for VCD exit criteria, with the exception of reliability. The system demonstrated only 58% of its threshold reliability requirement.
- The system provided core voice and position location capabilities during GDT 2.2 in September 2011, but demonstrated only 22% of its reliability.

Assessment of Operational Test Readiness (AOTR)
- DASD(DT&E) recommended delaying entry into IOT&E until new deficiencies on the LRIP version of the radio could be resolved and reliability growth questions could be addressed. Late changes in phasing of the Program's tests caused the remaining RR DT&E (GDT 2.3) to occur after Initial Operational Test, which diverged from Army-approved TEMP and raised the risk of RR associated with entry to IOT&E. Finally, the IOT&E test unit had significant challenges using the Soldier Radio Waveform Network Manager to load and initialize the Rifleman Radios prior to IOT&E due to complex procedures and inadequate training.

Key Management Infrastructure (KMI) Increment 2



Executive Summary: The Key Management Infrastructure (KMI) program is a vital element of the DoD's defense-in-depth strategy, adopted to ensure the security posture for the Global Information Grid (GIG) by providing transparent cryptographic capabilities consistent with operational imperatives and mission environments. As a critical enabler to the GIG Information Assurance (IA) strategy, KMI is characterized by the steady rollout of Capability Increments toward end-state IA objectives consistent with the overarching GIG and Cryptographic Modernization capability requirements.

KMI Increment 2 completed several critical DT events during FY 2011 as well as two Operational Assessments resulting in a favorable MS C Decision in October 2011. The DASD(DT&E) has recommended that the KMI Program Office implement a reliability growth program to achieve the threshold levels as outlined within the KMI CPD prior to entering IOT in FY 2012.

Summary of FY 2011 DT&E Activities

- In January 2011, the KMI program successfully completed nodal testing on the Primary Services Node, Client Node, and Product Source Node. The test verified all system interfaces between nodes. System-level testing began in February 2011 after completion of the Nodal DT&Es and the interface testing between all nodes.
- The program successfully completed System DT&E1 on 4 March 2011 at the System Integration Lab of the prime contractor, enabling the program to move into System DT&E2 on 7 March

2011. Prior to system-level DT&E2 testing, the program closed all open System DT&E1 Priority 1 and 2 Discrepancy Reports (DRs).

- From 7 to 18 March 2011 the program conducted system DT&E2 testing at three operational sites. National Security Agency operators ran the nodes at the KMI Storefront, while military Service operators executed the structured test plan with oversight by DT personnel from the Joint Interoperability Test Command. The test uncovered a number of Priority 1 and 2 DRs. The system integrator provided software updates to address each at the conclusion of the test.
- The program conducted two OAs in March and August 2011, respectively. Many of the same Priority 1 and 2 DRs found during DT&E2 were observed again during system operations early in the OA testing. Following additional software corrections, the system demonstrated significant improvement in stability and effectiveness during the second OA; however, issues with the token interface, symmetric key ordering, and asymmetric key ordering limited the full effectiveness of the system. While the tokens demonstrated improved reliability, there was still a 4% token failure rate during the test. As a result of the 28 October 2011 Milestone C approval, the KMI Program Office has coordinated an agreed-upon token reliability growth plan which is planned for formal pilot and regression testing prior to entering IOT&E in 3rd quarter FY 2012.

Summary of FY 2011 DT&E Assessments

- DT&E risk is moderate for software stability and maturity. The program has not adequately demonstrated KMI token and Client Node reliability. The KMI PMO accepted the DASD(DT&E) recommendation to implement a reliability growth program to achieve the threshold levels as outlined within the KMI CPD. Additionally, DASD(DT&E) requested that IOT&E move from 2nd quarter FY 2012 to late 3rd quarter FY 2012 to allow time for sufficient regression testing to demonstrate closure of operational effectiveness and suitability issues identified during OA2 testing. The PMO accepted this recommendation as reflected in revised program documentation.
- Early FY 2012 testing indicated a token problem with electrostatic discharge. The PM is implementing two design changes to address the issue with new tokens expected in late March 2012 for additional testing.

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5 DASD(SE) ACTIVITIES

In FY 2011, DASD(SE) implemented a number of initiatives in the areas of policy and guidance, program engagement and oversight, and workforce development to increase the Department's systems engineering capability and capacity.

5.1 Policy and Guidance

DASD(SE) developed and published systems engineering and related specialty engineering policy and guidance to improve the application of systems engineering principles and best practices in the Department's acquisition programs. New policies include DoD Instruction (DoDI) 5134.16, "Deputy Assistant Secretary of Defense for Systems Engineering"; new policy and guidance for key acquisition documents; and DTM 11-003, "Reliability Analysis, Planning, Tracking, and Reporting." DASD(SE) also developed updates to the DAG and coordinated with the Joint Staff to update the JCIDS policy and guidance to improve consideration of early systems engineering analysis during the development of realistic operational requirements. In addition, the Principal Deputy, USD(AT&L) transferred the program manager's Critical Design Review (CDR) reporting responsibility to the Office of the DASD(SE), resulting in increased oversight of this key technical event. Significant DASD(SE) activities are summarized in the following paragraphs.

5.1.1 DoD Instruction 5134.16, "Deputy Assistant Secretary of Defense for Systems Engineering"

On August 19, 2011, the USD(AT&L) approved DoDI 5134.16 to establish systems engineering policy, assign responsibilities and functions, and prescribe relationships and authorities for DASD(SE) pursuant to 10 U.S.C. 139b. As principal advisor to the Secretary of Defense and the USD(AT&L) on systems engineering, development planning, and related engineering fields, the DASD(SE) communicates directly with the heads of DoD Components and the Joint Staff, serves as an advisory member of the Defense Acquisition Board (DAB), and approves SEPs for MDAPs and MAIS programs, including Defense Business Systems and National Intelligence Programs.

The instruction provides DASD(SE) with the authority to perform continuous technical engagement, oversight, and review of Department-wide systems engineering and development planning capabilities; to develop systems engineering, development planning, manufacturing, and reliability and maintainability (R&M) policy and guidance; to influence pre-Materiel Development Decision (MDD) and MS A activities; and to participate in AoA oversight.

5.1.2 Acquisition Documents

The USD(AT&L) memo "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending," released on September 14, 2010, provided guidance to deliver better value to the taxpayer and warfighter by improving the way the Department does business. One of the areas the memo targeted was non-productive processes and unnecessary bureaucracy. In response to this guidance, DASD(SE) led or supported several streamlining activities to eliminate non-relevant content and reduce the volume and cost of key acquisition documents while focusing

documentation and reporting requirements on the critical content required to successfully manage an acquisition program. In FY 2011, DASD(SE), partnering with the Office of the Director, Acquisition Resources and Analysis (ARA), the Office of Defense Procurement and Acquisition Policy (DPAP), and the Office of the Assistant Secretary of Defense for Logistics and Materiel Readiness (ASD(L&MR)), implemented updated outlines for the TDS/AS, the SEP, the PPP, and the Life Cycle Sustainment Plan (LCSP).

The new TDS/AS Outline increases emphasis on program business arrangements, risk, and affordability, and incorporates the technical data rights strategy. Other content has been moved to the SEP (i.e., the Modular Open Systems Approach; the Corrosion Prevention and Control Plan; the Environmental, Safety, and Occupational Health Summary; and the Human Systems Integration Summary).

The SEP Outline defines the critical core content and a set of data-driven products required for successful program execution. Several newly mandated tables and figures provide details on technical performance measures and metrics, design considerations, R&M activity planning and timing, engineering tools, reliability growth curve, and contractor technical staffing. The simplified and standardized data presentation focuses increased attention to critical systems engineering activities.

The PPP Outline emphasizes full life cycle planning and execution of all security activities in an acquisition program. The data-driven approach focuses on the central objectives of program protection: identification and protection of critical technology, components, and information with risk-based countermeasures and mitigations. As the office of primary responsibility for the PPP, DASD(SE) is working with stakeholders across the Office of the Secretary of Defense (OSD), including the DoD Chief Information Officer, to integrate the information assurance strategy with program protection activities and fully implement the Department's strategy for trusted defense systems reported to Congress in January 2010.

The LCSP establishes linkages to systems engineering with active partnership between the product support and systems engineering communities critical to meeting affordability targets. Sustainment planning depends on reliability, maintainability, and logistics activities that drive operations and support costs, ultimately influencing the total acquisition cost. Increased participation by systems engineers in the planning and execution of R&M engineering activities throughout the acquisition life cycle and in cooperation with the sustainment community will allow programs to identify opportunities to increase efficiency and effectiveness throughout the life cycle of the program, resulting in more affordable systems.

In the February 24, 2011, memorandum "Expected Business Practice: Post-Critical Design Review (CDR) Reports and Assessments," the Principal Deputy, USD(AT&L) approved transferring the program manager's CDR reporting responsibility to the Office of the DASD(SE). Members of ODASD(SE) participate in MDAP and MAIS CDRs and prepare a brief assessment of the program's design maturity and technical risks requiring Milestone Decision Authority attention.

5.1.3 DTM 11-003, "Reliability Analysis, Planning, Tracking, and Reporting"

DTM 11-003, approved for release on March 21, 2011, emphasizes the need for better reliability engineering in the acquisition process and seeks to improve the efficiency of the defense acquisition system by institutionalizing reliability planning methods and reporting requirements timed to key acquisition activities. This new policy requires MDAPs to describe their reliability activities in three core acquisition documents: the SEP, the TDS/AS, and the Test and Evaluation Master Plan (TEMP).

1. Effective in March 2011, the SEP describes mandatory R&M engineering activities, including the Reliability, Availability, Maintainability, and Cost (RAM-C) Rationale Report and the reliability growth curves beginning at MS A.
2. The TDS (preceding MS A) and the AS (preceding MS B and C) specify how sustainment characteristics and the sustainment Key Performance Parameter thresholds translate into R&M design requirements and contract specifications. The TDS/AS also include the tasks and processes to be stated in the request for proposal (RFP) that the contractor will be required to employ to demonstrate the achievement of reliability design requirements.
3. The TEMP specifies how reliability will be tested and evaluated (and includes updates to the reliability growth curve beginning at MS B).

Implementation of this policy is ongoing, with programs starting to provide insight into their R&M activities using these documents.

5.1.4 Defense Acquisition Guidebook

In FY 2011, DASD(SE) updated the DAG Chapter 4 (Systems Engineering) to reflect "fact-of-life" changes resulting from the Weapon Systems Acquisition Reform Act of 2009 (WSARA) and associated policy and guidance updates described in this report, including the development planning activities initiated in FY 2010. DASD(SE) also led the development of a new DAG chapter on program protection to reflect the new PPP Outline and guidance. The updated DAG provides the most current policy and guidance necessary for programs to manage their systems engineering activities.

In addition, the FY 2011 NDAA Section 812 required comprehensive guidance on the implementation of manufacturing readiness levels. DASD(SE) updated the DAG with new guidance on how manufacturing readiness should be used throughout the acquisition phases, beginning at the program's earliest phase. The guidance, included in DAG Chapter 4 (Systems Engineering), paragraph 4.4.14.2, provides best practices that can be tailored according to product domains, complexity, and maturity of critical technologies, and to specific risks that have been identified throughout the assessment process.

The best practices were developed jointly by industry and Government manufacturing subject matter experts who identified nine manufacturing risk areas that program managers should assess before and during technical reviews and before acquisition milestones. DASD(SE) also supported DPAP's update to the Defense Federal Acquisition Regulation with language that considers the assessment of manufacturing during the source selection process.

5.1.5 Systems Engineering in Joint Capabilities Integration and Development System

The Joint Staff orchestrated a comprehensive JCIDS process review during FY 2011. DASD(SE) was a proactive member of this review. Successful delivery of warfighter capabilities relies on the JCIDS process working in concert with the Defense Acquisition System process. Consistent with DASD(SE) efforts to influence Pre-MDD and MS A activities, a critical change in JCIDS was identified to strengthen this bond by requiring a more complete and deliberate role for the Joint Staff and the capability sponsor at MS A. This change requires the Joint Staff to provide informed advice to the Milestone Decision Authority at MS A based on the operational requirements as well as engineering and analytic activities within the Materiel Solution Analysis (MSA) phase. This collaboration is critical because the operational requirements going in to a MS A decision guide program activities in the following Technology Development (TD) phase, including contract actions leading to a preliminary design.

5.2 Program Engagement and Oversight

DASD(SE)'s program engagement and oversight efforts range from participating in AoA senior advisory groups and providing input to pre-MDD and MS A activities (e.g., development planning) to its primary role of continuous technical engagement, oversight, and review of MDAPs and MAIS programs. DASD(SE) uses its documented DAPS (Defense Acquisition Program Support) methodology (see Section 5.2.5) to review programs supporting SEP development, review, and approval; technical assessments; and review of program measures and metrics. DASD(SE) leverages the findings from the programs it reviews to perform systemic root cause analysis (SRCA) (Section 5.2.6) with the goal of influencing future policy and guidance. The following sections describe how DASD(SE) executes these responsibilities with respect to pre-MDAPs, MDAPs, and MAIS programs.

5.2.1 Development Planning

DTM 10-017, "Development Planning to Inform Materiel Development Decision (MDD) Reviews and Support Analyses of Alternatives (AoA)" established policy that enables the MDA to make informed decisions based on a sound technical foundation at the earliest stages of an acquisition program. DASD(SE) engages with the operational and capability sponsors early in the acquisition life cycle to ensure that capability gaps are understood well enough to transition to the acquisition system, that programs complete adequate technical planning and analysis to support the next phase of acquisition, and that technical, cost, and schedule risk drivers are considered in the analysis and final AoA recommendation(s). In FY 2011, DASD(SE) reviewed 23 Initial Capabilities Documents prior to Joint Requirements Oversight Council (JROC) approval, provided direct support to 21 pre-MDAPs preparing for an MDD review, and served as a technical advisor for 10 AoAs; details are shown in Figure 5-1.

To support policy implementation and establish a robust community of practice for development planning, DASD(SE) created the Development Planning Working Group (DPWG) in March 2011. Membership includes representatives from the three military departments; Office of the Director for Cost Assessment and Program Evaluation (CAPE); and AT&L organizations such as DASD for Strategic and Tactical Systems and the Defense Threat Reduction Agency; as well as the Joint Staff.

The working group facilitates sharing of current and emerging information; provides greater visibility into development planning implementation efforts at the OSD, Joint Staff, and military department level; and has helped establish a common understanding of policy objectives among its members, making it easier to implement the policy's intent.

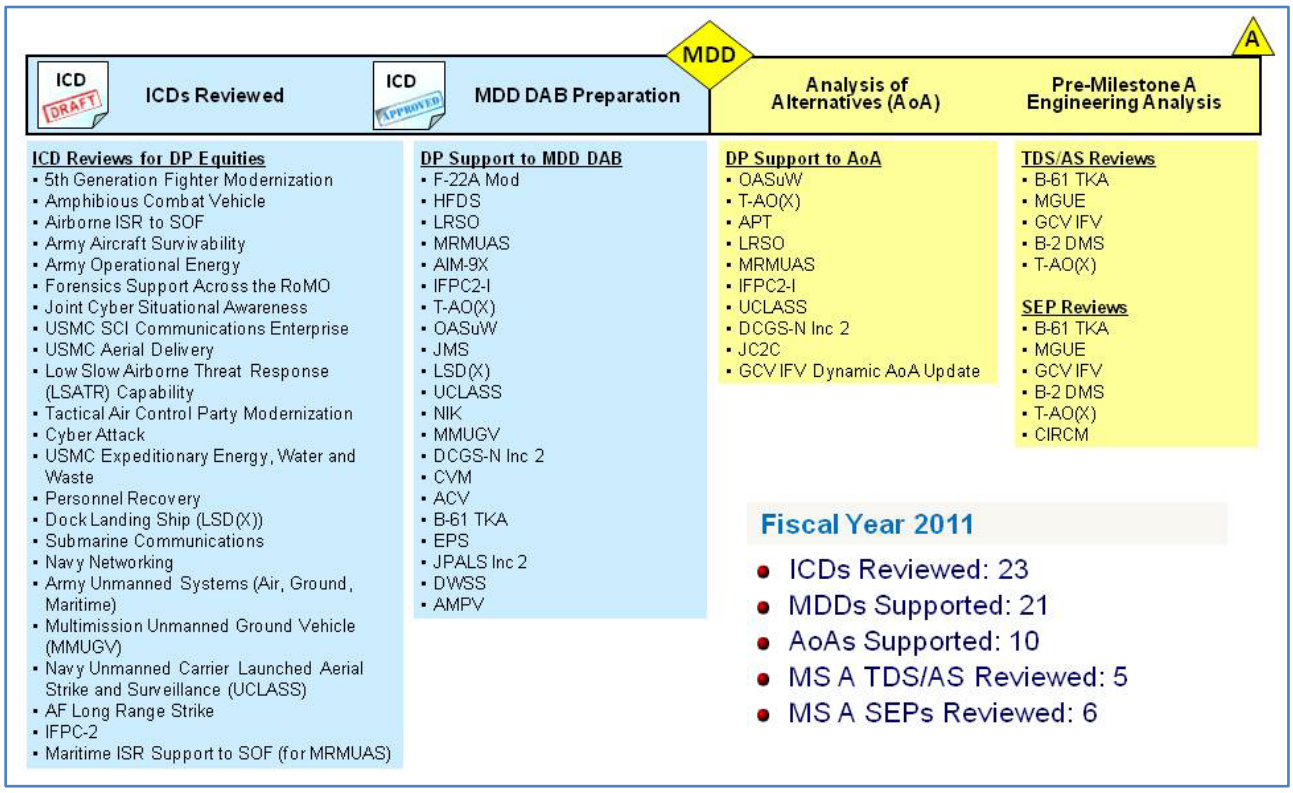

Figure 5-1. FY 2011 Development Planning Program Support

5.2.2 Performance Measures and Metrics

DASD(SE) implemented a multi-faceted approach to monitor the performance of MDAPs and MAIS programs focused on performance measures and metrics. The approach requires quantitative metrics to be documented in the program SEP.

DASD(SE) reviews SEPs to ensure programs approaching an acquisition milestone clearly document their strategy for identifying, prioritizing, and selecting a set of metrics for monitoring and tracking program management, systems engineering, and technical performance activities. A minimum set of metrics are documented in the updated SEP Outline released in April 2011.

- Programs are required to provide an overview of their plans for Technical Performance Measures (TPMs) and their metrics selection process, including the approach to monitor execution to the established plan, and identification of roles, responsibilities, and authorities for this process.
- SEPs must contain the TPMs and metrics, as well as intermediate goals, and the plans to achieve the TPMs and goals. TPMs and metrics provide quantitative insight for monitoring technical performance.

- DTM 11-003 now mandates programs include a reliability growth curve in their SEP to plan, illustrate, and report progress (see Section 5.1.3).

5.2.3 Systems Engineering Plan Development, Review, and Approval

DASD(SE) reviews and approves SEPs for MDAPs and MAIS programs. DASD(SE) provides technical guidance and assistance, and also participates in PMO-organized SE WIPTs, to help shape technical planning and documentation of the SEP. Table 5-1 summarizes these FY 2011 SEP-related activities. DASD(SE) typically will engage PMOs approximately 6 to 12 months prior to the program's next milestone review, to support SEP development. Typically, SEPs developed and reviewed in one fiscal year are approved in the following year, as programs will engage DASD(SE) up to a year out from a major milestone event to support SEP development and formal approval.

Table 5-1. FY 2011 SEP Review and Approval Activity Summary

Major Program	SEPs Reviewed	SEPs Approved*
MDAP/Pre-MDAP	20	14
MAIS	3	1
Total	23	15

* Note: 12 SEPs reviewed in FY10 were approved in FY11, and 20 SEPs reviewed in FY11 are expected to be approved in FY12.

5.2.4 Systems Engineering Technical Reviews and Assessments

DASD(SE) provided systems engineering technical oversight, guidance, and assessments through continuous program engagements, Program Support Reviews (PSRs) and focused independent reviews of major programs. Engagements during Systems Engineering Technical Reviews (SETRs) and SE WIPTs provide technical insight into program performance and health. DASD(SE) technical support reviews such as PSRs use the DAPS methodology (see Section 5.2.5) to independently assess program health. Reviews are conducted on major programs prior to and in support of an Overarching Integrated Product Team (OIPT) or DAB review. Typically, reviews focus on the PMO to help shape a program's technical and management processes to ensure positive outcomes, assess program health, and increase the probability of program success.

DASD(SE) engagements are balanced across military departments, system domains, and the product development life cycle through the following systems engineering activities:

1. Program Support Reviews (PSRs) – DASD(SE) conducted 15 PSRs in FY 2011. PSRs are conducted on all Acquisition Category (ACAT) ID and ACAT IAM programs in accordance with DoDI 5000.02. PSRs inform the Milestone Decision Authority, OIPT, and program office staff of the status of technical planning and management processes by identifying cost, schedule, and performance risks as well as recommendations to mitigate those risks. PSRs are conducted to support pending OIPT program reviews, requests by the USD(AT&L), and requests from program managers (PMs).
2. Nunn-McCurdy (N-M) Certification Reviews – DASD(SE) supports IPT #5 and assesses program management and systems engineering processes, to certify the management structure of the program is adequate to manage and control costs. The same review methodology used to

support PSRs is essentially used for N-M Certification Reviews. DASD(SE) supported five N-M Certification Reviews in FY 2011.

3. Focused Reviews – DASD(SE) conducted 19 focused technical reviews in FY 2011. These included an Independent Manufacturing Readiness Review, a Defense Management System review in concert with an Air Force Independent Technical Review, an OIPT-directed review, two reliability reviews on a program, and a quick-look technical review of one program.
4. Systems Engineering Technical Reviews (SETRs), and Preliminary Design Review (PDR) and Critical Design Review (CDR) Assessments – DASD(SE) participates in technical reviews of MDAPs, particularly those such as the PDR and CDR, which result in reports to the USD(AT&L) as the Milestone Decision Authority. DASD(SE) provides an independent assessment of PDR and CDR system-level reviews, and in the case of the PDR, informs the Milestone Decision Authority's 10 U.S.C. 2366b certification activities. DASD(SE) also attended subsystem SETRs, which lead to a system-level review in a building block approach, and delta or Engineering Change Proposal reviews that do not require a formal assessment. In FY 2011, DASD(SE) attended and conducted three PDR and seven CDR system-level assessments. DASD(SE) also attended five PDRs and 16 CDRs that were subsystem reviews not requiring an independent assessment. In summary, DASD(SE) supported 58 SETRs, which included 31 PDRs/CDRs, and 37 other program SETRs.
5. Peer Reviews - DASD(SE) supports the Director, DPAP as a team member during pre-award Peer Reviews for service contracts with an estimated value of $1B or more. Pre-Award Peer Reviews are conducted in three phases: (1) prior to issuance of the solicitation; (2) prior to request for final proposal revisions; and (3) prior to contract award. DASD(SE) supported 6 Peer Reviews in FY 2011.

Table 5-2 provides a summary of the major DASD(SE) engagement areas in support of MDAPs and MAIS programs in FY 2011. This table lists a summary of technical reviews and assessments, informally referred to as SE touch points, for the major programs in FY 2011. Figure 5-2 provides a pie chart distribution showing the number of engagements across military departments, domain areas, and the various types of SE touch points.

Table 5-2. FY 2011 DASD(SE) Technical Reviews and Assessment Summary

Major Program	PSRs	N-M Reviews	Focused Reviews	SETRs	PDR Assessment	CDR Assessment	DPAP RFP Peer Reviews
MDAP/Pre-MDAP	15	5	17	57	3	7	4
MAIS/MDA	0	0	2	1	0	0	2
Total	15	5	19	58	3	7	6

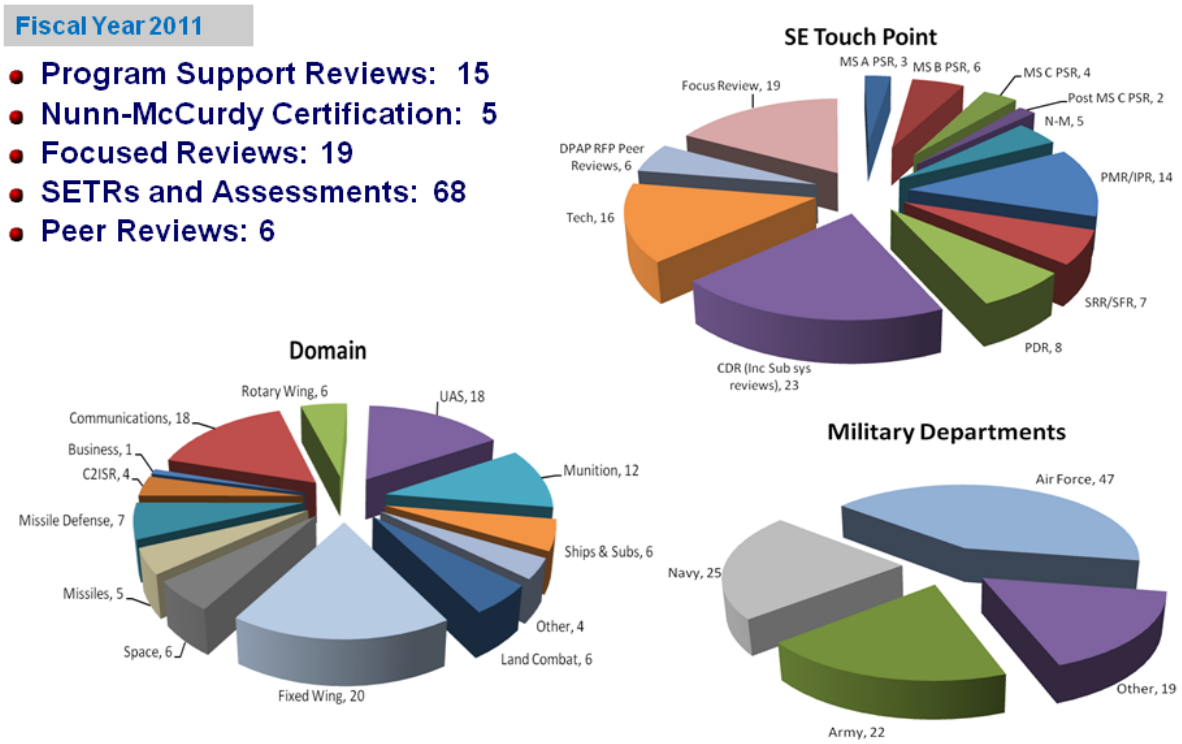

Figure 5-2. FY 2011 DASD(SE) Technical Reviews and Assessments by Domain and Military Department

Table 5-3 provides a list of major programs detailing the systems engineering activities, technical reviews and assessments, and support to other OSD reviews in FY 2011. The activities highlight DASD(SE) involvement in WIPTs and working groups to support document development, technical reviews, and assessments. These activities are essential to providing independent assessments and recommendations throughout the program acquisition life cycle to inform leadership during OSD reviews. The OSD reviews include CAPE-led AoA Senior Advisory Group meetings and program Integrating Integrated Product Teams (IIPTs), which are working-level meetings typically held prior to formal senior official OIPT meetings. The OIPT informs the DAB and Milestone Decision Authority. Engineering analysis to highlight DASD(SE) issues and programmatic risks are developed and internally briefed to inform leadership prior to formal OSD reviews.

Table 5-3. FY 2011 DASD(SE) Program List and Activity Details

	SE Activities				Technical Reviews and Assessments							DASD(SE) Support to OSD Reviews					
PROGRAM NAME (Acronym)	**SE WIPT**	**Tech WG**	**SEP**	**PPP/AT**	**Peer Reviews**	**Focus Review**	**PSR**	**N-M**	**PDR**	**CDR**	**Other**	**AoA SAG**	**IIPT**	**OIPT**	**DAB Prep**	**DAB/ITABs**	**DAES**
3DELRR	1	1											1	1			
AARGM																	
AAS												1					
AB3-A/B	1	2		5							2						1
Abrams	1											1					
ACV		1										1	1	1			
ACWA*				1				1			1		1	2	2	2	1
AEHF														1			1
AGM-88E																	1
AIAMD*	2			1					1		1		1	1			
AIM-9X-II			1	1									1	1	1	1	
AMDR	3			1							2						
AMRAAM																	1
APEX													3				
AR/LSB												2					
B-2 DMS*			2								1		2	1	1	1	1
B-2 EHF Inc 1*			1				1				1						1
B61 TKA*	1		1	1			1						1	1			
BAMS*	2	1		2						6	1		1				1
Biometrics (BEC, BEI, IDS, and JPI)	10									2		2	5	1			
Bradley												1					
C-130 AMP													2	1			

	SE Activities				Technical Reviews and Assessments							DASD(SE) Support to OSD Reviews					
PROGRAM NAME (Acronym)	**SE WIPT**	**Tech WG**	**SEP**	**PPP/AT**	**Peer Reviews**	**Focus Review**	**PSR**	**N-M**	**PDR**	**CDR**	**Other**	**AoA SAG**	**IIPT**	**OIPT**	**DAB Prep**	**DAB/ITABs**	**DAES**
C-130J	2										2						1
C-27J	2	1	1	1							2		1	1	1		
C-5M															1	1	
CANES*		1		1						2			1	1	1	1	
CEC	2			1							1						1
CH-47F																	1
CH-53K*	7	3	1	2		1				1	2		1				
CIRCM			1														1
CJR		1															1
CVLSP	1											1					
CVN 78		1															
DCGS-A	2	1	1										1				
DCGS-AF																	1
DCGS-N Inc 2*	2	1										1	1	1	1	1	
DDG 1000*								1						1	1	1	
DI2E																	
DWSS				1									1	1	1	1	
E-2D AHE*	4	2				1							1	1	1	1	
E-8C JSTARS*	1	2					1			1							
EA-18G																	1
ECSS*														1	1	1	
EFV	1																
EHR		1										1					
EIBCT										1					1	1	
e-Procurement	1	1												1			
EPS				1									2	1			
Excalibur*****		3	1					1		1	1						
F/A-18E/F																	
F-22A Mod*				2					1		1		2	2			1
F-35*		1	1	1		2					2			1			
FAB-T*						3					2		1	1			1
Fire Scout		2											1				
FMTV																	1
G/ATOR	3	1											1	1			

	SE Activities				Technical Reviews and Assessments							DASD(SE) Support to OSD Reviews					
PROGRAM NAME (Acronym)	**SE WIPT**	**Tech WG**	**SEP**	**PPP/AT**	**Peer Reviews**	**Focus Review**	**PSR**	**N-M**	**PDR**	**CDR**	**Other**	**AoA SAG**	**IIPT**	**OIPT**	**DAB Prep**	**DAB/ITABs**	**DAES**
GCSS-A*	1	1								1				1	1	1	1
GCV IFV*	1		1		2								1	2	1	1	1
Global Hawk*	2	4	1	2		1	1	1					7	2	2	2	
GMLRS-AW*		2	1						1			1					1
GPS III SV 1-8			1	1			1			1		1	1				2
GPS OCX*			1				1		1				3	1	1	1	2
Gray Eagle*	4	6		3		2					1		1	2	1	1	1
GBMD					2												
H-1			1										1	1	1	1	
HC / MC-130 Recap	1			1													2
HFDS												1	1				
HH-60RC	2	2		1									1				
HIMARS																	
HPCMP														1			
IFPC2-I	1											1	2	1	1		
ISPAN Inc 2		1												3			
JAGM*	1		1	1			1		1				2				
JALN												4	1				
JASSM-ER*	1	1		1			1				1		1	1	1	1	
JATAS			1														
JC2C												3	2	2			
JCTI-G												3	1	1	1	1	
JHSV*													1	1	1	1	
JLENS				1							1		1				
JLTV*	3	5	1	1			1						2	1			
JMS*			1	1			1						2	1			
JPAL Inc 1A*	1	1								1							1
JPALS Inc 1B	1	1									1						
JPALS Inc 2	1	2	1										2				
JSOW																	1
JTRS GMR*								1									
JTRS AMF*	1					1				1	1		1	1			1
JTRS HMS*		4	1	1		1					1		1		1	1	1

	SE Activities				Technical Reviews and Assessments							DASD(SE) Support to OSD Reviews					
PROGRAM NAME (Acronym)	**SE WIPT**	**Tech WG**	**SEP**	**PPP/AT**	**Peer Reviews**	**Focus Review**	**PSR**	**N-M**	**PDR**	**CDR**	**Other**	**AoA SAG**	**IIPT**	**OIPT**	**DAB Prep**	**DAB/ITABs**	**DAES**
JTRS NED		2															
KC-130J													1				1
KC-46A	1		1	1	2	1					1		1	1	1	1	
KMI	2	6	2	2		2					1		1	1	1		1
LCS (Seaframes)*	1	3		3									2	2	2	2	
LCS MM*	3	2	1	2									2	1	1	1	
LHA 6																	1
LPD 17														1	1	1	
LRSO												2	2	1	1	1	
LUH																	
MGUE - GPS			1				1						1				1
MH-60R																	1
MIDS JTRS*		4															
MLP	1	2	1	1			1		1					1	1	1	
MMUGV												1		1			
MP-RTIP		2		1													
MPS Inc IV														2			
MRAP			1														
MRMUAS	1	1		1								2	1	1	1	1	
MUOS																	1
NAVSTAR GPS																	1
Nett Warrior	1		2											1			
NGEN	6		1	2									4	2			
NGJ	1			1									1	1	1	1	
NMT		1															
OASuW												3	2	1	1	1	
ORP*	2	6		1			1						1	1	1	1	
P-8A	3	2		1													1
PIM		1	1											1	1	1	
PKI Inc 2	2	9											1	1	1		
Reaper*	2	4	1			1	1		1	2	1		1	1	1	1	2
RMS*	4	8	1	1									1	1	1		
SBIRS		1															1
SDB II*	1									2	4						

	SE Activities				Technical Reviews and Assessments							DASD(SE) Support to OSD Reviews					
PROGRAM NAME (Acronym)	**SE WIPT**	**Tech WG**	**SEP**	**PPP/AT**	**Peer Reviews**	**Focus Review**	**PSR**	**N-M**	**PDR**	**CDR**	**Other**	**AoA SAG**	**IIPT**	**OIPT**	**DAB Prep**	**DAB/ITABs**	**DAES**
SM-6*	3	3		1		1					1		1	1	1	1	
SPACE FENCE				1									2				
SSC	1		1	1			1		1				1				
SSN 774	4	4															
Stryker*				1		1					1						
T-AO(X)*	2		1	2								3		1	1	1	
Teleport Gen3 Phase 2	1									1			1				
TRIDENT II																	1
T-X Adv Pilot Trainer												2					
UCLASS	2	2		1									4	2	1	1	
UH-60M																	1
V-22	1			1													1
VTUAV		2															1
VXX	1																
WGS																	1
WIN-T Inc 2		3				1							1				1
WIN-T Inc 3													1				1
Totals	116	125	38	61	6	19	15	5	8	23	37	38	101	73	44	39	50

* MDAP assessment provided in this report (Section 7).
SE WIPT – Systems Engineering Working Integrated Product Team
Tech WG – Technical Working Group, usually an informal meeting with program engineers
SEP – Systems Engineering Plan
PPP/AT – Program Protection Plan/Anti-Tamper
PSR – Program Support Review
N-M – Nunn-McCurdy Certification Review
PDR – Preliminary Design Review, to include subsystem PDRs and assessments
CDR – Critical Design Review, to include subsystem CDRs and assessments
Other – Other SETRS, including System Requirements Reviews (SRRs), System Functional Reviews (SFRs), Technical Information Meetings (TIMs), Program Management Reviews (PMRs)
AoA SAG – Analysis of Alternatives Senior Advisory Group review meetings
IIPT – Integrating Integrated Product Team
OIPT – Overarching Integrated Product Team
DAB – Defense Acquisition Board
ITAB - Information Technology Acquisition Board
DAES – Defense Acquisition Executive Summary

5.2.5 Defense Acquisition Program Support (DAPS) Methodology

The DAPS methodology is the DASD(SE) authoritative process for conducting PSRs to assist programs in preparing for milestone decisions. First published in October 2004, the DAPS methodology defines a robust listing of programmatic and technical areas, sub-areas, factors, and assessment criteria, developed to be both broad in scope and sufficiently detailed to be applicable to programs of all types. PSR teams employ the DAPS methodology to ensure a consistent program assessment approach and sufficient depth in all relevant review areas, adapted to the current development phase and intrinsic conditions.

The DAPS methodology was derived from numerous sources in the Defense acquisition community and reflects expert knowledge and acquisition experience from both Government and industry. The DAPS methodology was updated in 2011 to reflect fact-of-life changes pursuant to the WSARA, and other focused enhancements. These enhancements include: updates to reflect the current DoD acquisition model (e.g., competitive prototyping, and PDR before MS B); program protection planning; modeling and simulation; and manufacturing, software, and reliability and development planning DTMs.

The DAPS methodology is integral to PSR team preparation in structuring the scope and focus of review areas. Review teams visit program offices and contractor facilities, and conduct on-site interviews with relevant discussions in context, all informed by prior analysis of program documentation. PSR team members strive to identify program strengths, weaknesses, risks, and issues, while assessing root causes as bases for findings and actionable recommendations.

PSR findings and recommendations are briefed and adjudicated with the program managers and prime contractors prior to finalizing the report, which is provided to the PMO, briefed internally, and summarized at the OIPT. The PSR results also are captured in a database for systemic analysis. An automated DAPS methodology tool is being developed to facilitate consistency in team assessments and reporting from PSRs.

5.2.6 Systemic Root Cause Analysis

DASD(SE) performs systemic root cause analysis (SRCA) of findings identified during PSRs. The SRCA database provides a summary of insights to identify the most prevalent issues discovered during PSRs for the major acquisition programs across all military department domains. The purpose is to identify and develop effective recommendations that go beyond treating symptoms. This analysis allows DASD(SE) to identify opportunities to improve acquisition performance through updates in policy, education, and effective systems engineering practices.

5.3 Workforce

DASD(SE) strives to ensure the Department's engineering workforce is trained, certified, and qualified to meet the needs of complex systems engineering efforts. As part of this activity, DASD(SE) provides oversight of the Defense Acquisition Workforce Improvement Act (DAWIA) SPRDE-SE/PSE Career Paths, and the PQM Career Field workforce certification standards for education, training, and experience. As Functional Leader for the SPRDE-SE/PSE and PQM career

fields, DASD(SE) continued to provide advocacy, oversight, and guidance to elements of the acquisition workforce responsible for systems engineering, development planning, and life cycle management and sustainability functions in FY 2011.

5.3.1 DAWIA Career Paths and Career Fields

DASD(SE) reviews the workforce certification standards to ensure they are relevant to and consistent with current systems engineering policy and guidance and to provide direction to DAU regarding course content. To this end, DASD(SE) sponsored the following DAU course development and revisions in FY 2011, primarily responding to changes in DoDI 5000.02 ("Operation of the Defense Acquisition System"), the DAG, 10 U.S.C. 139b, and the USD(AT&L) Better Buying Power initiative:

- Revision of SYS 101, Fundamentals of Systems Planning, Research, Development, and Engineering
- Revision of SYS 202/203, Intermediate Systems Planning, Research, Development, and Engineering, Part I and Part II
- Revision of SYS 302, Technical Leadership in Systems Engineering
- Development of SYS 350, Systems Engineering Technical Leadership
- Revision of LOG 103, Reliability, Availability, and Maintainability
- Revision of PQM 201B, Intermediate Production, Quality, and Manufacturing, Part B
- Revision of PQM 301, Advanced Production, Quality, and Manufacturing

5.3.2 Engineering Workforce Initiatives

DASD(SE) led several workforce development initiatives intended to address the growing challenges to the Department and the Defense Industrial Base (DIB) for attracting and retaining the most qualified engineering leaders. These initiatives included supporting the ASD(R&E) STEM strategic and implementation plans; leading the PSE component of the Key Leader Professional Development program; working with the defense industry and engineering professional organizations on education and training initiatives; and conducting national and international workshops that explore lessons learned in systems engineering education, training, and development.

DASD(SE) also initiated the 21st Century Engineering Workforce Development project in collaboration with DAU. This initiative envisions an engineering workforce with the capability, capacity, and competence needed to address 21st century acquisition technical and programmatic challenges. The goals are to establish a process that leverages workforce development and robust certification and qualification as the foundations for cultural and technical revitalization of the DoD engineering enterprise and to determine the essential technical knowledge, skills, and abilities needed by practicing DoD systems engineers to contribute to the technical success of acquisition programs across all experience levels.

5.3.3 Systems Engineering Research Supporting Workforce Initiatives

The DASD(SE)-sponsored Systems Engineering Research Center (SERC) is conducting four collaborative research projects described below that are intended to advance DoD workforce performance:

1. Research Topic (RT)-1: The Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE) (funded by DASD(SE)) is being developed as an international standard for constructing the engineering development model and provides up-to-date reference material to enhance learning content.
2. RT-19: The Systems Engineering Capstone Program (funded by ASD(R&E)) will give SERC and military-affiliated schools an opportunity to experience the multidisciplinary systems engineering experience and better understand the DoD/DIB work environment to capture these engineers for our workforce. This initiative provides lessons learned and promising practices on incorporating systems engineering principles into the curriculum.
3. RT-4: Technical Leadership (funded by DAU) will develop a DAU advanced course in the systems engineering curriculum, SYS 350A, to help aspiring technical leaders develop and refine their skills in analyzing complex technical problems, finding solutions, and making sound judgments in the presence of high ambiguity, rapid change, and challenging nontechnical constraints. This initiative is applicable to senior technical leaders in systems engineering across all communities and all standards of excellence and covers systems, business, and enterprise leadership skills.
4. RT-16: Experience Accelerator (funded by DAU) will develop a simulator-based learning experience that puts the learner in an experiential state to facilitate deep learning. This experience would compress the time required to train and would greatly accelerate the learning of a systems engineer to a rate faster than would occur naturally on the job. This initiative seeks to transform the professional development of systems engineers by creating a new paradigm to provide the skills necessary to address emerging systems challenges in an economically attractive manner.

5.3.4 DoD Systems Engineering Workforce Data

Table 5-4 shows the latest workforce data for each Military Department and DASD(SE), including the total number of Government (civilian and military) acquisition-coded personnel in the SPRDE-SE/PSE career fields for FY 2005 through FY 2011, the planned growth of the personnel from FY 2012 through FY 2016, and the FY 2016 planned end-state. It also shows the total number for FY 2011 and the projected number for FY 2012–2016 for contractor positions in-sourced to the SPRDE-SE/PSE career fields, DoD personnel recoded to SPRDE-SE/PSE positions, and the SPRDE-SE/PSE new hires. The total number of SPRDE-SE/PSE personnel is projected to be 38,861 by the end of FY 2016, a growth of 924 since the end of FY 2011.

Table 5-4. Systems Engineering Workforce Positions in the DoD Reported by Military Department SEs and DASD(SE)

Total Number of Civilian and Military Acquisition-SPRDE-SE/PSE Personnel								
Fiscal Year	**Year Ending**	**US Army**		**US Navy**[1]		**US Air Force**		**DASD(SE)**	
FY05	30-Sep-05	11,138		16,745		6,505		13	
FY06	30-Sep-06	11,964		16,670		6.242		14	
FY07	30-Sep-07	11,050		16,785		6,162		13	
FY08	30-Sep-08	10,769		16,495		6,430		14	
FY09	30-Sep-09	10,208		18,086		7,206		13	
FY10	30-Sep-10	10,647		19,279		7,625		14	
FY11	30-Sep-11	10,071		19,327		8,516		23	
Planned Growth in Civilian and Military Acquisition-Coded SPRDE SE & PSE									
Fiscal Year	**Year Ending**	**US Army**		**US Navy**		**US Air Force**[2]		**DASD(SE)**	
As Reported In:		**FY10**	**FY11**	**FY10**[3]	**FY11**[4]	**FY10**	**FY11**	**FY10**	**FY11**
FY12	30-Sep-12	255	10	146	282	150	-543[5]	0	0
FY13	30-Sep-13	208	11	225	160	86	-86	0	0
FY14	30-Sep-14	220	11	88	94	170	160	0	0
FY15	30-Sep-15	125	0	164	79	-4	-6	0	0
FY16	30-Sep-16		0		35		-9		0
Total Number of Contractor Positions In-sourced to SPRDE SE & PSE Positions									
Fiscal Year	**Year Ending**	**US Army**		**US Navy**[6]		**US Air Force**[7]		**DASD(SE)**	
FY 11	30-Sep-11	22		17		205		0	
FY12	30-Sep-12	0*		190		90		0	
FY13	30-Sep-13	0*		76		25		0	
FY14	30-Sep-14	0*		56		0		0	
FY15	30-Sep-15	0*		79		0		0	
FY16	30-Sep-16	0*		35		0		0	
Total Number of DoD Personnel Recoded SPRDE-SE/PSE Positions									
Fiscal Year	**Year Ending**	**US Army**		**US Navy**[8]		**US Air Force**		**DASD(SE)**	
FY11	30-Sep-11	71		-188		732		0	
FY12	30-Sep-12	0**		----------		0		0	
FY13	30-Sep-13	0**		----------		0		0	
FY14	30-Sep-14	0**		----------		0		0	
FY15	30-Sep-15	0**		----------		0		0	
FY16	30-Sep-16	0**		----------		0		0	
Total Number of SPRDE SE & PSE New Hires									
Fiscal Year	**Year Ending**	**US Army**		**US Navy**[9]		**US Air Force**[2]		**DASD(SE)**	
FY11	30-Sep-11	18		115		552 (actual)		9	
FY12	30-Sep-12	2		92		106		0	
FY13	30-Sep-13	5		84		0		0	
FY14	30-Sep-14	5		38		160		0	
FY15	30-Sep-15	***		0		0		0	
FY16	30-Sep-16	***		0		0		0	
Planned End-State Total Number of Civilian and Military Acquisition-Coded SPRDE SE & PSE									
Fiscal Year	**Year Ending**	**US Army**		**US Navy**[10]		**US Air Force**[2]		**DASD(SE)**	
FY16	30-Sep-16	10,103		20,703		8,032		23	

* In-Sourcing program put on hold as of 31 DEC 2010.
** Projections not practical. SPRDE recoded positions varies based on need.
*** FY15 and FY16 projections unknown at this time due to the end of DAWDF growth hiring and the hold on

in-sourcing.

[1]Data as of 30 Sep 2011 from DACM MIS.

[2]Data based on FY 13 PB 23 as of 11 Jan 2012.

[3]Data from PB12/PB23. Accounts for in-sourcing and Section 852 only.

[4]Data from PB13/PB23 of Jan 2012. Accounts for in-sourcing and Section 852 only.

[5]Overhires play a significant role in the delta between FY11 personnel and FY12 positions. In FY 11, there were 379 SPRD&E-SE/PSE overhires funded by DAWDF alone.

[6]Numbers represent positions to be hired and not contractor positions eliminated as implied by the title. Data from PB13/PB23 of Jan 2012.

[7]Data based on Manpower Programming and Execution System as of 30 Sept 2011.

[8]DON defines a recode as a change in the position category of a billet from a non-acquisition billet into an acquisition position (a gain (+)) or from an acquisition to a non-acquisition position (a loss (-)). Changes within the acquisition workforce from one career field designation to another are not considered recodes.

[9]DON does not track a specific category known as new hires. For the purposes of this report, only Section 852 hires are provided here. A combination of in-sourcing and Section 852 could also be considered "new hires" as provided in planned growth section of this table. Adding Section 852 and in-sourcing numbers gives the total provided in Planned Growth in Civilian and Military in SE/PSE.

[10]US Navy planned end-state is based on PB13/PB23 FY11 planned number (19,398 civ + 262mil) and not the FY11 actuals. Add insourcing +852 (planned growth from above - 650 cum) then add other growth (393 - cum from FY12-FY16). Other growth is growth that is not attributed to in-sourcing or Section 852 growth. Does not factor in recodes.

6 DASD(SE) ASSESSMENTS OF MILITARY DEPARTMENTS

6.1 Assessment Overview

DASD(SE) requested that each of the military departments (Army, Navy, and Air Force) submit a systems engineering self-assessment in accordance with the reporting requirements in 10 U.S.C. 139(b) as follows:

> "The service acquisition executive of each military department and each Defense Agency with responsibility for a major defense acquisition program shall develop and implement plans to ensure the military department or Defense Agency concerned has provided appropriate resources for…
>
> (B) Development planning and systems engineering organizations with adequate numbers of trained personnel in order to—
>
> (i) support key requirements, acquisition, and budget decisions made for each major defense acquisition program prior to Milestone A approval and Milestone B approval through a rigorous systems analysis and systems engineering process;
>
> (ii) include a robust program for improving reliability, availability, maintainability, and sustainability as an integral part of design and development within the systems engineering master plan for each major defense acquisition program; and
>
> (iii) identify systems engineering requirements, including reliability, availability, maintainability, and lifecycle management and sustainability requirements, during the Joint Capabilities Integration Development System process, and incorporate such systems engineering requirements into contract requirements for each major defense acquisition program."

The military departments were asked to provide an update of their FY 2011 progress and FY 2012 plans in implementing the 10 U.S.C. 139(b) requirements as well as the impact of the FY 2012 budget on their systems engineering workforce.

The Departments of the Army, Navy, and Air Force systems engineering self-assessments are provided in their entirety in Appendices A though C, respectively. DASD(SE) used the self-assessments to review the organizations and capabilities of the military departments with respect to systems engineering, development planning, reliability and maintainability engineering, and systems engineering in contracting and JCIDS, and to identify needed changes or improvements to such organizations' capabilities and policies in accordance with 10 U.S.C. 139(b).

6.2 Systems Engineering

Based on the self-assessments provided by the military departments, DASD(SE) confirmed that each has continued to pursue efforts in FY 2011 to advance the practice of systems engineering.

6.2.1 Organization

The military departments have made changes to their acquisition organizations that are likely to affect the systems engineering mission in FY 2012.

The Army has taken the positive step of standing up the Office of the Chief Systems Engineer (OCSE), which expands the scope and mission of the systems engineering function at Army headquarters level over the previous Office of the Director of Systems of Systems Engineering (SoSE). In addition, the Army has established the System of Systems Integration Directorate, reporting to the OCSE, to continue the function previously served by the Office of the Director of SoSE. However, this reorganization comes at the expense of standing down the Program Executive Office (PEO) for Integration, which served the role of integrating functions across the Army PEOs, and aligns the SoSI Directorate and the OCSE under the Deputy of Acquisition and Systems Management within the Office of the Assistant Secretary of the Army of Acquisition, Logistics, and Technology (ASA(ALT)).

The Department of the Navy (DON) has taken the positive step of fully establishing the Competency Aligned Organization Business Model in FY 2011. DON Systems Command (SYSCOM) alignment to the Competency Aligned Organization business model provides a collaborative operating structure that permits systems engineers to provide independent technical assessments to the Program Manager while honoring lines of command, fiscal accountability, and program requirements. The Navy has committed in FY 2012 to actively engage the SYSCOM technical authorities in all phases of the acquisition process, and the PEOs will be encouraged to use this structure to support programs. The DON continues to successfully leverage the Systems Engineering Stakeholders Group (SESG) to ensure collaboration across the four SYSCOMs responsible for acquisition. The Navy Chief Engineer position, previously occupied by an SES billet, has been abolished as part of the Secretary of Defense efficiencies initiative; all headquarters systems engineering activity now reports through the DASN(RDT&E), along with other functions. DASD(SE) looks forward to continued cooperation with the DASN(RDT&E) as the DON headquarters advocate for systems engineering policy, guidance, workforce advocacy, and corporate acquisition decision support.

The Air Force has taken several positive steps toward improving its systems engineering capabilities. The Air Force has transferred operational control of the Air Force Center for Systems Engineering, the organization responsible for revitalizing systems engineering, to the Secretary of the Air Force for Acquisition (SAF/AQ). The Air Force Research Laboratory has established a Chief Engineer position at its headquarters and in each of its technical directorates to lead early systems engineering activities. The Air Force has also appointed a Center Level Technical Authority (CLTA) in each center to assess the adherence of program offices to center-level systems engineering policies, practices, guidance, tools, education, and training. The CLTA will assist the PEOs in appointing Chief Systems Engineers assigned to each program. These actions represent a positive step within the Air Force to ensure that, at the program level, there will be a successful implementation of systems engineering within the centers and MDAPs throughout the acquisition process. The Air Force Materiel Command is reducing the number of its centers from 12 to 5 with plans to have the Air Force Life Cycle Management Center focus on acquisition. The Air Force also recently began to take steps to relocate the systems engineering function at the headquarters level. The impact of these reorganizations on the Air Force's systems engineering capabilities is not yet known.

In times of constrained budgets and potential manpower reductions, the Department of Defense must continue to ensure that critical systems engineering functions have the adequate resourcing, authority, and support at the military department headquarters level, within the PEOs/SYSCOMs and within MDAP program offices. In adapting to these new budget constraints, it will be critical for the Department to protect the recent progress made toward improving the systems engineering capabilities of the Department and implementing the Weapon Systems Acquisition Reform Act.

6.2.2 Policy and Guidance

Efforts are under way or planned for FY 2012 across the military departments to address recent OSD systems engineering and development planning policy updates. These efforts provide guidance specific to each military department to strengthen their execution of systems engineering. The Army's OCSE is working with the Army G-8 to align their SoS engineering processes and tools with the recent portfolio management process established by the Army, including a SoS Engineering Handbook currently in development. The DON released SECNAV Instruction 5000.2E in September 2011, which describes the Naval systems engineering policy in support of DoDI 5000.02, with plans to flow this policy update to guidance in FY 2012. In addition, each of the Navy SYSCOMs is working on efforts such as establishing technical authorities and competencies, technical reviews, and developing and managing requirements, all of which will be shared through the SESG across the Naval enterprise. The Air Force has updated AFI 63-101 (Acquisition and Sustainment Life Cycle Management) and AFI 63-1201 (Life Cycle Systems Engineering) in FY 2011 to incorporate early systems engineering and development planning processes.

Each military department is adapting its acquisition policies and processes to implement acquisition policy requiring that the Preliminary Design Review (PDR) take place before Milestone B. This requirement sets a demand for robust systems engineering early in the acquisition process. Through implementation of the revised DASD(SE) SEP Outline, the military departments and the MDAPs are performing more effective and streamlined technical planning to achieve this better technical risk identification and management strategies earlier in the acquisition process.

6.3 Development Planning and Early Systems Engineering

The military departments have made progress to address the challenges of performing early systems engineering and to comply with the intent of OSD development planning policy as required by DTM 10-017, "Development Planning to Inform Materiel Development Decision Reviews and Inform Analyses of Alternatives." Examples of this progress are evident in each military department and across the Department of Defense.

Development planning and early systems engineering play a key role in ensuring that requirements are achievable and well-defined at the outset, allowing for more predictable and attainable execution of acquisition programs. DASD(SE) recommends that each military department ensure the systems engineering community is resourced and authorized to provide value-added input to the requirements development process and the preparation of RFPs. Well-defined operational and system performance requirements informed by engineering analysis will lead to well-structured contract requirements and more successful overall acquisition programs.

DASD(SE) acknowledges the Army's efforts to better align acquisition to requirements through the Network Integration Agile Process and the Network Integration Evaluation effort. DASD(SE) recommends that the Army continue to emphasize the role of systems engineering during requirements development. The Army's Ground Combat Vehicle (GCV) provides an example of how collaboration between systems engineers and requirements developers early in the acquisition process resulted in prioritized and achievable system performance requirements. The Army should demonstrate that its policies, guidance, processes, and workforce capabilities ensure that requirements developers incorporate systems engineering considerations in assessing the feasibility and prioritization of requirements, and that those requirements translate into well-defined system development contracts.

DASD(SE) commends the DON's commitment to improving its capability to ensure that operational and system performance requirements are informed by the systems engineering community through the realignment of acquisition Gate 3 to precede MS A and its reorganization into a Competency Aligned Organization construct. This construct enables independent technical authorities to provide systems engineering guidance and advice in the development of achievable and well-defined operational requirements during execution of the JCIDS process and the development of procurement and sustainment contracts.

The Air Force has incorporated development planning into its policy and guidance. In FY 2011, the Air Force continued to resource a stand-alone program element (PE), which funded completion of five development planning efforts producing Concept Characterization Technical Description documents in preparation for an MDD. The Air Force is also working to improve collaboration between its science and technology (S&T) and development planning communities to better align planning for S&T, technology transition, and materiel development.

As a leader in revitalizing development planning as a discipline within the Department of Defense, the Air Force has successfully reintroduced systems engineering into the operational and system performance requirements development processes in the pre- and early phases of the acquisition life cycle. By maintaining the portfolio perspective in a cooperative fashion between the requirements sponsor and the acquisition community, the Air Force is able to make balanced investment decisions. It incorporates current and emerging technological capabilities while considering the technical risks and constraints identified by the systems engineering community. In addition, Commander-appointed CLTAs can ensure compliance with established DoD and Air Force acquisition policy, enforcing good systems engineering practice in developing operational and system performance requirements, RFPs, and contracts. The challenge facing the Air Force, as with the other military departments, will be to recruit and retain the qualified workforce to implement good systems engineering practice as it relates to informing the Department's requirements development and contracting processes.

At the enterprise level, the Development Planning Working Group (DPWG), chaired by the DASD(SE), has served as a forum for the military departments and OSD to share emerging information, work through issues, and draw on lessons learned from across the Department to improve plans and implementation strategies.

The Department must continue its progress toward efficient and effective early systems engineering. DASD(SE) will look to engage with the military departments in FY 2012 to solidify their foundation for development planning. In particular, the military departments should:

- Evaluate and update/create, where necessary, policy and guidance at the military department level to implement DoD policy and guidance on development planning.
- Continue to mature the organization and governance structure in place to support their execution and oversight of development planning.
- Identify the development planning resources needed to implement strategies specific to each military department.
- Begin to consider methods or measures to evaluate and track the quality of development planning being performed and its impact on system acquisitions.

6.4 Reliability and Maintainability (R&M)

The military departments were active participants in the working groups that led to the development of the new DoD R&M policy contained in DTM 11-003, "Reliability Analysis, Planning, Tracking, and Reporting," approved March 21, 2011. The new policy requires that each military department formulate a comprehensive R&M strategy for MDAPs. This strategy includes mandatory engineering activities as well as key systems engineering planning for R&M. After the DTM was signed in March, the military departments have made visible progress toward implementing the new DoD R&M policy.

In adopting the policies of the DTM, the military departments have identified R&M points of contact (POCs) within their individual systems engineering organizations to address R&M engineering matters and to promote top-level interaction with ODASD(SE). For example, the DON has created an R&M Engineering Directorate and has adopted R&M Integrated Project Teams (IPTs) or Working Groups within all SYSCOM systems engineering organizations. The Air Force has identified a lead to coordinate life cycle systems engineering integration in the area of R&M. The military departments recognize that identifying top-level leadership is an important first step toward implementing the DTM.

The military departments are currently modifying or in the process of releasing their own policy to implement the new DoD R&M DTM. The Air Force, for example, is working to append an attachment to Air Force Instruction (AFI) 62-101, which specifically addresses R&M. The Navy is planning to tailor R&M policy from the DTM and expand the scope to include all ACAT levels. The military departments are developing detailed training to improve the acquisition workforce skills required to implement the new R&M policy (e.g., Air Force has worked with Air Force Institute of Technology (AFIT) to tailor a short course to address product center needs, DON has shown efforts to provide basic R&M fundamentals training, and Army has established a comprehensive Specialty Engineering Education and Training (SE2T) pilot program through DAU).

Although progress has been made in implementing and adopting the DTM, there is a recognized need to increase the capacity of the R&M engineering workforce. A consequence of acquisition reform in the mid-1990s was the elimination of a large portion of the Government and contractor R&M

engineering workforce. For example, in 1989 the Air Force had 52 dedicated R&M engineers at Wright-Patterson Air Force Base; by 2001, only six remained.

In addressing this issue, the military departments are working to recruit and equip their workforce. The Army has pursued consortiums with universities that have R&M-focused curriculums in order to gain access to the universities' top R&M engineering graduates. The DON has employed R&M engineering tools such as the Integrate Reliability Software Suite to provide a standard and efficient approach to the many facets of R&M engineering.

One key observation common across the military departments was an inadequate number of trained R&M engineers to support current and future MDAP R&M requirements. The dilemma of maintaining an adequate workforce is a complex problem. By appointing the R&M POCs and identifying leadership positions, the military departments have taken initial steps to begin to address this challenge.

6.5 Workforce Initiatives

The Army, Navy, and Air Force all continue to use the Defense Acquisition Workforce Development Fund (DAWDF) (Section 852) funds to recruit, hire, develop, train, and retain their acquisition workforce. These funds continue to be a vital part of these workforce activities. In the area of training, the military department PEOs all use multiple methods to train new and mid-level engineers in an effort to build bench capability in support of systems engineering. These methods include a variety of resources offered by DoD, academia, industry, and industry associations.

For example, the Army has developed partnerships with the Naval Postgraduate School for a master of science in systems engineering degree. The Army's Research, Development, and Engineering Command (RDECOM) has established a cooperative research and development agreement with the Systems Engineering Research Center (SERC) to develop techniques and an approach for addressing complex SoS problems, to develop courses that apply systems engineering principles on solving complex system of systems problems. RDECOM and SERC are working with DASD(SE) and DAU to refine the new Technical Leadership (SYS 350) course, which teaches leadership skills and lessons learned. Most important, RDECOM has established a Systems Engineering IPT across the command. The IPT focuses on establishing corporate processes for executing systems engineering discipline within the command through tools, methodology, and application to engineering programs.

The Navy is executing according to the DON Acquisition Workforce Strategic Plan of August 2010, which set out to grow the SPRDE workforce by 16 percent from 2010 through 2015. Each Systems Command has taken measures to address its individual needs for recruiting, hiring, training, development, and retention, utilizing the Naval Postgraduate School's Master of Science in Systems Engineering (MSSE) Program and the Systems Engineering Management–Product Development Leadership Education in the 21st Century (SEM-PD21) Program as two sources for advanced education. A Systems Engineering Career Path Model with suggested avenues for qualifications and certifications, professional development, and leadership opportunities has been provided to enable the workforce to develop depth and breadth across its professional lifetime.

The Air Force completed the Bright Horizons–Air Force STEM Workforce Strategic Roadmap. The USAF STEM Advisory Council is chaired by SAF/AQ and meets quarterly to review progress on the goals and initiatives in Bright Horizons. Through the Council and the Roadmap, the Air Force is developing measures to attract, retain, shape, and manage its mission-critical STEM workforce.

The Air Force also developed a Career Path Tool to inform workforce members of career opportunities and to provide information that assists career field managers in shaping and managing career field resources. Four panels have been formed to incorporate information into this tool: Continuing Education and Training; Career Development Programs and Placement; Qualification and Certifications; and Workforce Capability Requirements.

6.6 Additional Authorities or Resources Needed

DASD(SE) recognizes that the proper authorities and resources required to sustain an adequate systems engineering workforce within the Department are critical to the successful execution of acquisition programs. This requires continued adequate funding, flexibility in hiring processes and compensation, and congressional and defense leadership interest in sustaining the systems engineering workforce as a priority to preserve recent growth and recruit, retain, and train the systems engineering workforce.

On March 16, 2011, the USD(AT&L) and the USD(Comptroller/Chief Financial Officer) issued a memorandum titled "Continuation of Defense Acquisition Workforce Improvement Initiative." The memo supports a continued commitment to bring on new hires within existing civilian workforce ceilings but also restricts contractor-civilian conversions to a case-by-case basis.

Existing authorities are sufficient to support high-priority and critical positions in the military department systems engineering workforce. The military departments will need to prioritize resources, including DAWDF funding, to recruit, train, and retain critical systems engineering skill sets.

6.7 Impact of FY 2012 Budget on Systems Engineering Workforce

Maintaining a capable, competent, and adequately resourced systems engineering workforce is critical to ensuring the successful execution of the Department's acquisition programs. Although the impacts of the FY 2012 budget on the Department's systems engineering workforce are not yet fully known, DASD(SE) will continue to work closely with the military departments to guide, oversee, and advocate for a systems engineering workforce that is capable of executing the WSARA mission.

The Army's previously planned objectives for growing the systems engineering workforce have been reduced, and contractor-to-civilian conversions have been suspended at the time of this report submission. The DON stated that the FY 2012 budget is sufficient to support planned programs.

The Air Force stated that its civilian workforce reductions are contingent on implementation of the FY 2012 budget. Specific impacts to the systems engineering workforce will not be known until the Major Commands identify these reductions in the Unit Manpower Documents, which are planned to

be completed March 2012. A prolonged hiring freeze will potentially create new experience gaps in the workforce similar to the gaps caused by the post-Cold War drawdown. To prevent loss of critical acquisition expertise and capability, the Air Force needs to continue timely and targeted replenishment hiring while staying with the force ceilings that the DAWDF funds would provide. The loss of DAWDF funds would also force cuts to training and halt future training improvements. The Air Force Materiel Command plans to reduce its number of centers from 12 to 5, and this provides an opportunity to standardize business practices and streamline processes; however, the impact of this reorganization on the systems engineering community is unknown.

7 DASD(SE) PROGRAM ASSESSMENTS

The following sections include detailed assessments of 42 Major Defense Acquisition Programs (MDAPs), Major Automated Information Systems (MAISs), and special interest programs that involved significant systems engineering activity in FY 2011. Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011).

The assessments are organized by military department (Army, Department of the Navy, and Air Force), followed by DoD (Joint) programs.

Assessments of the organization and capabilities of the Department of Defense for systems engineering and development planning with respect to such programs, required by 10 U.S.C. 139b, are addressed in Section 6 of this report, DASD(SE) Assessments of Military Departments.

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7.1 DASD(SE) Assessments of Army Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries on the following seven programs:

- Army Integrated Air and Missile Defense (AIAMD)
- Excalibur
- Global Combat Support System–Army (GCSS-A)
- Gray Eagle (MQ-1C) Unmanned Aircraft System (UAS)
- Ground Combat Vehicle (GCV)
- Guided Multiple Launch Rocket System–Alternative Warhead (GMLRS-AW)
- Stryker Family of Vehicles (Stryker)

Army Integrated Air and Missile Defense (AIAMD)

Prime Contractor: Northrop Grumman Space and Mission Systems Corporation

Executive Summary: AIAMD is an integrated fire control system that networks distributed sensors and shooters using common command and control (C2) and provides common situational awareness for air and missile defense. The program is currently in the Engineering and Manufacturing Development (EMD) phase. DASD(SE) worked with the program office to maintain technical rigor leading up to the 2012 CDR.

Mission Description: AIAMD provides a network-centric system of systems capability that integrates Army Air and Missile Defense (AMD) sensors, weapons, and BMC4I (battle management, command, control, communications, computers, and intelligence), functioning interdependently to provide total operational capabilities not achievable by the individual element systems. This future architecture will enable the distributed support of engagements with available sensor assets not limited to system-centric organic sensors.

System Description: AIAMD major end items include an Integrated Battle Command System (IBCS) Engagement Operations Center that provides the common BMC4I capability, the Integrated Fire Control (IFC) Network (IFCN) capability to provide fire control connectivity and enabling distributed operations, and the IBCS Common Plug-and-Fight Kits that will network-enable multiple sensor and weapon components.

Schedule: The program is in the EMD phase. MS B was held in December 2009, and MS C is planned for FY 2015. The program CDR is scheduled for April 2012. Key FY 2011 systems engineering activities included PDR closeout, Launcher on the Net Preliminary Design Update (LOTN PDU), and a Systems Engineering Working Integrated Product Team (SE WIPT) to review planning for system CDR, including development of a comprehensive body of evidence to support entry/exit criteria.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the MS B SEP in April 2010. The SE WIPT coordinated a minor update in November 2010. There are no approved waivers or deviations from the SEP. The objectives of the SEP are being met. The LOTN PDU demonstrated the effectiveness of the Technical Performance Measure (TPM) and trade study processes to identify potential performance issues, evaluate alternatives, and manage the technical baseline.
- **Requirements** – The JROC validated the CDD in 2009. The AIAMD program has five KPPs. All are on track for being demonstrated by FY 2016. Program performance requirements are stable and reasonable. The Army continues to evolve its AMD portfolio, which may drive changes to the number of systems planned. The reduction or elimination of the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) and Surface-Launched

Advanced Medium Range Air-to-Air Missile (SLAMRAAM) may affect acquisition and engineering plans. Plans may also be impacted by the Army's decision to use IBCS as the single common AMD C2 system. This will replace seven separate systems, which may result in more ICBT units and a decreased per-unit cost. The U.S. decision not to procure the international Medium Extended Air Defense System (MEADS) for its own use resulted in direction to accelerate placing the PATRIOT launcher and radar directly on the IFCN.

- **Program Protection Plan (PPP) –** DASD(SE) last reviewed the PPP in Nov 2009, and the draft version provided was considered incomplete. The program is currently working to perform program protection analysis and will be providing an updated PPP prior to MS C.

FY 2011 Systems Engineering Assessments

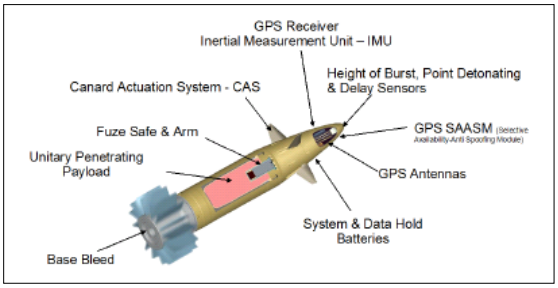
- DASD (SE) conducted one assessment in FY 2011 on the Delta System PDR. The program office also held an additional technical review for the LOTN PDU in May 2011, which updated the allocated baseline. DASD(SE) participated in the LOTN PDU as part of the PDR assessment.
- In its PDR assessment, DASD(SE) found that the PDR was effective and successfully demonstrated the needed technical and programmatic maturity.
- The PDU was an event-driven review, which found that the LOTN/Radar Interface Unit (RIU) design is affordable and executable with acceptable risk to the cost, schedule, and performance baseline. The design update focused on emerging detailed design progress related specifically to implementation of the LOTN/RIU concept as part of the program's path to CDR.
- One technical review (CDR) is planned for 3rd quarter FY 2012, for which DASD(SE) will participate and conduct a CDR assessment.

Measurable Performance Criteria

- **Reliability –** The program has reliability requirements and metrics. Current predictions meet or exceed CDD requirements. The program has an effective reliability program, developed in coordination with Army Test and Evaluation Command, which includes a reliability growth program.
- **Software –** The program has software requirements and metrics to manage the 2.6M source lines of code effort. All software builds have been estimated, and detailed metrics are in place.
- **Manufacturing** – The AIAMD program will rely heavily on COTS/GOTS hardware; manufacturing planning and metrics will be established in the CDR time frame.
- **Integration** – The AIAMD program integrates multiple programs into a single fire control network. The program has established an Interface Control Working Group to manage technical and programmatic interfaces. Interface Control Documents define both internal and external interfaces. The program uses integration laboratories and demonstrations to evaluate the technical maturity of interfaces; one example is the Joint Track Management Capability bridge demonstration effort conducted in September 2011. The IBCS Prime Contractor successfully participated in Joint Track Management Capability bridge Software/Hardware in the loop demonstration implementing the open Joint Track Management Capability Composite Track Bridge interface between the IBCS prototype track manager solution and simulated USN, USAF, and USMC units operating on a CEC network.

Conclusion: The program is on track and is executing an effective systems engineering process.

Excalibur



Prime Contractor: Raytheon Missile Systems

Executive Summary: The Excalibur, an ACAT IC (Army) program, is a cannon-delivered precision artillery round with Increment Ia in production and Increment Ib in the Engineering and Manufacturing Development (EMD) phase. A DASD(SE) manufacturing assessment during the Nunn-McCurdy Review showed the program could not support the proposed production profile for Increment 1b, due to a steep initial ramp-up rate. As a result of the DASD(SE) assessment in support of the Nunn-McCurdy Review, the Defense Acquisition Executive (DAE) directed a lower risk manufacturing option.

Mission Description: The Excalibur artillery round is fired by the M777A2 Lightweight 155mm howitzer (LW155), and the M109A6 (Paladin) howitzer. Excalibur provides improved fire support through greatly increased accuracy with a 10-meter accuracy requirement at all ranges and offers significant reduction in collateral damage over conventional rounds. It also increases the range over current rocket-assisted projectiles from 32 kilometers to 40 kilometers.

System Description: Excalibur is a cannon-delivered, precision engagement, extended-range family of indirect fire artillery projectiles that is self-guided to a programmed aim point. Excalibur is a versatile unitary munition with a high-explosive fragmenting and penetrating warhead. It includes an integral fuze capable of air, point, or delayed detonating fuze options. The Excalibur projectile is composed of three major subsystems: base, warhead, and guidance section. Increment Ia, in production, has been successfully employed in combat in Iraq and Afghanistan. The Army is developing Increment 1b to improve system reliability and decrease cost. Increment Ib represents the final 46 percent of rounds required to meet the Army Acquisition Objective.

Schedule: The Joint Munitions Command approved full materiel release for Excalibur Increment Ia-2 in FY 2011, and it entered FRP in March 2011. Increment Ib is in the EMD phase, with its MS C currently planned for January 2013.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The Army approved the Excalibur SEP in FY 2007 to support Increment Ia MS C. There are no approved waivers or deviations from the SEP. The program is meeting the objectives of the Increment Ia SEP. The DAE directed an update to the SEP for Increment Ib; DASD(SE) approval is expected in FY 2012.
- **Requirements** – The Army approved the Increment Ia CPD in October 2007. The Army plans to approve the Increment Ib CPD in 2012 to support MS C. The Excalibur Increment Ib program has five KPPs. There are risks associated with the program meeting its reliability and range KPPs due to design immaturity relative to schedule. Program requirements are stable and reasonable. Additionally, both the Army and the Marines procured Excalibur projectiles based upon urgent operational needs. The Kingdom of Sweden is a co-developer with a range requirement exceeding the current design capability of the Increment Ib using a 52 caliber tube.
- **Program Protection Plan (PPP) –** A PPP is in staffing for Army approval.

- **Systems Engineering Support of Life Cycle Management and Sustainability** – The program conducted design for reliability activities for Increment Ib to improve reliability and maintainability (R&M) performance (e.g., R&M allocations, Failure Definition and Scoring Criteria, reliability growth testing, and Failure Mode, Effects, and Criticality Analysis).

FY 2011 Systems Engineering Assessments

- DASD(SE) participated in two systems engineering assessments in FY 2011. The assessments included a Nunn-McCurdy Review and a CDR.
- The Nunn-McCurdy Review, conducted from September 2010 to January 2011, concluded that the program management structure has controls in place to effectively manage risk. The DASD(SE) assessment supporting manufacturing resulted in DAE direction for a lower risk production ramp rate for Increment Ib. Positive observations included sound systems engineering and risk management processes.
- DASD(SE) participated in a CDR in April 2011. Closure of the CDR, expected by the end of March 2012, is contingent upon completion of two delta CDRs and several critical actions such as the approach for the fuze second arming environment and the tactical telemetry module circuit card assembly update. The program office is using rigorous systems engineering practices to hold the vendor accountable for closing CDR actions. The program office identified and recommended efforts to reduce schedule and performance risks associated with base and fuze subsystem design integration. DASD(SE) plans to complete the CDR assessment after the closure of all CDR actions.
- The program plans a Production Readiness Review in FY 2012 after CDR and prior to MS C.

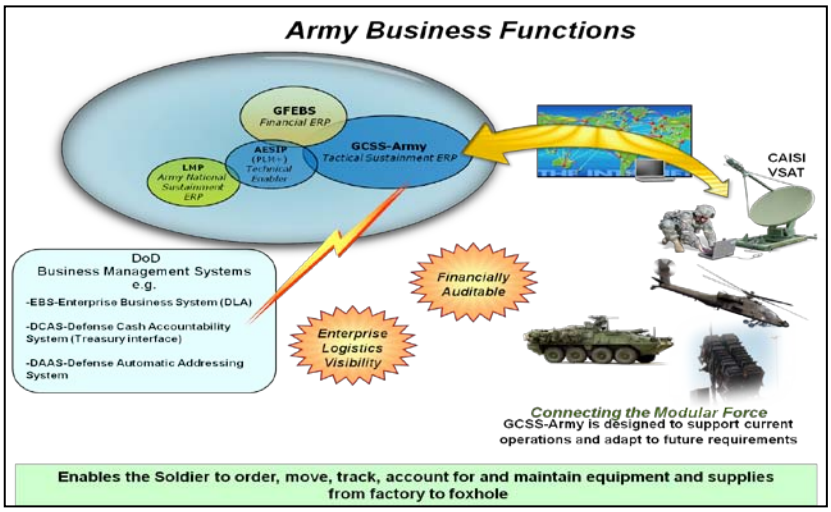
Measurable Performance Criteria

- **Reliability –** Increment Ia is demonstrating 88 percent reliability, meeting its 85 percent requirement. Reliability is the measurement of an accurate warhead delivery of up to 35 kilometers distance with a proper warhead event. The Increment Ib design intends to grow reliability to 90 percent. Systems engineering efforts to improve reliability performance include a classic test-analyze-fix-test activity.
- **Software –** Increment Ia projectiles are delivered with approximately 123k source lines of code. Increment Ib will slightly increase the source lines of code to 128k to improve munition accuracy. Updated Increment Ia-1 software (referred to as Operational Flight Software (OFS) X9.17) will be retrofitted into Increment Ia-1 production rounds. The software requirements are stable. The CDR panel determined that the contractor needs to improve its requirements traceability documentation through software verification and validation.
- **Manufacturing** – Planned upgrades from Increment Ia to Increment Ib will require changes in manufacturing processes at the vendor and subvendor level to enhance producibility at a reduced price. The Nunn-McCurdy certification directed the Increment Ib first-year production rate to be lowered from 2,000 rounds to 881 to reduce production ramp-up risks. The contractor must address risks associated with supply chain management to achieve the schedule and cost goals. The program will conduct a Production Readiness Review in FY 2012.
- **Integration** – The Excalibur round has external interfaces with the howitzer, the propellant, the fuze setter, fire control software, and GPS. Integration efforts for Increment Ib are on track.

Conclusion: Excalibur Increment Ia is fielded and meets all program KPPs. Increment Ib, planned to reduce costs and increase reliability, has schedule and performance challenges that the Army program office is addressing.

Global Combat Support System-Army (GCSS-A)

Prime Contractor: Northrop Grumman / Information Systems Division



Executive Summary: GCSS-A provides a single integrated sustainment system for near real-time management for tactical logistics and finance and uses a commercial off-the-shelf (COTS) SAP® Enterprise Resource Planning (ERP) solution. The program was awarded entry to MS C in August 2011, and a Full Deployment Decision (FDD) is planned for 4th quarter FY 2012. DASD(SE) supported development of the SEP, which included developing and implementing a reliability growth plan.

Mission Description: GCSS-A Increment 1 focuses on reengineering many existing logistics Standard Army Management Information Systems, which were originally developed based on vertical information flows within a stovepiped structure. GCSS-A implements the Army Enterprise Systems Integration Program's enterprise hub services and centralized master data management. GCSS-A will streamline access to information and exchange of operational data, integrating tactical logistics enterprise information for leaders and decision makers. This exchange will result in a single picture that integrates sustainment information affecting the management of combat power.

System Description: The cornerstone of GCSS-A is configurable COTS software provided by SAP®, which provides increased adaptability, flexibility, openness, and efficiency in support of the Army's unique tactical logistics sustainment requirements supporting mobilization, deployment, employment, sustainment, and redeployment of Army Forces and Joint Forces. GCSS-A is a Web-based software suite that utilizes the existing communication infrastructure known as the Unclassified but Sensitive Internet Protocol Router Network. GCSS-A can be deployed to units equipped with Combat Service Support (CSS) Very Small Aperture Terminal and/or CSS Automated Information System Interface.

Schedule: The program is in the Production and Deployment phase. The program was awarded entry to MS C at a DAB/Information Technology Advisory Board in August 2011, and FDD is planned for 4th quarter FY 2012. DASD(SE) activities included support to program SEP development to include a reliability growth plan.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The Army Program Executive Office Enterprise Information System approved the GCSS-A SEP in May 2011 to support MS C and the October 2011 Initial Operational Test and Evaluation (IOT&E). The program office is planning an update

to support FDD during 4th quarter FY 2012. The program is fulfilling the objectives of the SEP without waivers or deviations.

- **Requirements** – The JROC validated the CPD in June 2011 in support of MS C. The GCSS-A program has two KPPs. Both are on track for being demonstrated by FDD. The program requirements are reasonable and stable.
- **Program Protection Plan (PPP) –** The GCSS-A program will conduct a criticality analysis to identify critical functionality and associated components (hardware, software, and firmware) requiring protection; identify potential vulnerabilities; analyze risk; develop a list of potential countermeasures; and perform a cost-benefit analysis to determine the countermeasures to implement. The program is planning to provide a PPP for approval in FY 2012.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted no formal systems engineering assessments during FY 2011, and there are currently no systems engineering assessments scheduled in FY 2012.

Measurable Performance Criteria

- **Reliability –** The GCSS-A program has a reliability threshold requirement of 716 hours for Mean Time Between System Abort (MTBSA) and has achieved this requirement as demonstrated in the October 2011 IOT&E with a MTBSA of almost 900 hours. The program is demonstrating well above the CPD threshold value.
- **Software –** The GCSS-A has software requirements in association with the completion of 434 Reports, Interface, Conversions, Extensions, Forms, and Workflow objects, and is currently on track to achieve this requirement by Release 1.2 in March 2013.
- **Manufacturing** – GCSS-A is a software program operating on a COTS infrastructure.
- **Integration** – The SEP has a dedicated annex that addresses system integration, specific interface requirements, and data migration among all 46 trading partners. The program is conducting integration and user environment testing at the Army Data Center at Redstone Arsenal, Huntsville, AL.

Conclusion: GCSS-A is on track and DASD(SE) will continue to monitor fielding, system complexity risks, data cleansing, and migration as the program completes system development and begins full fielding in 4th quarter FY 2012.

Gray Eagle (MQ-1C) Unmanned Aircraft System (UAS)

Prime Contractor: General Atomics Aeronautical Systems Incorporated (GA-ASI)

Executive Summary: The Gray Eagle program is simultaneously in the Production and Deployment (P&D) phase, integrating new sensors capabilities, and supporting Quick Reaction Capability (QRC) operations to the current war effort. DASD(SE) conducted technical reviews to assess and improve reliability engineering and software development. A Reliability Engineering Management Plan has been implemented and software process implementation has improved estimation and development practices.

Mission Description: The Gray Eagle is a medium-altitude, long-endurance UAS providing multiple sensor and weapons capability. The system executes reconnaissance, surveillance, security, attack, and command and control missions to provide dedicated mission-configured UAS support to assigned Army and Joint Force units based upon the Division Commander's mission priorities.

System Description: The Gray Eagle consists of weapons-capable unmanned aircraft equipped with Synthetic Aperture Radar (SAR) and Electro-Optical/Infrared/Target Designation payloads, Ground Control Station (GCS), Tactical Common Data Link (TCDL), satellite communication, and other equipment. There is one initial program increment. The Block 0 Gray Eagle is based on legacy sensors and ground control and communications and the MQ-1 Predator aircraft. Four aircraft of this block and two QRC units are deployed to theater to support emergent operations. The Block 1 configuration will be in the first unit equipped for the program of record and is expected to meet the approved system requirements.

Schedule: The program is in the P&D phase. A Low-Rate Initial Production (LRIP) 2 DAB was held in February 2011 and a LRIP 3 decision is planned for May 2012. An FRP decision was initially scheduled for March 2012, but an aircraft mishap and poor system reliability led to a 9-month delay. The FRP decision is scheduled for March 2013.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** DASD(SE) approved the Gray Eagle SEP in May 2010 to support MS C. An update is planned in FY 2013 to support FRP. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The CPD was approved on March 24, 2009. The program has seven KPPs. Five are on track to be demonstrated by FRP. The net-ready KPP is at risk due to software development and integration delays with a waiver being granted for Link 16 prior to FRP. The sustainment KPP is at risk due to equipment setup times and low aircraft and GCS reliability. OSD and the Army are reviewing the system reliability requirements to determine if they are reasonable and achievable.

- **Program Protection Plan (PPP)** – The program formed a PPP working group in March 2011 and is currently developing a PPP with DASD(SE) providing support and oversight.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted technical reviews of system reliability and software development planning and assisted the program in developing a Reliability Engineering Management Plan.
- DASD(SE) engaged with the program through a focused review and the establishment of a reliability working group in July 2011. The review addressed issues with system reliability, initiated a reliability growth plan, and began efforts to improve design for reliability. These measures are aimed at meeting operational requirements by FRP. The working group continues to address reliability shortfalls through continuous DASD(SE) and program engagement.
- DASD(SE) will assess system reliability requirements and growth planning to inform the LRIP 3 decision in FY 2012. A PSR to support the FRP decision is planned for FY 2013.

Measurable Performance Criteria

- **Reliability –** The program has a Mean Time Between System Abort (MTBSA) reliability requirement of 300 hours for the GCS, 100 hours for the aircraft, and 250 hours for the combined payloads. Operational experience during the QRCs and developmental test results indicates MTBSA is significantly below requirements. Based on this data, DASD(SE) recommended the program initiate a reliability growth program to increase reliability. The Army is conducting analysis to determine the impact of reducing the GCS requirement to 150 hours.
- **Software –** Total software lines of code are estimated at 4.5M, with 3.5M reused or off-the-shelf and 1M new or modified. Unstable requirements, concurrent development, and fixes to problems identified in testing and QRC have led to 11 unplanned software revisions. Process improvements include eliminating concurrent software builds by moving to a single active thread per software release and performing formalized requirements reviews with user participation.
- **Manufacturing** – GA-ASI has mature manufacturing processes and significant in-house capability, and it has demonstrated it has the capacity to meet the LRIP production schedule. Risk associated with integrating a new 2.0-liter heavy fuel engine into the manufacturing line has been identified and mitigated.
- **Integration** – The Gray Eagle architecture development is at an advanced phase. Flight testing of the Common Sensor Payload began in April 2011, and STARLite SAR testing is set to begin in March 2012. The Army's Link 16 infrastructure is incomplete, and Gray Eagle can transmit only a partial message set. Full Link 16 capability will be incrementally developed.

Conclusion: The Gray Eagle program continues to make progress toward fielding the Block 1 configuration, but must address risk areas in software and reliability. The program has enhanced its software and reliability engineering processes and continuing improvements are evident.

Ground Combat Vehicle (GCV)

TD Phase Competitive Prototyping Contractors: General Dynamics Land Systems (GDLS) and British Aerospace (BAE)

Notional Drawing of the GCV IFV

Executive Summary: The GCV program is using an incremental approach to acquiring modern combat vehicle capabilities. The first increment is focused on acquiring an Infantry Fighting Vehicle (IFV) intended to replace the Bradley IFV. The GCV IFV program recently entered the Technology Development (TD) phase. DASD(SE) FY 2011 activities included participation in the TD phase Request for Proposal (RFP) Peer Reviews and approval of the SEP with a focus on the capabilities trades space process.

Mission Description: The GCV IFV is the Army's future infantry combat vehicle in support of Joint Forces across the full range of military operations. The GCV replaces the Bradley M2A3 IFV in the Heavy Brigade Combat Team (HBCT). It will provide mobile, reconfigurable armored protection in a variety of terrain and weather, and against a variety of hybrid threats. GCV will provide both destructive fires against threat armored vehicles and direct fire support for the infantry squad during dismounted assaults.

System Description: GCV affords the infantry squad a highly mobile, protected transport to decisive locations on the battlefield. GCV IFV provides a significant growth potential for enhanced survivability and lethality to meet future threats.

Schedule: The program entered the TD phase with a MS A decision in August 2011. The program has planned to acquire and deliver the first production IFV capability in approximately 7 years. The Defense Acquisition Executive (DAE) directed the program to assess alternative strategies, requirements, and cost trade space; conduct a formal Analysis of Alternatives (AoA) Update; and explore Non-Developmental Vehicles (NDV) during the TD phase in order to position itself to best meet the cost and schedule targets.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the GCV SEP in March 2011 to support the TD phase. The program will update the SEP to support MS B. The objectives of the SEP are being met, and there are no approved waivers or deviations.
- **TD Phase Peer Reviews** – DASD(SE) participated in two TD phase Peer Reviews prior to contract award.
- **Requirements** – The JROC approved the GCV ICD in December 2009. The Army is targeting July 2013 for GCV IFV CDD approval. The GCV IFV program has 9 draft KPPs (7 core, 2 IFV) and 40 KSAs (28 core, 12 IFV). The Army tiered its TD specification requirements to clarify priorities and provide trade space for prospective contractors in order to allow them to better balance Unit Manufacturing Cost (UMC) and technical risk to meet the planned 7-year schedule. The program will assess progress toward meeting these requirements as the contractors' designs and other analyses progress through the TD phase.

- **Program Protection Plan (PPP) –** The program will identify critical program information (CPI), and conduct a criticality analysis as it proceeds through the TD phase and ensures CPI is protected throughout the system life cycle.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – TD phase activities include sustainability assessments of contractor designs of logistics criteria and maturing the GCV Supportability Strategy. The program office added early prototype development and testing in the Engineering and Manufacturing Development (EMD) phase to reduce risk areas and mature reliability and sustainability.

FY 2011 Systems Engineering Assessments

- DASD(SE) focus areas in FY 2011 included interoperability, requirements development, and the capabilities trade process as the program updated its Technology Development Strategy, SEP, and analysis plans.
- The program plans to conduct System Requirements Reviews and System Functional Reviews with the two competing contractors in FY 2012. The program is scheduled to conduct Knowledge Point Reviews in FY 2012 that will include assessment of risk against requirements in order to make informed trade decisions. The program plans to conduct an initial Technology Readiness Assessment (TRA) during 2012.

Measurable Performance Criteria

- **Reliability –** The GCV IFV draft reliability requirement is 310 hours Mean Time Between System Abort. The program SEP describes reliability metrics that were included in the performance specification.
- **Software –** The program identified potential technical and management software development metrics in the SEP to be assessed throughout the software life cycle.
- **Manufacturing –** The program has identified producibility analyses to influence design trades and will receive an initial manufacturing readiness self assessment from the contractors 60 days after TD phase contract award that establishes the basis for follow-on assessments during the TD phase. The request for proposal requires manufacturing readiness reports at MS B.
- **Integration –** The SEP identifies system integration metrics. The competitive prototyping TD phase requires contractors to conduct system-level integration planning in preparation for the integration, assembly, test, and checkout of the system prototypes in the follow-on EMD phase. Armor and Hit Avoidance/Active Protection System are potential technologies to integrate, with the goal of meeting force protection and survivability requirements.

Conclusion: The GCV program is executing the three-pronged strategy as directed and has plans to continue to explore the cost, schedule, and performance trade space. Periodic knowledge points and reports back to the DAE in 2012 should provide good insight into continued program execution and further refinement of requirements.

Guided Multiple Launch Rocket System–Alternative Warhead (GMLRS-AW)

Prime Contractor: Lockheed Martin (Rocket System); ATK (Government Selected Alternative Warhead Sub-Contractor)

Executive Summary: The Guided Multiple Launch Rocket System – Alternative Warhead (GMLRS-AW) will replace an earlier GMLRS increment in order to comply with Unexploded Ordnance requirements. GMLRS-AW is an ACAT IC (Army) program nearing completion of the Technology Development (TD) phase. DASD(SE) activities included participation in the program Preliminary Design Review (PDR) for the three subcontractors that competed to be the Government directed subcontractor for the Alternative Warhead (AW).

Mission Description: The mission of GMLRS is to attack/neutralize/suppress/destroy targets using indirect precision fires. GMLRS provides Field Artillery units with medium and long-range fires, up to 70+ kilometers, while supporting brigade, division, corps, Army, theater, Joint/Coalition Forces and Marine Air-Ground Task Forces in full, limited, or expeditionary operations.

System Description: The GMLRS rocket is a solid propellant artillery rocket deployed from the M270A1 Multiple Launch Rocket System (MLRS) and the M142 High Mobility Artillery Rocket System (HIMARS) mobile launch vehicles. GMLRS uses an Inertial Measuring Unit (IMU) with Global Positioning System assistance to guide the rocket to a specific point to deliver effects on a target. GMLRS is transported and fired in a Rocket Pod Container that consists of six rockets. Increment 1 is GMLRS with the Dual-Purpose Improved Conventional Munitions (DPICM), and Increment 2 is GMLRS Unitary. GMLRS-AW (Increment 3) is designed to replace the DPICM rocket, while providing similar effects against area and soft targets at comparable range. GMLRS-AW will satisfy the Unexploded Ordnance requirements as defined in the Department of Defense Policy on Cluster Munitions and Unintended Harm to Civilians, dated June 19, 2008.

Schedule: The Army conducted MS A for GMLRS-AW in September 2009 and approved MS B in December 2011.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The Army approved the GMLRS Unitary SEP in March 2007. There are no approved waivers or deviations from the SEP. The objectives of the SEP are being met. A new SEP for GMLRS-AW has completed Army review and approval, and is in staffing for DASD(SE) approval to support the December 2011 MS B decision.
- **Requirements** – The GMLRS-AW CDD has completed review by the Functional Configuration Board and was approved by the JROC in November 2011. The requirements are reasonable and stable.
- **Program Protection Plan (PPP) –** A draft PPP was approved by the PEO M&S in July 2011 and is in review for Army approval.

FY 2011 Systems Engineering Assessments

- DASD(SE) participated in the three GMLRS-AW system-level PDRs in January 2011. Positive observations from the PDRs included establishment of the allocated baseline traceable to all requirements, and a robust configuration management process. DASD(SE) also participated in the quarterly Program Manager Integrated Product Teams and assisted with SEP development.
- The program is positioned for success. The acquisition plan for transition from the TD to the EMD phase has a 12-14 month contract gap, which presents a risk in that it creates a potential loss of intellectual capital and may affect EMD start-up and schedule.
- No DASD(SE) assessments are planned for FY 2012.

Measurable Performance Criteria

- **Reliability** – The GMLRS-AW has a threshold Materiel Reliability requirement of 92 percent probability of a successful launch, flight, and warhead event. The program is currently on track to achieve this requirement by MS C.
- **Software** – All software resides in the Guidance Set of the rocket; there is no resident software contained in the warhead section of the rocket. The software functions required for the GMLRS-AW are common with predecessor increments such that the existing GMLRS software components may be reused with appropriate modifications made to support the unique characteristics and performance needs for the AW. The GMLRS-AW program has developed software metrics and is currently on track to achieve these by MS C.
- **Manufacturing –** Other than the warhead itself, the GMLRS-AW rocket utilizes the same subsystems as does the GMLRS Unitary rocket. Rocket manufacturing processes are mature. The GMLRS-AW program will perform Manufacturing Readiness Assessment (MRA) evaluations at the warhead supplier and system levels prior to MS C.
- **Integration –** Eighty percent of the GMLRS-AW hardware is common to the GMLRS Unitary, with the warhead section being the difference. Form and fit of the AW into the GMLRS rocket closely match those of the GMLRS Unitary rocket in production. The GMLRS-AW rocket will have the same external interfaces as its predecessors, for example, Global Positioning System (GPS), the launcher platform, and the fire control system.

Conclusion: The GMLRS-AW program is on track to meet performance requirements.

Stryker Family of Vehicles

Prime Contractor: General Dynamics Land Systems (GDLS)

Executive Summary: Stryker is an eight-wheel-drive combat Family of Vehicles (FoV) that completed production of the Flat Bottom Strykers in FY 2011, with the exception of two variants. DASD(SE) FY 2011 activities included a Double-V Hull (DVH) review and driver protection assessments. The DVH upgrade on the existing FoV is on track to provide increased Soldier protection against underbelly blasts.

Mission Description: The Stryker Brigade Combat Team (SBCT) is designed and optimized for contingency operations in urban or complex terrain while confronting low- and mid-range conventional and asymmetric warfare threats. The SBCT is a self-contained organization that enhances strategic responsiveness by providing the versatility demanded by the National Military Strategy. All Stryker vehicle variants have successfully deployed.

System Description: The Stryker FoV comprises 10 eight-wheel-drive combat vehicle variants built on a common chassis: (1) Infantry Carrier Vehicle, (2) Anti-Tank Guided Missile Vehicle, (3) Reconnaissance Vehicle, (4) Fire Support Vehicle, (5) Engineer Squad Vehicle, (6) Mortar Carrier Vehicle, (7) Commander's Vehicle, (8) Medical Evacuation Vehicle, (9) Nuclear, Biological and Chemical Reconnaissance Vehicle (NBCRV), and (10) Mobile Gun System (MGS). The DVH upgrade provides increased Soldier protection against underbelly blasts associated with improvised explosive devices and mines in Iraq and Afghanistan. The improved DVH design combined with a new vehicle suspension, wider tires, and blast attenuating seats enhances soldier survivability.

Schedule: Eight of the 10 variants completed FRP in FY 2011 and additional DVH models are in production. MGS completed its Low-Rate Initial Production (LRIP) in FY 2011. The Army will not pursue a MGS FRP decision on the current configuration until a potential future modernization program is initiated. NBCRV FRP decision was made in December 2011, and is currently in FRP.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DUSD(A&T) approved the Stryker SEP in March 2008. The SEP is comprehensive and includes systems engineering activities for the entire program, including MGS and NBCRV. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – Change 1 to the Stryker Operational Requirements Document was approved in November 2007. The Stryker program has six KPPs. Responding to increasing threats, documented in Urgent Operational Need Statements (UONS), the Stryker program has significantly increased protection capabilities. More than 100 types of kits have been supplied to theater, including 17 that enhance survivability. Stryker Modernization (S-MOD) intended to address gaps in survivability, Size, Weight, and Power–Cooling (SWaP-C), integrated command and control compatibility, and mobility is being considered as a future effort.

- **Program Protection Plan (PPP)** – DASD(SE) facilitated the initiation of a PPP. The PPP is in development for planned approval in FY 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – Stryker is maintaining high levels of readiness and availability. Repair parts supply is transitioning to standard Army support, excluding DVH, in FY 2012.

FY 2011 Systems Engineering Assessments
- DASD(SE) conducted assessments on driver protection enhancements to support decisions to improve survivability. The classified findings addressed systems engineering issues on several kits.
- DASD(SE) reviewed DVH results. DVH is applied to 8 of 10 variants and went from concept design to production in less than a year using a robust systems engineering approach.
- A Stryker Reactive Armor Tile II assessment is planned in FY 2012.

Measurable Performance Criteria
- **Reliability** – The Stryker program has a reliability requirement of 1,000 Mean Miles Between System Abort. All variants have demonstrated the ability to meet the requirement. A 2007 Acquisition Decision Memorandum extended LRIP for the NBCRV in order to improve reliability of the vehicle and to demonstrate improvements via a reliability growth test plan. The 2010 Initial Operational Test and Evaluation Phase II demonstrated sufficient reliability for NBCRV.
- **Software** – The Government and contractor share responsibility for software support. Mission equipment and C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) software is maintained and upgraded by the responsible Government agency and tested at the GDLS Systems Integration Lab (SIL) prior to release. GDLS supports the vetronics software through an established configuration management process.
- **Manufacturing** – Three manufacturing sites have delivered more than 90 percent of the required vehicles. All variants except MGS and NBCRV (less DVH) completed FRP in FY 2011. The processes used to produce these vehicles are fully defined and proven. The program is seeking approval to complete NBCRV after DVH production. The program office assessed the manufacturing readiness as mature.
- **Integration** – To support integration activities and testing, PM Stryker and GDLS have established C4ISR SILs and used other Government laboratories and SILs to support integration and test. After SIL and software integration efforts are complete, GDLS holds ongoing Integration Readiness Checkpoint reviews to support configuration control management.

Conclusion: The Army has fielded the majority of Stryker variants. Survivability upgrades are improving Soldier protection in Afghanistan.

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7.2 DASD(SE) Assessments of Navy Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries on the following 14 programs:

- Broad Area Maritime Surveillance (BAMS) (MQ-4C) Unmanned Aircraft System (UAS)
- Consolidated Afloat Networks and Enterprise Services (CANES)
- CH-53K Heavy Lift Replacement (CH-53K)
- DDG 1000 Zumwalt Class Destroyer (DDG 1000)
- Distributed Common Ground System-Navy (DCGS-N), Increment 2 (DCGS-N Inc 2)
- E-2D Advanced Hawkeye (AHE)
- Fleet Replenishment Oiler T-AO(X)
- Joint High Speed Vessel (JHSV)
- Joint Precision Approach and Landing System (JPALS), Increment 1A (JPALS Inc 1A)
- Littoral Combat Ship (LCS) Mission Modules (MM)
- Littoral Combat Ship (LCS) Seaframes
- OHIO Replacement Program Ballistic Missile Submarine (OHIO Replacement)
- Remote Minehunting System (RMS)
- Standard Missile-6 (SM-6)

Broad Area Maritime Surveillance (BAMS)
(MQ-4C) Unmanned Aircraft System (UAS)

Prime Contractor: Northrop Grumman Aerospace Systems

Executive Summary: The BAMS program is in the System Development and Demonstration (SDD) phase and has completed CDR. DASD(SE) conducted an assessment of the CDR in February 2011. The assessment indicated that the program has an integrated design that will meet system requirements with identified and managed risks. The program has established a product baseline that is on track to satisfy the system performance and suitability requirements.

Mission Description: BAMS UAS provides persistent maritime intelligence, surveillance, and reconnaissance capability as a continuous source of information to help maintain the Common Operational and Tactical Picture in the maritime battle space. The BAMS UAS will operate both independently and with other assets to provide a more effective and supportable persistent maritime surveillance capability than currently exists. Data collected by the BAMS UAS will be made available on the Global Information Grid (GIG) and will support a variety of intelligence activities and nodes.

System Description: The BAMS UAS will be a system of systems consisting of land-based unmanned aircraft, interactive mission payloads, line-of-sight (LOS) and beyond-LOS communications systems, a mission control system, and associated support equipment. The BAMS UAS will incorporate networked communications architecture in alignment with the DoD GIG through the Distributed Common Ground System–Navy and Global Command and Control System–Maritime. There are three system increments envisioned, with Increment 1 in development. Increment 2 will provide an improved airborne communications relay package, and Increment 3 will provide increased signals intelligence capability.

Schedule: The program is in the SDD phase. The MS B decision was in April 2008 and the program completed its CDR in February 2011. A Test Readiness Review and a Flight Readiness Review are planned in FY 2012. MS C is planned for July 2013.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** DASD(SE) approved the SEP in January 2008 to support MS B. An update is planned in FY 2012 to support MS C. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements –** The CDD was approved in May 2007. The program has seven KPPs. All are on track to be demonstrated by Initial Operational Test and Evaluation. Program requirements are stable. DASD(SE) conducted a gap analysis during the CDR, concluding that all requirements have been adequately flowed to subsystem specifications.

- **Program Protection Plan (PPP) –** The BAMS PPP was approved in March 2006. A program protection working group was conducted June 2011 to initiate PPP updates in preparation for MS C. The PPP update will address protection issues that are common with the Global Hawk.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The system support strategy has been a prime factor of consideration in system design, influencing design trades and supporting iterative performance analyses of reliability, availability, and maintainability.

FY 2011 Systems Engineering Assessments

- DASD(SE) completed a CDR assessment to support entry into the System Fabrication, Demonstration and Test portion of the SDD phase. DASD(SE) participated in multiple subsystem technical reviews to ensure the integrated system was ready for the system-level CDR. Integrated Design Reviews of interim software builds also were conducted to support the CDR assessment.
- The reviews indicated that the program had an integrated design that would meet system requirements with identified and managed risks, and has established a product baseline.
- DASD(SE) will participate in the Test Readiness Review and Flight Readiness Review in FY 2012. The SEP and the PPP will be updated to support the upcoming MS C in FY 2013.

Measurable Performance Criteria

- **Reliability –** The BAMS program has a Mean Flight Hours Between Abort requirement of 145 hours and is currently estimating 170 hours. The program has established design for reliability and reliability growth programs. The BAMS program uses Effective Time on Station (ETOS) at Initial Operational Capability as a top-level measure of its effectiveness at meeting operational requirements. The current ETOS estimate of 88 percent exceeds the requirement of 80 percent. The program has several Technical Performance Measures reported on a quarterly basis and is executing to plan.
- **Software –** The current estimate of total software lines of code is 5.7M, of which 3.9M are reused or modified. The program's current software estimate of 1.77M equivalent source lines of code (ESLOC) falls within the allocations of 1.854M ESLOC. Coding of software for the major subsystems started in FY 2011, and releases to the Systems Integration Laboratories began in late FY 2011.
- **Manufacturing** – The SDD manufacturing schedule and draft production sequence plan were presented at system CDR in February 2011. BAMS UAS production will use the facilities currently being used by the Global Hawk program. SDD aircraft manufacturing started in mid-FY 2011 and has been integrated into the master plan for the joint Global Hawk/BAMS manufacturing facilities.
- **Integration** – The BAMS UAS program has created Interface Requirements Specifications among its 16 external interface segments and maintains consistency and concurrency with the other programs using SV-4 diagrams generated from the DoD Architectural Framework.

Conclusion: The BAMS UAS program continues to employ a thorough systems engineering process and remains on track to meet its operational requirements.

Consolidated Afloat Networks and Enterprise Services (CANES)

Prime Contractors: Competitive development between Northrop Grumman Information Systems and Lockheed Martin Maritime Systems and Sensors Tactical Systems

Executive Summary: CANES is designed to streamline and update shipboard networks to improve interoperability across the Fleet. The program is in the Engineering and Manufacturing Development (EMD) phase. DASD(SE) assisted the program office in completing the SEP in accordance with latest guidance.

Mission Description: CANES will provide LAN-based communication infrastructures that will host tactical and administrative applications to support ship-to-ship and ship-to-shore communications.

System Description: CANES will implement a scalable common computing environment and infrastructure allowing the fusion of warfighting, intelligence, and business mission area information. The communication formats include data, video, and voice. CANES will consolidate five primary networks: Non-secure Internet Protocol Router Network (NIPRNET), Secret Internet Protocol Router Network (SIPRNET), Sensitive Compartmented Information (SCI), Combined Enterprise Regional Information Exchange System-Maritime (CENTRIXS-M), and Video Information Exchange System (VIXS).

Schedule: The program office conducted a MS B review during January 2011 and CDRs with both contractors during May and July 2011. The program office is planning for a down-select decision during February 2012 to choose the prime contractor for FY 2012 and FY 2013 production. The program office is planning for a MS C review during May 2012.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The Navy Acquisition Executive approved the SEP on August 31, 2010, to support MS B. The program office will provide an update during FY 2012 to support MS C. The program office is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The program office conducted CDRs with the two competing contractors, Northrop Grumman during May 2011 and Lockheed Martin during July 2011. The program office intends to demonstrate the three KPPs by MS C.
- **Program Protection Plan (PPP) –** DASD(SE) reviewed the draft PPP during July 2011 to ensure the PPP addressed both critical program functions and potential supply chain risks. DASD(SE) also included in the Acquisition Decision Memorandum (ADM) the requirement for an updated PPP at least 60 days prior to the next MS. The program office plans to complete the PPP no later than 60 days before MS C.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** Although the contractor competition remains ongoing, none of the KPPs are considered high or medium risks

at this time. The program office expects the program will meet the thresholds for Mean Time Between Failure (MTBF) and System Availability for Critical and Non-Critical Services.

FY 2011 Systems Engineering Assessments

- The program office conducted CDRs in May and July 2011 with each contractor to support a MS C decision. A subsequent DASD(SE) assessment of the CDR indicated the program was progressing and on schedule. While the program office identified issues during the PDR with respect to shock and vibration isolation of the computers on ships, these issues were resolved prior to the CDRs.
- CANES is primarily a system integration effort of commercial equipment. The contractors met all entrance and exit criteria for their CDRs and received the Government's approval upon completion of the reviews. There were no subsystem CDRs. The contractors established and verified their product baselines during their CDRs. They accomplished this by showing traceability from the configuration item back through the engineering artifacts to the CDD. The contractors delivered several layers of interface management documents, two of which remained outstanding at the end of FY 2011. The program is on track to meet all of its KPPs and EMD exit criteria. As of July 2011, 100 percent of "build-to" packages were complete and under configuration control.

Measurable Performance Criteria

- **Reliability –** The program has reliability requirements with metrics and is currently on track to achieve them by MS C. The MTBF threshold requirement for both Critical Services and Critical User Access is 495 hours, with an objective of 4,995 hours. Specific reliability data will not be available until the contractor down-selection occurs during February 2012.
- **Software –** CANES is largely a COTS systems integration effort with no software development planned. The program will be using the Open Systems Interface Reference Model to promote computing and communications open systems architectures to comply with net-ready external interface standards, including IEEE 802.3 for Ethernet communications. Specific software data will not be available until the contractor down-selection occurs during February 2012.
- **Manufacturing** – CANES manufacturing requirements are for lightweight racks designed to contain servers and computers. The racks are similar in design to those manufactured for Army shelters but with more stringent environmental requirements for HVAC and corrosion. This limited manufacturing requirement is another factor contributing to the program's low-risk status.
- **Integration** – All CANES design baseline "build-to" packages are complete and under configuration control with the Government. Assembly of the racks with the computers and servers will initially be performed at the contractor's facility, then taken to a Government assembly site and verified for ease of installation before actual installation on the intended platform.

Conclusion: The CANES program is on track for a down-select decision during February 2012 and a successful MS C during FY 2012.

CH-53K Heavy Lift Replacement

Prime Contractor: Sikorsky Aircraft Corporation

Executive Summary: The CH-53K Heavy Lift Replacement helicopter will provide a much improved U.S. Marine Corps heavy-lift capability. The program is in the Engineering and Manufacturing Development (EMD) phase and completed CDR activities in January 2011. DASD(SE) conducted a CDR assessment, which identified the program as well positioned to continue through System Capability and Manufacturing Process Demonstration within EMD. In September 2011 the CH-53K program was selected to receive the 2011 DoD Systems Engineering Top 5 Program Award, which recognizes programs for systems engineering achievement.

Mission Description: The CH-53K will meet Marine Air Ground Task Force vertical heavy lift warfighting requirements beyond 2025. The aircraft will internally transport passengers, litters, cargo, and vehicles, and includes provisions for weaponry while external lift of cargo is done on three independent cargo hooks, capable of lifting three times the capacity of the CH-53E.

System Description: The aircraft is a build-new, evolutionary update of the CH-53E design. It is a dual-piloted, multi-engine helicopter, incorporating the latest vertical lift, survivability, reliability, maintainability, and avionics technologies. The CH-53K will be equipped with a seven-blade main rotor system and a four-blade canted tail rotor designed by Sikorsky Aircraft Corporation. Main engine power is supplied by three GE38-1B turboshaft engines. The airframe structure is designed for a service life of 10,000 flight hours.

Schedule: The program is in the EMD phase. MS B was held in 2005, a program rebaseline (cost and schedules) is planned in 2012, and MS C is planned for FY 2015.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – A SEP revision detailing program activity beyond the CDR is in routing for final signature. The objectives of the SEP are being met without waivers or deviations.
- **Requirements** – The JROC approved the CH-53K Operational Requirements Document (ORD) in 2005. The ORD will be updated as a CPD in support of MS C. The program has seven KPPs; all are predicted to be met within the restructured schedule. The program has taken positive steps to prevent requirements growth. The Capabilities Integrated Product Team serves as a configuration steering board to identify and resolve aircraft mission-related issues and program requirements.
- **Program Protection Plan (PPP) –** The program's update of the PPP, based on completion of the CDR and required for MS C, is tracking ahead of plan. Status was last reviewed during the September 2011 Systems Engineering Working Integrated Product Team (SE WIPT) with completion anticipated in late FY 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – Design efforts have included an emphasis on design for maintainer and design for reliability. Three of the seven KPPs (reliability, logistics footprint, and sortie generation rate) are logistics based. Legacy platform reliability assessments helped focus early design trades.

FY 2011 Systems Engineering Assessments

- Key FY 2011 program events included a system-wide program management review, CDR closure activities, Software Integrating Design Review (IDR), multiple SE WIPTs, and Reliability, Availability, and Maintainability (RAM) WIPTs.
- A Software IDR was conducted March 2011 to review the architecture and high-level design of the system, including all air and ground Computer Software Configuration Items (CSCIs). The program used system-level IDRs throughout the critical design phase (nine between PDR and CDR) to facilitate understanding and resolution of total system interface issues. DASD(SE) completed the CDR assessment in May 2011. DASD(SE) participated in a September 2011 program review conducted with the prime contractor at their Florida assembly and test facility. Some well-understood technical challenges associated with a small number of subcontractors were identified and are being aggressively addressed by the program team.
- DASD(SE) maintains close and integrated engagement with the program, conducting SE WIPTs monthly to evaluate technical progress and risk. All seven KPPs and all 24 Technical Performance Measures are at or above required performance levels, indicating that the program is on track to meet requirements by FRP. Weight empty continues to trend lower and is tracking below the threshold parameter of 43,750 lbs at first flight. The program's IDR has been identified as a systems engineering best practice.
- In FY 2012 DASD(SE) will assess the program restructure schedule and continue to participate and monitor program reliability improvement efforts and program protection activities.

Measurable Performance Criteria

- **Reliability –** System reliability is projected to meet system requirements, and DASD(SE) has worked with the program through SE WIPTs to develop a robust reliability growth plan. Reliability of the system is measured through Mean Flight Hours Between Operational Mission Failures-Design Controllable ($MFHBOMF_{DC}$) with a requirement of 31.5 hours and a current estimate at 39.46 hours, and Mean Flight Hours Between Failures-Design Controllable ($MFHBF_{DC}$) with a requirement of 1.7 hours and a current value of 1.8 hours.
- **Software –** There are 7M lines of code, including more than 2M of new development. Software release plans include three major builds with functional qualification testing prior to each major release. Each build is preceded by two or more engineering releases for lab integration and is followed with formal updates on a 3- to 4-month cycle. There have been two software build deliveries to the Software Integration Lab (SIL) at the contractor's facility. Software interface alignment issues are being addressed and the burn-down tracked (28 of 40 resolved – remaining 12 to be resolved by December 2011). Software is on track for Ground Test Vehicle (GTV) light off (FY 2012) and first flight (FY 2014) with all planned functionality.
- **Manufacturing** – There is a strong focus on producibility; lean manufacturing; modularization; smart design guidelines for machined parts and tolerances; ergonomics; safety; foreign object debris prevention; assembly and installation mistake proofing; process capability; and up-to-date 3D solid models and graphic work instructions. The GTV is in production at the West Palm Beach Production facility. A Production Readiness Review is currently scheduled for the 1st quarter FY 2014. GTV fabrication/assembly and subsystem qualification testing have progressed according to schedule in FY 2011.
- **Integration** – There are no known program issues affecting current and future interrelationships, dependencies, and synchronization with complementary systems.

Conclusion: The CH-53K program is on track. Challenges remain, but the program uses a robust set of technical metrics to assess progress and focus management attention.

DDG 1000 ZUMWALT Class Destroyer

Prime Contractor: General Dynamics Bath Iron Works, Huntington Ingalls Industries, Raytheon, BAE Systems

Executive Summary: DDG 1000 is a multi-mission surface combatant. The program is in the Engineering and Manufacturing Development phase. MS B originally was held in November 2005. In 2010, the program experienced a critical Nunn-McCurdy breach as a result of a reduction in the number of program ships. DASD(SE) supported the Nunn-McCurdy review and MS B recertification of November 2010. MS C is planned for 2016.

Mission Description: The DDG 1000 program mission is to carry the war to the enemy through offensive operations. Armed with an array of weapons, DDG 1000 will provide the Joint Force Commander with the ability to destroy targets ashore with precision strike and volume fires.

System Description: DDG 1000 is a multi-mission surface combatant armed with an array of weapons to provide offensive, distributed, and precision firepower at long ranges in support of forces ashore.

Schedule: MS B was originally held in November 2005 and conducted again in October 2010 following the certification associated with a Nunn-McCurdy critical breach. Initial Operational Capability is planned for July 2016.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved an update to the SEP in July 2010 to support the reliability growth plan, as required by the Nunn-McCurdy certification review Acquisition Decision Memorandum (ADM) dated June 1, 2010. There are no waivers or deviations from the SEP. The objectives of the SEP are being met.
- **Requirements** – The JROC approved the Operational Requirements Document (ORD) on January 23, 2006. The DDG 1000 program has 13 KPPs, which are related to its critical technologies.
- **Program Protection Plan (PPP) –** The program is executing to a Service-approved PPP. An update is planned to commence in FY 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The program is on track to achieve all reliability-related requirements and has established a reliability growth plan. Automation has been designed and integrated into the ship to reduce manning.

FY 2011 Systems Engineering Assessments

- DASD(SE) performed a systems engineering assessment in FY 2011 and participated in the certification of the program following the Nunn-McCurdy breach in FY 2010. This breach resulted from a program reduction from 7 to 3 ships, not as a result of program performance. MS B was rescinded and subsequently reapproved October 8, 2010.

- DASD(SE) recommended updating the SEP to include a full reliability growth plan. The program submitted change pages to reflect a full reliability growth plan. An annual review of the program's compliance with Nunn-McCurdy certification review ADM actions was conducted in December 2011, and the resulting ADM noted that the Navy is executing the Nunn-McCurdy certified program while recognizing, addressing, and retiring risks for the program. The ADM further directed that the program be designated as an ACAT IC program with the Navy as the lead Component.
- DASD(SE) identified intra- and cross-program impacts of removing the ship's Volume Search Radar (VSR), directed by the Nunn-McCurdy ADM, as a potential multidisciplinary risk area associated with the program. The change will affect software and schedule as the program must replace the removed VSR (S-Band) functionality and apply it to the existing Multifunction (X-band) Radar. The program is executing the change through development and integration in FY 2011 through 2013 and testing in FY 2013 through 2017.
- DASE(SE) plans no assessments for FY 2012.

Measurable Performance Criteria

- **Reliability** – The DDG 1000 program has a 120-day wartime Operational Availability (A_o) requirement of 0.90 and an 18-month extended deployment A_o requirement of 0.90. The current estimate of both values exceeds 0.90. Reliability growth planning was added to the SEP in Change 2 to Version 2 in June 2010.
- **Software** – The program recently rephased software acquisition to better support production and ship activation activities. Software release 5 has been delivered and certified, and software release 6, which is required for hull, mechanical, and electrical (HM&E) activation, has been fully coded and delivered to the Philadelphia Land-Based Test Site for a series of integrated power – ship control system tests. The first such test, which was successfully conducted in May 2011, demonstrated local control of the Integrated Power System (IPS) components; a second test of integrated control is planned for 2012. For the last three software releases, the program is achieving at or above the software development productivity and schedule performance plan. A detailed analysis is under way to gauge the impact to software rework and integration as a result of removing the VSR.
- **Manufacturing** – Ultra units (very large multiple construction module constructs) are being built under cover and on schedule to meet planned launch and sea trial dates. DDG 1000 is over 60 percent complete, and DDG 1001 is over 20 percent complete as of January 2012.
- **Integration** – Removal of the VSR requires hardware and software engineering changes. In May 2011 the program demonstrated the ship IPS at the Land-Based Test Site. IPS provides the first combined shipboard integrated electric propulsion and ships electrical power generation system.

Conclusion: The DDG 1000 is on track and DASD(SE) will continue to monitor the impact of removing the VSR and reducing the number of ships in the class.

Distributed Common Ground System–Navy (DCGS-N) Increment 2 (Inc 2)

Prime Contractor: TBD

Executive Summary: DCGS-N Inc 2 is a software-centric intelligence, surveillance, and reconnaissance (ISR) integration solution for both afloat and ashore platforms. DASD(SE) has supported this program since inception and successfully encouraged the program to charter a Systems Engineering Working Integrated Product Team, which is ensuring early phases of the program adequately address technical planning and management.

Mission Description: DCGS-N Inc 2 provides ISR and targeting capabilities, multi-INT fusion and analysis capabilities, both afloat and ashore to support Navy Information Dominance goals. DCGS Inc 2 leverages recent processing and data storage advancements across the Department of Defense and Intelligence Community (IC). Inc 2 is a software-centric solution that addresses DCGS-N Inc 1 shortfalls in the Navy's ability to fuse and analyze the expected increase in intelligence data coming from new sensor platforms and from enhanced cross-agency sharing.

System Description: DCGS-N Inc 2 builds upon DCGS-N Inc 1 capabilities and replaces the Spiral 1 prototype. It leverages the evolution of developing and fielded IC technologies. This increment will provide applications to process, exploit, fuse, analyze, and disseminate intelligence from the Navy's new ISR tactical platforms that will be integrated into a standards-based environment, and will facilitate federated ISR production supporting global maritime operations. Inc 2 will converge afloat and shore ISR capabilities into an integrated information dominance enterprise.

Schedule: DCGS-N completed an Inc 2 Materiel Development Decision (MDD) during August 2011 with an ADM signed in late September and is now conducting an Analysis of Alternatives (AoA) within the Materiel Solution Analysis phase. The program plans to complete the AoA during 2nd quarter FY 2012. The program is endeavoring to enter the acquisition process pre-MS B, with MS B projected during 1st quarter FY 2014.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The program is developing an Inc 2 SEP in support of the pre-MS B Decision Review. There are no approved waivers or deviations from the SEP.
- **Requirements** – The program office is developing the Inc 2 CDD, which is based on the JROC-approved DCGS Enterprise ICD (March 2009), the Maritime Domain Awareness Fusion and Analysis ICD (November 2010), and six deferred requirements from the DCGS-N Inc 1 CPD (September 2008).
- **Program Protection Plan (PPP) –** The program office is currently developing the Inc 2 PPP to support the Pre-MS B Decision Review. DASD(SE) conducted PPP training for program personnel during FY 2011 to ensure the program understands current guidance and policies.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – DCGS-N Inc 2 is early in the acquisition lifecycle; however, DASD(SE) has assisted in successful efforts to include reliability criteria as part of the AoA.

FY 2011 Systems Engineering Assessments

- **Assessments –** DASD(SE) did not conduct any assessments during FY 2011, and there are currently no scheduled DASD(SE) assessments to be conducted during FY 2012. DASD(SE) plans to assess the program's PDR and conduct a PSR during FY 2013, which will support a MS B decision during FY 2014.

Measurable Performance Criteria

- **Reliability** – The DCGS-N Inc 2 program is in the process of identifying reliability requirements as part of their CDD development activity, which will be influenced by the outcome of the 2nd quarter FY 2012 AoA.
- **Software** – DCGS-N Inc 2 is nearly a 100-percent software effort. This increment will provide an enterprise solution that will integrate multi-intelligence fusion and analytical capabilities, and enhance tasking, collecting, processing, exploitation, and dissemination capabilities to meet increased data load from sensors coming on-line through FY 2016 and beyond.
- **Manufacturing –** Inc 2 does not anticipate having any manufacturing requirements and associated metrics because of its software-centric nature. Inc 2, Release 1, will reside on Office of Naval Intelligence (ONI) Enterprise Architecture (EA) ashore and at the maritime operations centers. Inc 2, Release 2, will reside on Consolidated Afloat Networks and Enterprise Services (CANES) afloat on Force Level Ships.
- **Integration** – DCGS-N Inc 2 will leverage hardware infrastructure provided by CANES on afloat platforms. Ashore nodes may also consider hardware infrastructure provided under DCGS-N Inc 1, CANES, ONI EA, or by non-Navy infrastructure providers if they comply with the Defense Intelligence Information Enterprise. Inc 2 will also interface with the DCGS Family of Systems and other third-party stakeholders, and is on track to integrate with these systems.

Conclusion: The DCGS-N Inc 2 program is early in its acquisition life cycle. Known systems integration challenges have been identified, and program personnel are planning to address them during the analysis and planning stages.

E-2D Advanced Hawkeye (AHE)

Prime Contractor: Northrop Grumman

Executive Summary: The E-2D AHE is a manned aircraft supporting battle management command and control in the maritime theater of operations. The program is an ACAT ID in Low-Rate Initial Production (LRIP) and is executing to cost and schedule. DASD(SE) engaged with the program on resolution of the platform's radar performance and reliability challenges.

Mission Description: The E-2D Advanced Hawkeye (AHE) is a carrier-based, all-weather, multi-mission aircraft. The AHE mission is to provide premier airborne battle management command and control and surveillance as part of the Naval and Joint Integrated Air and Missile Defense architecture including the Naval Integrated Fire Control-Counter Air capability. The E-2D AHE will provide early warning of hostile threats and provide the force with the right data to prosecute hostile engagements. New capabilities allow the E-2D AHE to provide a significant contribution to execution of other mission areas such as Strike, Combat Search and Rescue, and Homeland Defense.

System Description: The E-2D AHE includes the AN/APY-9 RADAR system; an electronically scanned Identification, Friend or Foe (IFF) system; a modernized tactical cockpit; a new Intercommunication System (ICS); generator and cooling upgrades to support all capabilities; and investments to reduce Total Ownership Cost (TOC). In addition, the E-2D AHE will comply with the Chief of Naval Operations' system safety mandates and Communications, Navigation, Surveillance/Air Traffic Management (CNS/ATM) requirements.

Schedule: The program is in LRIP. MS C was successfully completed in June 2009 and FRP is planned for 1st quarter FY 2013. Key FY 2011 systems engineering activities included a Quarterly Systems Engineering Review and technical assessment in support of a successful LRIP 3/4 DAB decision.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SEP in January 2009 to support the MS C decision. There are no approved waivers or deviations from the SEP. The objectives of the SEP are being met.
- **Requirements** – The JROC approved the CPD in September 2008 in support of MS C. The E-2D AHE program has 12 KPPs. The KPPs are on track to be demonstrated by the FRP decision. Program requirements are stable and reasonable.
- **Program Protection Plan (PPP)** – The program office approved the PPP in March 2008. DASD(SE) will work with the program office to update the PPP in support of the FRP decision.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted two systems engineering assessments in FY 2011.
- DASD(SE) conducted an independent radar assessment to review detection range, antenna system performance, and radar deficiency reports to provide the program office with an independent review of potential technical solutions for improving radar performance and stability.
- DASD(SE) also conducted a final Quarterly Systems Engineering Review in early FY 2011 in support of the LRIP 3/4 decision. The review focused on progress to software discrepancy resolution, flight test, Earned Value Management System (EVMS) metrics, and system reliability. Positive observations included that software discrepancy resolutions were tracking to plan, the program was maintaining cost and schedule performance, and air vehicle and mission system verification were on track to support FRP. DASD(SE) recommended greater adherence to a rigorous reliability methodology. The program is working to implement this recommendation. Although the radar's Mean Time Between Failure rate is improving, the radar reliability is at risk of not meeting the LRIP exit criterion. The system and radar built-in test (BIT) false alarm rates are higher than threshold (low is better), increasing aircrew and maintenance workload.
- No formal DASD(SE) assessments are planned for FY 2012. DASD(SE) will continue to emphasize reliability, radar, and manufacturing in support of the FRP decision.

Measurable Performance Criteria

- **Reliability** – The E-2D AHE program is projected to meet its platform-level reliability requirements but is challenged to achieve the lower level radar reliability and BIT false alarm rate requirements. The Failure Reporting and Corrective Action System program instituted in 2009 was beneficial in increasing radar reliability. DASD(SE) reviewed the program's reliability methodology and provided recommendations for improvement. The NAVAIR reliability competency has initiated an effort to adopt a more rigorous methodology.
- **Software** – There are approximately 4.7M total equivalent source lines of code in development. The E-2D AHE program has demonstrated a sound process for resolving software discrepancies by systematically overcoming a significant number of Priority 1 and 2 discrepancies earlier in the year. Discrepancies were resolved in line with program mitigation plans, a notable improvement. The few remaining discrepancies are primarily related to Cooperative Engagement Capability (CEC) integration.
- **Manufacturing** – The E-2D AHE program is in LRIP. The prime contractor has delivered all six aircraft to date on or ahead of schedule.
- **Integration** – The CEC system provides connectivity between the E-2D AHE and other air, land, and sea platforms transferring fire control quality data essential to the Theater Air and Missile Defense mission. Integration risk is elevated as E-2D/CEC integration occurs late in the E-2D AHE development cycle, a result of parallel concurrent CEC development. The program has viable mitigation plans and off ramps to address unforeseen issues. Completion of system verification is planned for 1st quarter FY 2012.

Conclusion: The program is on track and has demonstrated improved performance over the E-2C. The program is aware of and mitigating challenges associated with radar performance, reliability, and BIT false alarm rates.

Fleet Replenishment Oiler T-AO(X)

Prime Contractor: TBD

Executive Summary: The T-AO(X) program will provide the primary fuel pipeline linking Navy ships, and their embarked aircraft, with logistics nodes ashore. The program is pre-MS A. DASD(SE) participated in development planning and focused the Analysis of Alternatives (AoA) studies on relevant trade-off issues.

Mission Description: The primary Concept of Operations (CONOPS) for T-AO(X) is to shuttle from resupply ports to customer ships; therefore, along with Combat Logistics Force (CLF) dry cargo/ammunition ships (T-AKEs), they are generally referred to as "shuttle ships." When fast combat support ships (T-AOEs) are unavailable, T-AOs, in conjunction with a T-AKE, operate as a substitute "station ship," accompanying and staying on-station with a Carrier Strike Group (CSG) or an Amphibious Ready Group (ARG) to provide fuel and stores as required. In that case, the station T-AO is linked to logistics nodes ashore by other T-AOs operating in a shuttle ship mode.

System Description:
The desired operational capabilities are:

- Replenishment of bulk petroleum products (JP-5 and F-76) from shore depots to Naval and Support Forces under way in both peacetime and wartime.
- Ability to provide sustainment support to the Sea Base, as required.
- Replenishment of dry stores/packaged cargo, fleet freight, mail, and personnel to combatant and support forces under way in both peace time and wartime through Connected Replenishment (CONREP) and Vertical Replenishment (VERTREP).

This capability will need to support and operate with Fleet and other afloat assets. The enabling systems are:

- Navy standard CONREP and VERTREP systems.
- Government Off-the-Shelf (GOTS) turn-key and Commercial Off-the-Shelf (COTS) communication systems.
- Protection by Naval Sea Shield and other Maritime services or combined forces while operating in a threat environment.
- Baseline C4I capability will be no less than that of existing like-ship types as published in the appropriate OPNAVINST.

Schedule: The program received a Materiel Development Decision (MDD) in late February 2011 and began an AoA based on an ICD approved by the JROC in January 2011. A MS A decision is anticipated by October 2012. DASD(SE) participated in shaping the MDD by adding reliability considerations to the AoA guidance and by participating in AoA deliberations.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** The program submitted a draft SEP for review. DASD(SE) made suggestions to improve the definition of metrics to be included in the SEP and provided to RFP bidding contractors. DASD(SE) is currently collaborating with the T-AO(X) program office

to define these metrics and to discuss technical planning strategies relating to a PDR, which would be included in a draft Acquisition Strategy.
- **Requirements –** The JROC approved the ICD on January 4, 2011. The CDD is currently in draft.
- **Program Protection Plan (PPP) –** The PPP is in development for approval in FY 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The program will use the Military Sealift Command's proven structure for T-AO(X) life cycle management and sustainability.

FY 2011 Systems Engineering Assessments
- DASD(SE) was instrumental in early development planning efforts for the program, participating in the AoA as well as providing guidance to the T-AO(X) program office. DASD(SE) influenced the evaluation criteria for the AoA, insisting that the AoA document reliability assumptions (Operational Availability and Materiel Availability) used for calculating the number of required T-AO(X) ships as well as technical risks associated with each of the alternatives under consideration. While participating in the AoA activity, DASD(SE) recommended and the program initiated consideration of commercial tankers as shuttle-only ships to augment the T-AO(X)/T-AKE station ship pairs and initiated consideration of the variability of Littoral Combat Ship (LCS) average operating speed in determining the number of T-AO(X) ships required.
- The program has submitted a draft Acquisition Strategy for review. DASD(SE) made recommendations on how to better execute the aggressive program strategy, making provisions for the conduct of a PDR with associated System Requirements Review (SRR) and System Functional Review (SFR). DASD(SE) also recommended event-driven Systems Engineering Technical Reviews (SETRs) to reduce risk by ensuring a common understanding between the Government and the implementing contractor of ship design requirements and approach before ship construction begins.
- DASD(SE) recommended and the program initiated LCS speed-related sensitivity analysis, resulting in an AoA conclusion that the total number of ships could vary from 17 to 20 based on LCS average speed and an acquisition approach that monitors LCS actual fuel consumption rates to determine the need for additional tankers. This approach should improve the ability to meet operational needs.
- DASD(SE) will conduct a PSR in FY 2012 to support the MS A decision.

Measurable Performance Criteria
- **Reliability** – The program initiated efforts to define reliability, reliability growth, and program technical tracking metrics in concert with development of MS A SEP and CDD. Sustainability KPP requirements will be synthesized in conjunction with T-AO(X) CDD development.
- **Software** – Software development is not expected to be a major risk since the Machinery Control System (MCS) and Integrated Bridge System (IBS) software is delivered as a turnkey Original Equipment Manufacturer product along with these systems.
- **Manufacturing** – Most potential shipyard bidders are qualified to build the baseline double-hull tanker.
- **Integration** – During program planning, the program must allocate sufficient time to find, fix, and test solutions to problems during integration.

Conclusion: The AoA has successfully bounded a potential materiel development solution and the program is on track for a successful MS A decision review.

Joint High Speed Vessel (JHSV)

Prime Contractor: Austal USA

Executive Summary: JHSV is a high-speed vessel used for intra-theater transport of troops and vehicles. It is in the Engineering and Manufacturing Development phase. DASD(SE) sponsored focused reviews in 2011 that supported clearing program Main Propulsion Diesel Engine risks, characterizing vessel structural design versus light ship weight risks, and facilitating procurement of vessels 6-9.

Mission Description: The JHSV will provide high-speed, shallow-draft transport for intra-theater transport of medium payloads of personnel and cargo for Joint forces, to bridge the gap between low-speed sealift and high-speed airlift for combat-ready personnel, equipment, and supplies over operational distances. It will provide access to littoral offload points that include austere, minor, and degraded ports.

System Description: JHSV is a modified version of an existing commercial vessel (non-developmental). JHSV has an aluminum catamaran hull with water-jet propulsion. It incorporates military-unique features such as light armament, aviation, C4I (command, control, communications, computers, and intelligence), damage control, and firefighting. It has a threshold payload of 600 Short Tons (ST) and can carry up to 312 troops. The Military Sealift Command will maintain and operate JHSV.

Schedule: JHSV received DAB authority to initiate construction in December 2009. MS C is planned for FY 2013. Key FY 2011 DASD(SE) activities included participation in OIPT and DAB assessments, which enabled procurement of vessels 6-9 in accordance with negotiated agreements, eliminating the need for contract renegotiation and associated cost increases.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** DASD(SE) approved the program SEP in October 2009. The program is following the SEP as planned with no waivers or deviations.
- **Requirements –** JROC validated and approved the CDD on February 8, 2007. JHSV has eight KPPs, primarily centered on meeting speed-distance-payload requirements of 600 ST for 1,200 nautical miles at an average speed of 35 knots. The design supports all KPPs for demonstrating threshold goals by the end of FY 2013. The CDD did not address reliability, but the program has taken measures to comply with DoD reliability, availability, and maintainability (RAM) requirements.
- **Program Protection Plan (PPP) –** The program will provide a PPP in preparation for a MS C decision in May 2013.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The program will use the Military Sealift Command's proven structure for JHSV life cycle management and sustainability. There are no known systems engineering sustainment issues.

FY 2011 Systems Engineering Assessments

- DASD(SE) participated in a FY 2011 DAB for procurement of vessels 6-9.
- DASD(SE) assessed resolution of discrepancies resulting from a failure during the 1,500-hour Factory Acceptance Test (FAT) of the Main Propulsion Diesel Engine. DASD(SE) concluded that resolution of the discrepancies was on track with no safety-related or operationally limiting reliability issues.
- DASD(SE) assessed adequacy of shipyard facilities and training and learning curve projections to support the yard's ability to deal effectively with production of two ship classes (JHSV and LCS-2).
- DASD(SE) performed a sensitivity analysis of the program-supplied ship weight design trade-off of structural reinforcement against light ship weight limits to meet the JHSV primary transport KPP of 600 ST, over 1,200 nautical miles at an average speed of 35 knots, concluding that the design was on track to meet the KPP.
- DASD(SE) assessments and recommendations supported DAB authorization of immediate procurement of vessels 6-7, and with approval of FY 2012 funding, vessels 8-9. Requirements, funding, and schedule are balanced and on track. The next annual DAB is planned for late 2012 to approve procurement of vessel 10.
- DASE(SE) plans no assessments for FY 2012.

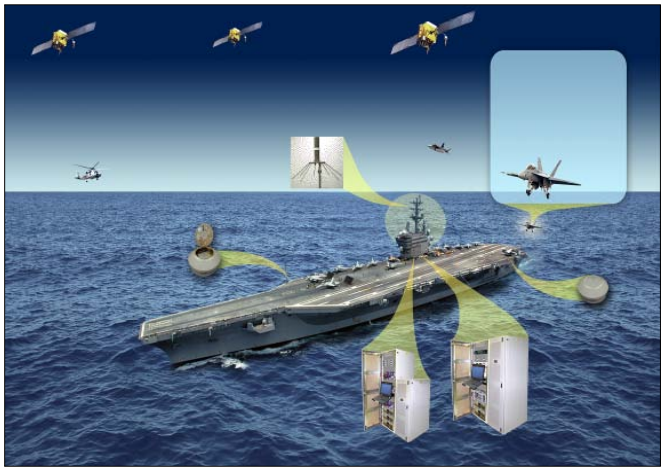
Measurable Performance Criteria

- **Reliability –** The program has established reliability targets of Materiel Availability of 0.72, Materiel Reliability of 127 hours Mean Time Between Failure (MTBF) based on a 4-day mission, and Mean Down Time of 175 hours per year. Reliability, Availability, Maintainability and Cost (RAM-C) analysis and follow-up TIGER modeling using accumulated reliability data indicate that these targets will be exceeded. Current estimates are: Materiel Availability of 0.78, Materiel Reliability of 294 hours MTBF, and Mean Down Time of 151 hours/year.
- **Software –** JHSV uses Original Equipment Manufacturer (OEM) Engineering Control System (ECS) and Integrated Bridge System (IBS) software delivered on commercial ferries with identical ship characteristics.
- **Manufacturing** – The program has overcome startup process problems with the Friction Stir Welding process used to fuse major JHSV hull sections, and JHSV-1 was launched only slightly behind schedule. The contractor has developed a modern, automated facility that is in operation, and the contractor continues to refine worker training and processes support to improve production turnaround time.
- **Integration –** A potential integration risk exists with respect to the potential for corrosion problems (similar to LCS-2) in the vessel water jet tunnels where aluminum to stainless steel interfaces exist. The program indicates that coating, passive current monitoring, and sacrificial anode design differences mitigate against potential corrosion.

Conclusion: The JHSV program is stabilizing. JHSV 1 will not be delivered until May 2012, six months later than planned. JHSV 2 and later are expected to deliver on time and at cost.

Joint Precision Approach and Landing System (JPALS) Increment 1A (Inc 1A)

Prime Contractor: Raytheon Network Centric Systems



Executive Summary: JPALS Inc 1A will provide a Global Positioning System (GPS)-based landing capability on board all aviation ships. The Navy conducted a system-level CDR in December 2010. DASD(SE) performed an assessment of the CDR and concluded that the Inc 1A program was ready to proceed into the System Capability and Manufacturing Process Demonstration portion of the Engineering and Manufacturing Development (EMD) phase.

Mission Description: JPALS will provide a rapidly deployable, adverse weather, day-night, survivable, and interoperable precision approach and landing capability that can support the principles of forward presence, crisis response, and mobility.

System Description: JPALS is a GPS-based precision approach and landing system that will replace several aging and obsolete aircraft landing systems and will function in more operational environments to support DoD sea-based applications. Inc 1A provides for the development, integration, installation, and test of sea-based JPALS and includes a functionally representative air system component to test and verify all of the Inc 1A KPPs.

Schedule: The program is in the EMD phase. MS B was approved in July 2008 and MS C is scheduled for 3rd quarter FY 2013. Key FY 2011 systems engineering activities included a system-level CDR assessment completed in September 2011 and a DASD(SE)-led workshop on Program Protection Plan (PPP) development in August 2011.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the Inc 1A SEP in December 2007 to support a MS B decision and approved an updated SEP in January 2009 as directed by the Acquisition Decision Memorandum. In addition, the program office will submit an update to support MS C in FY 2013. There are no waivers or deviations from the SEP. The objectives of the SEP are being met.
- **Requirements** – The JROC validated the CDD in March 2007. JPALS Inc 1A program has four KPPs: net-ready, guidance quality, manpower, and Operational Availability. All KPPs are projected to be at or above threshold values, based on analysis of the corresponding 24 Technical Performance Measures (TPMs).
- **Program Protection Plan (PPP)** – The Inc 1A PPP will be reviewed prior to MS C. The PPP update will incorporate new guidelines on criticality analyses and supply chain risk assessments.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The Life Cycle Support Analysis was included as a design consideration and addressed during the CDR.

The Level of Repair Analysis, Reliability-Centered Maintenance, and maintainability analysis all aided in confirming that the Initial Product Baseline would satisfy the Mean Corrective Maintenance Time (MCMT) requirement of equal to or less than 2 hours. The current MCMT prediction is 1.3 hours.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted one assessment in FY 2011.
- The program conducted a CDR in December 2010 to support entry into the System Capability and Manufacturing Process Demonstration portion of the EMD phase. The review was event driven; all entry criteria were met and closeout actions were identified.
- DASD(SE) performed an assessment of the CDR and concluded that all program designs were baselined, under configuration control, and ready to proceed with software coding and hardware build activities. No remedial action was required to achieve the Acquisition Program Baseline (APB) thresholds, and no requirement trades were required based on assessment of cost, schedule, and performance risks.
- No assessment is scheduled for FY 2012.

Measurable Performance Criteria

- **Reliability** – The system reliability and maintainability criteria parameters are established with corresponding TPMs to track the progress to achieve the actual performance measure. The JPALS Operational Reliability requirement, defined as Mean Time Between Operational Mission Failure (MTBOMF), is required to be equal to or greater than 4,000 hours. The current MTBOMF prediction is 4,326 hours.
- **Software** – The JPALS detail software (SW) design is complete and design artifacts delivered and accepted, subsequent to the system-level CDR. The current SW line of code estimate is over 500k and includes more than 300k reused and 200k new lines of code. SW development is continuing within the parameters of the TPMs and the software development plan.
- **Manufacturing** – The CDR determined that 80 percent of the design components and assemblies were non-developmental items (NDI). The NDI components are current production items, and no further development is required. The remaining 20 percent of the components and assemblies, including new and modified items, have completed designs, and manufacturing readiness practices are ongoing. The significant amount of NDI components and the ongoing manufacturing readiness practices (for new or modified items) support reduced risk for transition to production.
- **Integration** – The JPALS ship integration strategy uses the Systems Engineering Technical Review process to plan and assess each subsystem (with its associated internal and external interfaces) individually and collectively. Each subsystem has a corresponding unique subsystem integration plan with detailed integration procedures, verification tests, and evaluations defined for each subsystem. The contractor and Government Ship Integration Laboratories (SIL) replicate the shipboard environment to support system integration and developmental test and evaluation. Integration of an AN/USN-3(V)1 shipboard system is expected to be completed at both the contractor and Government SILs in early FY 2012 to support verification prior to shipboard installation.

Conclusion: The program is on track, executing to technical plans, performing to established metrics, and progressing with risk-mitigation activities.

Littoral Combat Ship (LCS) Mission Modules (MM)

Prime Contractor: Northrop Grumman

Executive Summary: USD(AT&L) established LCS MM as an ACAT ID program by Acquisition Decision Memorandum on April 7, 2011. The program is in the Technology Development (TD) phase. It had previously been part of the LCS program. DASD(SE) is working with the program to develop the SEP.

Mission Description: LCS MMs provide a modular, focused mission capability to the Combatant Commanders to provide assured access against littoral threats, specifically mines, small surface ships, and submarines. Mission systems are added to the MM baseline incrementally as they reach a level of maturity necessary for fielding.

System Description: Mission Packages (MP) are functional groupings of MMs that integrate with the Seaframe and mission-specific manning to provide the means for executing a particular mission as mine countermeasures (MCM), surface warfare (SUW), or anti-submarine warfare (ASW). MPs are based on increments of capabilities added into MM as they mature and are tested for effectiveness and suitability. LCS can change out MPs (MMs and crew) pierside in a friendly port to meet changing mission requirements.

Schedule: MS B is planned for FY 2012. Key FY 2011 DASD(SE) activities included participation in OIPT and DAB assessments, which established LCS MM as a separate program. DASD(SE) also worked with the program in SEP development and preparation for MS B.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The MS B SEP is in development for approval in FY 2012. It is the initial SEP for the program. An update is planned in FY 2014 to support MS C.
- **Requirements** – MMs share a common CDD with LCS, which was validated June 17, 2008. The MM program has a total of 14 KPPs. Capabilities are incrementally delivered, and final MM compositions have not been defined (the flexibility exists to take advantage of emerging technology). Inherent instability in capabilities exists due to emerging technologies. Specific requirements for MMs are still evolving and not stable. DASD(SE) is working with the program to ensure a process is in place to manage requirements development as MM composition and capabilities evolve.
- **Program Protection Plan (PPP) –** The PPP is in development for approval in FY 2012.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted a focused assessment in support of a DAB in FY 2011, which split the LCS program into separate LCS Seaframe and LCS MM programs. Recommendations included

establishing a different SEP for MMs and defining metrics to ensure that LCS MM and Seaframe programs are closely coordinated.
- DASD(SE) determined that splitting the programs provides equal visibility to both programs as they move forward, allowing the MM program to more effectively focus on MM performance and integration. The program is establishing metrics to ensure it is synchronized with Seaframe development.
- DASD(SE) found that concurrent development, production, deployment, and testing results in Seaframe and MP schedules were not being synchronized. No uniform operational concepts exist across MCM MP and Fleet operations, resulting in an inability to allocate CDD requirements down to the individual MM level. The program lacks an integration organization with the authority to conduct real risk mitigation, and it has not demonstrated use of Navy software acquisition best practices as delineated in the Guidebook for Acquisition of Naval Software Intensive Systems of September 2008.

Measurable Performance Criteria
- **Reliability** – The CDD requirement for Materiel Availability is 0.64 threshold, 0.712 objective to meet Fleet operational requirements. A reliability growth plan is in place, but it is too early to determine its effectiveness.
- **Software** – LCS MM reports more than 8.9M delivered lines of code with a 89 percent reuse rate for the MCM and SUW MMs. With the exception of the ASW MM, software builds have been generally completed. Software components have been individually developed by various Government and contractor sources and lack consistent best development practices and metrics as required by the Navy for central software management within the programs. DASD(SE) has not noted significant movement to correct these shortfalls in FY 2011.
- **Manufacturing** – Manufacturing Readiness Level varies from new developments to mature systems, depending upon the component. The program has procured two MCM, two SUW, and one ASW MM. The program is implementing a design change for the ASW MM, as the delivered system was determined to be operationally ineffective.
- **Integration** – There is significant integration required between MM and LCS programs. To address this, the program established an Integrated Product Team to develop, maintain, and manage interface specifications and examine construction details to ensure smooth interfaces.

Conclusion: The LCS MM program is a complex system-of-systems engineering effort. The program faces challenges in the areas of integration and requirements allocation to deliver initial capabilities to the Navy.

Littoral Combat Ship (LCS) Seaframes

Lockheed Martin USS Freedom

General Dynamics USS Independence

Prime Contractors: Lockheed Martin (LCS 1, 3 plus 10), General Dynamics (LCS 2, 4 plus 10)

Executive Summary: The LCS Seaframe program is in the Engineering and Manufacturing Development (EMD) phase. DASD(SE) conducted focused reviews in 2011 supporting the LCS Seaframe and Mission Module (MM) program split DAB. The review addressed the risk management processes for the unique problems of each program and targeted integration issues.

Mission Description: LCS provides small focused mission ships to prosecute littoral warfare mine countermeasures, surface warfare, and anti-submarine warfare. LCS has the capability to detect, identify, track, and protect against anti-ship cruise missiles, threat aircraft, and small boats. It also has the interfaces to MMs that support these missions.

System Description: The LCS Seaframe comprises the ship, crew accommodations, hotel services, and systems required to support embarked modular Mission Packages (MPs). Seaframe core systems provide self-defense, navigation, C4I (command, control, communications, computers, and intelligence), and other requirements common to all mission areas.

Schedule: MS B was held in 2nd quarter FY 2011 and MS C is planned for 3rd quarter FY 2012. Key FY 2011 systems engineering activities included the program split DAB review, participation in resolving discrepancies from the LCS and Joint High Speed Vessel (JHSV) Main Propulsion Diesel Engine Factory Acceptance Test, and initiation of a SEP update for MS C.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the LCS MS B SEP July 29, 2010. There are no approved waivers or deviations from the SEP. The current SEP is being followed as planned. The program is required to update the SEP for MS C planned in FY 2012. DASD(SE) is engaged with the program to ensure that metrics for tracking software quality, reliability, integration, and shipbuilding manufacturing are documented to support the transition from development to production.
- **Requirements** – The JROC validated the LCS CDD for flight 0+ on June 17, 2008. The LCS program has 10 KPPs, primarily involving speed, range at transit, mission module payload, draft, and crewing. Program requirements are stable.
- **Program Protection Plan (PPP) –** The PPP is in development for approval in FY 2012.

FY 2011 Systems Engineering Assessments

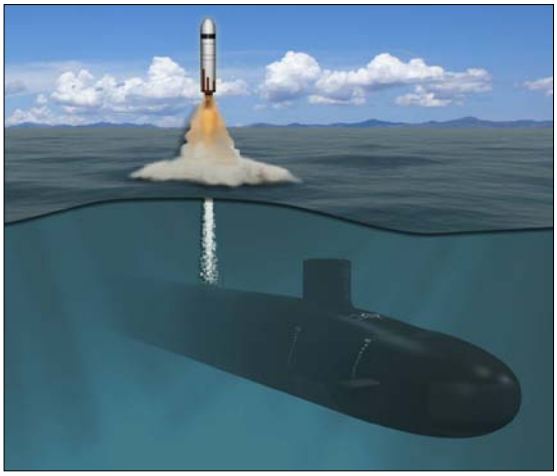
- DASD(SE) supported a program split DAB review in FY 2011 to support evaluation of the benefit/risk of splitting the LCS program into separate LCS Seaframe and LCS MM programs. Resulting Acquisition Directive Memorandum directives included continuous monitoring of Displacement Service Life Allowance (SLA), completion of design testing on both Seaframe platforms prior to MS C, and demonstration of the Launch Handling and Recovery System performance in a relevant environment on both Seaframes.
- DASD(SE) evaluated the March-April 2011 Main Propulsion Diesel Engine (MPDE) focused review directed by the program manager in conjunction with a JHSV OIPT review. The JHSV program conducted a 1,500-hour Factory Acceptance Test of the MPDE used in both JHSV and LCS Independence classes. The engine failed the test with 10 discrepancies. DASD(SE) follow-up determined that design modifications for all 10 discrepancies have been finalized.
- Splitting the Seaframe and MM programs provides visibility to both programs and separates management responsibilities. This facilitates identification and assessment of each program's outstanding integration issues and progress toward their resolution. The programs are establishing metrics to ensure they remain synchronized and deliver the required capability to the fleet. DASD(SE) found that risk management between Seaframes and MMs needs improvement.
- DASD(SE) focused on Displacement SLA, hull cracking, and corrosion, and promoted empowering the Mission System to Ship System Integration Team to better resolve identified integration issues.
- A MS C PSR is scheduled for FY 2012.

Measurable Performance Criteria

- **Reliability** – The CDD requirement for Materiel Availability is 0.64 threshold, 0.712 objective; Operational Availability is 0.85. Reliability models indicate these requirements can be met, but no reliability testing feedback is available from the programs to validate the modeling results.
- **Software** – Software cost/metric reports have not been available to the Defense Cost and Resource Center since 2005. DASD(SE) conducted a 2010 PSR, which determined that the program was not employing Navy best practices for software-intensive systems.
- **Manufacturing** – Each shipyard has delivered two ships. Both shipyards have experienced initial design-for-manufacturability issues such as hull cracking/corrosion problems on the Freedom class and corrosion/water jet cavitation problems on the Independence class. The Navy considers these routine first-of-class issues and is taking steps to improve design and manufacturing processes to correct the problems for future hulls.
- **Integration** – DASD(SE) and other OSD offices are working with the program to establish metrics.

Conclusion: Four ships have been delivered with authorization for an additional 20, ten from each shipyard. The program office is aware of and taking steps to address the challenges associated with manufacturing and integration as well as pursuing improvements to their risk management and software development processes.

OHIO Replacement



Prime Contractor: General Dynamics Electric Boat Division

Executive Summary: The OHIO Replacement program is a pre-Major Defense Acquisition Program (MDAP) to design, build, and sustain a replacement for the OHIO Class Fleet Ballistic Missile Submarines (SSBNs), retiring at the rate of one per year beginning in 2027. DASD(SE) completed a PSR in support of the OIPT and MS A Defense Acquisition Board (DAB) in the 1st quarter FY 2011.

Mission Description: The OHIO Replacement ballistic missile submarine will continue the strategic nuclear deterrence function of the OHIO Class submarines with the Trident II D5 missiles as the nation's most survivable arm of the triad.

System Description: The OHIO Replacement is a ballistic missile submarine functionally similar to the existing OHIO Class SSBNs. The new design will integrate four major subsystem areas: the submarine Hull, Mechanical, and Electrical (HM&E) systems; the propulsion plant; the Common Missile Compartment (CMC) with its Strategic Weapons System (SWS); and the Non-Propulsion Electronic Systems (NPES).

Schedule: The program is in the Technology Development (TD) phase. The MS A Acquisition Decision Memorandum was signed on January 10, 2011, approving program entry to TD. DASD(SE) completed a PSR in support of the MS A OIPT on October 15, 2010, and the DAB review on December 9, 2010.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SEP on September 28, 2010, to support MS A. An update is planned in FY 2014 to support MS B. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The program has a JROC-approved ICD. A Service CDD to guide the TD phase was approved by the Navy Resource Requirements Review Board (R3B) on September 19, 2011. Decomposition of requirements to lower indentured levels is maturing and will be documented in the ship design specification expected in FY 2012. The program has unique design requirements related to the coordinated stern, propulsion, CMC manufacturing, and SWS re-hosting. The program requirements are reasonable. Design trade-offs of key attributes will be examined throughout the TD phase, with a focus on affordability.
- **Program Protection Plan (PPP) –** The strategy to identify Critical Program Information (CPI) and develop a PPP is documented in both the SEP and Technology Development Strategy (TDS). The program will develop a PPP to support the MS B decision planned in FY 2014.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The program will use a design, build, and sustain systems engineering process through the life of the program. Early systems engineering activities include design for affordability and reduction of total

ownership cost initiatives. Major design initiatives include the potential elimination of a mid-life refueling overhaul, and the development of more reliable subsystems to increase operational availability between planned depot maintenance periods.

FY 2011 Systems Engineering Assessments

- DASD(SE) completed a PSR in October 2010 to support the OIPT held on October 15, 2010, and to support the MS A DAB on December 9, 2010. The reviews indicated the program was ready for entry into the TD phase and MS A approval.
- Positive observations included a well-defined requirements development process, along with demonstrated Navy proficiency in nuclear submarine shipbuilding, strategic weapon systems development, and sustainment. Key findings and recommendations included the need to demonstrate sufficient technical maturity to support the TD phase exit criteria, affordability considerations as part of the design effort, the need to better define contract incentives, and the need to develop performance metrics to include software engineering metrics to track progress during the preliminary design phase. The program is addressing these recommendations.
- No systems engineering assessments are scheduled for FY 2012.

Measurable Performance Criteria

- **Reliability** – The Navy is developing and maturing a Reliability, Availability, Maintainability, and Cost (RAM-C) report to guide design, build, and sustainment plans. Also, a RAM program plan will be developed to address the key tenets of RAM, including reliability growth. The RAM program plan will include a Failure Mode, Effects, and Criticality Analysis; detailed reliability allocations; thresholds and objectives; and a plan for sustainment. The SEP and RAM program plan are also part of the TD phase Request for Proposals.
- **Software** – The program intends to leverage existing NPES software, and no new NPES software development requirements are currently envisioned. The SWS also intends to leverage and re-host existing software from the OHIO Class. Program-level software engineering metrics still need to be developed for any new, modified, reused, and COTS software associated with ship-unique subsystems.
- **Manufacturing** – Competitive prototyping efforts were initiated in 2009 for the CMC integrated tube and hull (ITH) quad pack manufacturing and assembly plan. Fixture development was completed in FY 2011 to support the ITH build strategy. The spatial arrangements and integration of major ship construction areas will be defined in the Manufacturing Assembly Plan (MAP). Work sharing for the CMC between U.S. and U.K. industrial facilities adds additional manufacturing risk mitigation activities.
- **Integration** – Initial system integration strategies are documented in the SEP. The program is composed of major area integration teams (MAIT) responsible for overarching technical oversight and integration. MAITs interface with major area teams (MATs) to resolve issues or conflicts with the MAP and integration of major ship subsystem modules. The MAP will define major areas and modules as a subset of the HM&E systems, the CMC and SWS, the propulsion plant, and the NPES. System integration teams (SITs) and process integration teams (PITs) span and support the platform across specialty subsystem areas and major modules.

Conclusion: The OHIO Replacement program is a complex system of systems engineering effort. The program is on track and addressing all design considerations, opportunities, and risk. Balancing requirements, technical performance, and affordability will be a challenge as the program progresses through TD and preliminary design.

Remote Minehunting System (RMS)

Prime Contractor: Lockheed Martin Undersea Systems

Executive Summary: The AN/WLD-1(V)2 Remote Minehunting System (RMS) is in the Engineering and Manufacturing Development (EMD) phase. RMS is a mine reconnaissance system designed for the detection, classification, identification, and localization of bottom and moored targets in shallow and deep water. DASD(SE) has participated in Critical Systems Reviews (CSRs), a Design Review (DR), SEP update, and reliability growth plan (RGP) development meetings.

Mission Description: RMS is launched from the Littoral Combat Ship (LCS) as part of the Mine Countermeasures (MCM) Mission Package (MP). It enables LCS to detect, identify, and localize mines while keeping LCS at a safe standoff distance from the mine field.

System Description: RMS is a fully integrated system consisting of a semi-submersible Remote Multi-mission Vehicle (RMMV) carrying a towed variable-depth sensor (AN/AQS-20A). Line-of-Sight (LOS) and Over-the-Horizon (OTH) telemetry provides vehicle command and control and mine reconnaissance sensor data transmission to and from a system aboard LCS.

Schedule: MS C was rescinded in June 2010 due to a critical Nunn-McCurdy breach; a new MS C is planned for FY 2014. In 2011, RMS continued to address reliability issues highlighted in an Acquisition Decision Memorandum (ADM) on June 1, 2010. Key FY 2011 DASD(SE) activities included support of ADM-directed CSRs and DR; participation in development of the RGP; and SEP development and approval.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SEP on June 10, 2011, to support the EMD phase. An update is planned to support MS C in FY 2014. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The CDD was approved in May 2011. It includes Materiel Availability and sustainment KPPs as directed by the ADM. The RMS program has met all KPPs, with the exception of Operational Availability and Materiel Availability. All requirements are stable.
- **Program Protection Plan (PPP) –** The program will provide a PPP in preparation for a MS C decision in FY 2014.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** DASD(SE) participates in the maintenance planning technical working group, which ensures the sustainment KPPs in the CDD will be met. DASD(SE) is closely monitoring the conduct and progress of the RGP, which will have a direct impact on life cycle costs and sustainability.

FY 2011 Systems Engineering Assessments

- DASD(SE) participated in two CSRs, one DR, and reliability growth initiatives during 2011.
- RMS is pursuing correction of reliability problems highlighted in the 2010 Nunn-McCurdy review. As part of the reliability growth effort, the program has implemented fixes for previously identified high-impact failures and conducted verification in 2011.
- The CSRs and DR identified systems and components for redesign or replacement that have a direct effect on reliability. The more critical changes will be implemented and verified in 2012.
- DASD(SE) recommended that RMS establish an effective RGP. Initial results of the reliability growth effort are showing a positive trend in reliability.
- Although no systems engineering assessments are scheduled for FY 2012, DASD(SE) will be involved in ongoing DRs.

Measurable Performance Criteria

- **Reliability –** The RMS program has a reliability requirement of 75 hours Mean Time Between Operational Mission Failure (MTBOMF) for the RMMV. MTBOMF is defined per the RMS CDD Definition 1 and 2. The program initiated a RGP, including a reliability growth curve based on predictive modeling, CSRs, DRs, and verification plans. Thirty-two known fixes (29 failure modes and 3 process changes) have been incorporated in the RMMV, and 4 supply chain changes have been implemented. Initial results of reliability verification show RMS reliability growth.
- **Software –** Except for some minor integration and communications software, RMS has no software responsibility. The LCS Mission Modules program has software responsibility for the MCM MP, including RMS.
- **Manufacturing –** Qualified Manufacturing facilities are in place to build an additional eight RMMVs. No significant manufacturing activity will take place until FY 2015, after successful completion of the RGP.
- **Integration** – RMS has integration facilities at Naval Surface Weapons Center, Panama City. Integration testing on board the LCS has uncovered handling and communication problems. Design and procedural improvements are being pursued to address the problems. The Systems Engineering Working Integrated Product Team is monitoring progress on integration resolutions.

Conclusion: The program has developed and is implementing a viable RGP to address KPP deficiencies in system reliability and sustainment. Demonstrating the reliability requirement with confidence is still needed but on track. The program is aware of and addressing the challenges associated with shipboard integration and deployment.

Standard Missile-6 (SM-6)

Prime Contractor: Raytheon Missile Systems

Executive Summary: SM-6 is an Extended-Range Active Missile (ERAM) surface-to-air supersonic missile launched from Aegis cruisers and destroyers that is currently in the Production and Deployment phase. DASD(SE) worked with the SM-6 program office and stakeholders to maintain a focus on reliability and ensure processes, data, and models are in place to demonstrate required operational reliability in support of the Full-Rate Production (FRP) decision.

Mission Description: The SM-6 missile is capable of engaging manned and unmanned, fixed or rotary wing aircraft, and land attack or anti-ship cruise missiles. SM-6 is designed to provide ship self-defense, fleet area defense, and theater air defense for sea and littoral forces.

System Description: SM-6 is an integration of the SM-2 Block IV/IVA airframe, flight control, ordnance, and propulsion stack with a modified Advanced Medium Range Air-to-Air Missile (AMRAAM) active seeker that provides dual-mode (active/semi-active) performance in benign and electronic attack environments with the support of the Aegis Weapon System (AWS).

Schedule: An ACAT ID program, SM-6 completed MS C in July 2009, authorizing FY 2009 Low-Rate Initial Production (LRIP). Two subsequent DABs have authorized LRIP for FYs 2010 and 2011. The FRP decision is currently planned for FY 2012. FY 2011 systems engineering activities included Component Reliability Testing, Functional Configuration Audit (FCA), Production Readiness Review (PRR), and at-sea test planning and execution.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SM-6 SEP in June 2009 to support MS C. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The SM-6 CPD was approved in December 2008. The SM-6 program has five KPPs: down range, radar cross-section, single-shot kill probability, launch availability, and interoperability. The program plans to demonstrate radar cross-section and single-shot kill probability prior to FRP. Maximum down range, launch availability, and interoperability will be demonstrated during follow-on operational test and evaluation (FOT&E) when the updated AWS Baseline 9 is available. SM-6 requirements are stable and reasonable.
- **Program Protection Plan (PPP) –** The January 2009 SM-6 PPP was reviewed by DASD(SE) and considered adequate. The PPP will be updated for the FRP decision to reflect recent PPP policy changes.

FY 2011 Systems Engineering Assessments

- In support of a May 2011 LRIP, DASD(SE) conducted an in-depth assessment of the verification processes by which the program was assessing operational reliability. DASD(SE) found that the program's approach, based primarily on the limited SM-2 and AMRAAM legacy data and MIL-

HDBK-217 data, was inadequate to support a FRP decision, and that successful completion of Initial Operational Test and Evaluation (IOT&E) was at risk based on continued reliability issues. DASD(SE) recommended that the program develop a plan to improve the reliability assessment approach to add (1) the results of Reliability Demonstration Testing and Highly Accelerated Life Testing being conducted in response to earlier PSR findings, and (2) legacy SM-2 and AMRAAM seeker data to support a higher confidence level assessment of the availability KPP. The program established a Reliability Integrated Product Team (IPT) and wrote a Reliability Surveillance Program Plan, which included these programs.

- DASD(SE) plans to conduct a PSR to support the FRP decision in FY 2012 focused on FRP readiness and life cycle support.

Measurable Performance Criteria

- **Reliability –** The SM-6 program has specified requirements for launch availability and operational reliability. Demonstrating reliability with its flight and storage components has been a concern since program inception due to the limited number of flight test events and the inability to age test articles in their intended operational environment. Although the program met MS C and LRIP reliability exit criteria, it did not demonstrate adequate flight reliability during IOT&E. The recently established Reliability IPT is working with stakeholders to resolve reliability issues prior to FRP.
- **Software –** The SM-6 program has a CPD requirement to review all unique software with the Weapons System Explosive Safety Review Board. The program has done so prior to shipboard testing. The SM-6 Missile Performance Specification also requires that all Computer Software Configuration Items be reprogrammable at the AUR (all up round) level. The program is meeting this through its Maintenance Built-in-Test capability.
- **Manufacturing** – The program completed a PRR in November 2010 at which the AUR and each of its major subassemblies were assessed as having met LRIP manufacturing requirements. The program is currently meeting production requirements of four AUR missiles per month.
- **Integration** – The SM-6 AUR is contained in the MK21 Mod 3 Canister, which is physically and electrically integrated into the MK41 Vertical Launching System (VLS). Initial VLS integration testing was completed in 2007 at Lockheed Martin, Baltimore, and White Sands Missile Range (WSMR), NM, in a AWS Baseline 7 configuration. Integration with AWS Baseline 7.1R was completed at the Combat System Engineering Development Site (CSEDS), Moorestown, NJ, and WSMR Desert Ship installation in 2008. Integration with AWS Baseline 9, which will enable the full capabilities of SM-6, has commenced at CSEDS, and at-sea testing is planned to begin in late 2013.

Conclusion: Although the SM-6 program is working through reliability challenges, it has demonstrated new capabilities for theater, fleet area, and self-defense. The SM-6 program will integrate with AWS Baseline 9 in FY 2013 to demonstrate all CPD requirements.

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7.3 DASD(SE) Assessments of Air Force Programs

Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). This section includes summaries on the following 12 programs:

- B-2 Defensive Management System (B-2 DMS)
- B-2 Extremely High Frequency Satellite Communications and Computer Upgrade, Increment 1 (B-2 EHF Inc1)
- B61-12 Tail Kit Assembly (TKA)
- E-8C Joint Surveillance and Target Attack Radar System (JSTARS)
- Expeditionary Combat Support System (ECSS)
- F-22A Modernization (F-22A)
- Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)
- Global Hawk (RQ-4B) Unmanned Aircraft System (UAS)
- Global Positioning System (GPS) Next Generation Operational Control System (OCX)
- Joint Air-to-Surface Standoff Missile–Extended Range (JASSM-ER)
- Joint Space Operations Center (JSpOC) Mission System (JMS)
- Reaper (MQ-9) Unmanned Aircraft System (UAS)

B-2 Defensive Management System (DMS)

Prime Contractor: Northrop Grumman Aerospace Systems

Executive Summary: B-2 DMS is a pre-Major Defense Acquisition Program designed to replace the legacy DMS receivers, antennas, and display processors. The modernization will improve the B-2's ability to detect, geo-locate, identify, and avoid threats, significantly enhancing aircrew situational awareness. DASD(SE) supported the May 2011 System Functional Review (SFR), which highlighted software development as a key program risk.

Mission Description: The B-2 is an all-wing, two-pilot aircraft with twin weapons bays capable of carrying a total weapons load of more than 20,000 pounds. The aircraft is a multi-role, low-observable (LO) bomber capable of delivering conventional and nuclear munitions. The B-2 employs an array of signature-reduction techniques to significantly enhance the aircraft's ability to penetrate enemy defenses. The B-2 is tasked to attack global targets, day or night, in all weather and in highly defended threat areas at the strategic, operational, and tactical levels of warfare.

System Description: The B-2 DMS is a principal enabler for survivability for the B-2 stealth bomber. The legacy DMS Threat Emitter Locator System (TELS) detects, identifies, and locates enemy radar systems and facilitates real-time threat avoidance by providing threat warning and threat situational awareness information to the aircrew via the Tactical Situation Display. Shortcomings within the current DMS system limit overall B-2 operational capability and survivability. The B-2 DMS modernization will address these limitations by replacing TELS and its associated antennas with a more current Electronic Support Measure (ESM) subsystem for improved threat detection and an expanded aircraft display processing system to increase situational awareness.

Schedule: The program is in the Technology Development (TD) phase. MS A was August 2011. The B-2 program office has developed Rapid Acquisition Initiatives (RAI) to reduce the approved program duration by ~3 years with a $500M+ cost savings. The DMS program temporarily lost partial FY11/12 funding, delaying contract award. The B-2 program office expects minimal impact to achieving the RAI. MS B is planned for 3rd quarter FY 2014 with an Initial Operating Capability in FY 2019.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** DASD(SE) approved the MS A SEP in August 2011. There are no waivers or deviations and the SEP objectives are being met.
- **Requirements** – The Director, Cost Assessment and Program Evaluation (CAPE) approved the Analysis of Alternatives in March 2011. A draft CDD has been developed and coordinated internal to the Service as a guide to the early TD phase effort. An approved CDD is not required until MS B in FY 2014.
- **Program Protection Plan (PPP)** – The program does not yet have a PPP, as one was not required when the aircraft was in development. DASD(SE) continues to emphasize this area and

recommended the program initiate a PPP in accordance with current policy to ensure proper protection, including supply chain risk management.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The B-2 DMS modernization will emphasize reliability in the design process, while sustaining a two-level maintenance concept and reducing the deployment footprint.

FY 2011 Systems Engineering Assessments
- DASD(SE) conducted no formal assessments in FY 2011; however, throughout the TD phase, focus areas will include software development, Low Band Radio Frequency (RF) receiver-processors, and LO apertures technologies requiring maturation. In addition, antenna polarization will be assessed in the performance trade space going forward, and system and antennae integration will require attention.
- No DASD(SE) assessments are planned for FY 2012.

Measurable Performance Criteria
- **Reliability** – The B-2 DMS program has draft Operational and Materiel Availability KPPs. The program expects to achieve these requirements. In addition, the program's SEP includes a reliability growth curve and plans to ensure the contractor designs in reliability.
- **Software** – The SFR, conducted in May 2011, identified software development as a significant risk to the program. The Technical Authority recognized the shortfall and appropriately held the technical review open while the prime contractor addressed the concerns. DASD(SE) supported the review and decision to delay closure. The Software Development Plan was revised to address shortfalls including details on the proposed software prototyping strategy. The program office also sought additional outside support, and ASD(R&E) coordinated and funded additional software technical support through the Software Engineering Institute to reduce this risk and maintain schedule.
- **Manufacturing** – The selected ESM solution is a leveraged system, and the anticipated solutions for the antennas and display processors are also expected to leverage fielded systems or systems already in development. Therefore, excessive manufacturing risk is not expected. The program has implemented procedures to assess manufacturing readiness throughout the life cycle during all systems engineering technical reviews and in support of major milestones.
- **Integration** – The B-2 DMS program has identified integration risk related to ESM/antenna integration and new antenna locations. The program's single increment/two-phase TD phase approach was selected as a risk mitigation opportunity to allow the selected ESM contractor to optimize the overall system and reduce integration risk by defining interfaces and subsystem allocations prior to down-select on the critical ancillary subsystems (e.g., antennas, fiber/cable network, and displays).

Conclusion: Software development and maturation of the low-band RF receiver-processor and LO antennas are known challenge areas. The program will address these concerns in the TD phase.

B-2 Extremely High Frequency (EHF) Satellite Communications (SATCOM) and Computer Upgrade Increment 1 (Inc 1)

Prime Contractor: Northrop Grumman Aerospace Systems

Executive Summary: EHF Inc 1 upgrades the B-2's core processing capability and lays the foundation for future increments. The program is currently in the Engineering and Manufacturing Development (EMD) phase. DASD(SE) supported an Air Force-led PSR in support of an FY 2012 MS C. The review resulted in a recommendation to proceed into Production and Deployment.

Mission Description: The B-2 is an all-wing, two-pilot aircraft with twin weapons bays capable of carrying a total weapons load of more than 20,000 pounds. The aircraft is a multi-role, low-observable (LO) bomber capable of delivering conventional and nuclear munitions. The B-2 is tasked to attack global targets, day or night, in all weather and in highly defended threat areas at the strategic, operational, and tactical levels of warfare. The aging UHF MILSATCOM system used to support this mission is phasing out and will be replaced with the Advanced Extremely High Frequency SATCOM system.

System Description: The EHF Inc 1 program updates the existing computer/data storage infrastructure by adding two new Integrated Processor Units (IPUs) and increased data storage Disk Drive Units (DDUs). EHF Inc 1 translates and re-hosts the Flight Management Operational Flight Program (FMOFP) and installs a high-bandwidth, fiber-optic data bus. The program provides the computing and communication infrastructure that serves as the cornerstone for all future avionics upgrades to the platform.

Schedule: MS B was held in February 2007. MS C is planned for early FY 2012.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the MS B SEP in June 2007. An update is in work to support MS C. The objectives of the SEP are being met and there are no required waivers or deviations.
- **Requirements** – The EHF Inc 1 CPD was validated by the JROC in July 2011. The program has two KPPs focused on maintaining current capability while enabling future increments. The program is on track to meet these requirements, and the requirements have remained stable.
- **Program Protection Plan (PPP) –** The program does not yet have a PPP, as one was not required when the B-2 was in development. DASD(SE) recommended initiation of a PPP in accordance with current policy to ensure proper protection including supply chain resource management. The program has initiated development with DASD(SE) support.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The program adopted design for reliability initiatives in EMD to include Failure Modes, Effects, and Criticality Analyses; Environmental Stress Screening (ESS); and Highly Accelerated Life Testing. Major suppliers were required to provide Reliability Allocation and Prediction Reports. The production phase will continue to emphasize sustainability through the inclusion of continued ESS and

production acceptance testing of major components to include the DDU and IPU. These processes are captured in the program's SEP.

Summary of FY 2011 Systems Engineering Assessments

- DASD(SE) conducted one assessment in FY 2011.
- Air Force and OSD conducted a combined PSR in April 2011 to assess the technical planning and management prior to MS C. This review was the first Air Force-led PSR using the OSD methodology as the core process for conducting collaborative reviews combining multiple review activities (systems engineering, technology, manufacturing, etc.) under the PSR umbrella. Major areas reviewed were systems engineering, integration, and test; manufacturing readiness; technology readiness; logistics readiness; integrated risk assessment; human systems integration; environmental, safety, and occupational health; and schedule health assessment.
- Key findings fell in the areas of Diminishing Manufacturing Sources, immature schedule risk assessment capability, inadequate critical path analysis methodology, and lack of a robust Reliability Growth Plan. The program has taken action to address the recommendations. Positive observations included risk management, and a responsive and proactive logistics approach.
- No assessments are scheduled for FY 2012.

Measurable Performance Criteria

- **Reliability –** The program is on track to achieve the established mission reliability goals for the IPU and DDU of 6,000 and 5,000 hours respectively in terms of Mean Time Between Failure. The program has not planned to develop a system-level reliability growth curve due to the relatively short durations of Initial Operational Test and Evaluation. Alternatively, the program plans to provide a level of reliability, availability, and maintainability to maintain or exceed current capabilities such as system-level mean repair time.
- **Software –** The program has established software-related requirements and metrics, and software development is nearing completion. Software size estimates (~168k equivalent source lines of code (ESLOC)) have been largely stable since 2008, after original estimates were almost an order of magnitude low and led to early delays due to software development. The program has recovered, and software development and test was approximately 98 percent complete at the end of July 2011. The program is on track to release the final developmental software block and complete developmental flight testing in early FY 2012.
- **Manufacturing** – The program has defined manufacturing metrics and is on track to achieve plans. The PSR assessed manufacturing readiness and determined manufacturing processes were in control and the contractor and subcontractors are able to produce subsystems within a manufacturing environment. All risks identified have acceptable mitigation plans in place. Production phasing will permit an accelerated 2-year procurement in lots of five and eleven kits. All Engineering and Development Model and Low-Rate Initial Production units will be refurbished as necessary for a common configuration on all aircraft.
- **Integration** – EHF Inc 1 has no external interfaces or dependencies. However, within the B-2 system, interfaces external to the Inc 1 subsystem are present between existing avionics busses and other aircraft-avionics functions such as FibreNet and Ethernet. These interfaces have been thoroughly tested in laboratory and on-aircraft integration testing.

Conclusion: The B-2 EHF Inc I program is on track to enter Production and Deployment.

B61-12 Tail Kit Assembly (TKA)

Prime Contractor: TBD

Executive Summary: The life extension of the B61 ensures the United States and its allies will continue to have nuclear options provided by the B61 into the future. The B61-12 TKA is an ACAT ID pre-Major Defense Acquisition Program with a combined Materiel Development Decision (MDD) and MS A planned for FY 2012. DASD(SE) and SAF/AQ conducted a combined PSR in support of the upcoming MS A.

Mission Description: The TKA provides increased weapon delivery accuracy to allow a reduction in explosive yield to achieve the desired operational effects with reduced collateral damage. Other important benefits can be found in classified documents. The goal of the multi-agency B61 program is to extend the life of the weapon while modernizing within existing capabilities as directed by the Nuclear Weapons Council (NWC) and documented in its June 2008 tasking memorandum.

System Description: The B61-12 all-up round consists of two major assemblies: the bomb assembly (BA), developed and managed by the Department of Energy (DoE), and the TKA, developed and managed by the Department of Defense. The TKA requirements and design provide two distinct operating modes, System 1 and System 2. System 1 provides an analog interface between aircraft and weapon, while System 2 provides a digital interface and improved accuracy.

Schedule: The program is in the Pre-MDD phase with a combined MDD/MS A planned for 2nd quarter FY 2012. DASD(SE) conducted an FY 2011 PSR in support of the upcoming MS A.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The TKA SEP is in development with an initial formal review completed. The final document is on track to be completed in support of MS A.
- **Requirements** – JROC validated the ICD in May 2011. The program requirements are based on legacy capabilities and a draft requirements correlation table that was coordinated internal to the Service. A CDD will be approved in support of MS B in FY 2014. The draft KPPs and KSAs appear reasonable. An Analysis of Alternatives (AoA) Sufficiency Report (ASR) is being provided in lieu of a full AoA. This approach is supported by OSD Cost Assessment and Program Evaluation, and early reviews of the draft ASR have been positive. The ASR is under review and is expected to be approved prior to MS A. DASD(SE) and other key stakeholders have provided initial support as B61-12 is a modification of an existing capability and alternatives are limited by direction from key strategic planning documents and authorities.
- **Program Protection Plan (PPP) –** The PPP is being developed by the program office with assistance from DASD(SE). The document has been released for formal review and will be completed prior to MS A.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The life cycle support and system reliability plans are in development. The program office is working closely with OSD in these efforts.

FY 2011 Systems Engineering Assessments

- DASD(SE) and SAF/AQ conducted a combined PSR in support of MDD/MS A.
- This PSR was conducted with SAF/AQ in conjunction with the program's Concept Characterization and Technology Description (CCTD) risk reduction activity. The CCTD placed three vendors on contract to initiate early design work and planning activities. Positive observations included robust early development planning, a successful CCTD, and experienced program office and contractor staffs. The PSR determined all three vendors were able to leverage extensively from legacy weapons experience. Key findings included increased risk due to a strategy to competitively down-select to a single contractor shortly after MS A with competitive prototyping to be conducted at the subsystem/component level. The PSR also identified the reliability requirements as a challenge based on anticipated resource constraints and a limited opportunity for growth, due to a short production profile and concurrent development of the BA. The program has taken actions to address these recommendations.
- No assessments are planned for FY 2012.

Measurable Performance Criteria

- **Reliability –** The TKA program office is developing reliability requirements and metrics. In accordance with DASD(SE) recommendations, reliability growth planning details are being added to the SEP to include design for reliability methods and techniques to grow reliability during Technology Development and Engineering and Manufacturing Development. The program is developing a Reliability, Availability, Maintainability, and Cost (RAM-C) Rationale Report to support MS A. The PSR and initial SEP review identified significant reliability risks related to challenging requirements and limited opportunity for growth. The program office acknowledges these risks and is working to mitigate them.
- **Software –** Software development is not expected to be a significant program challenge based on experience with the development of similar capabilities.
- **Manufacturing** – Manufacturing risks are not expected to be significant based on experience and existing production of similar components and technologies.
- **Integration** – The TKA program is dependent on interagency coordination with DoE for weapon system development and test assets. The program is also dependent on the industrial base for inertial guidance, radiation hardening, and long dormant nuclear-specific technologies. In addition, the program is dependent on the F-35 program for platform environmental, fitment, and interface data. These interdependencies present additional technical challenges and will require close attention and development of well-defined interfaces and documentation (e.g., Interface Control Documents).

Conclusion: The TKA program is early in development and is positioned to track to the proposed accelerated schedule.

E-8C Joint Surveillance and Target Attack Radar System (JSTARS)

Prime Contractor: Northrop Grumman

Executive Summary: The E-8C JSTARS is a U.S. Air Force battle management, command and control (BMC2) aircraft responsible for ground surveillance and targeting in support of attack operations. JSTARS is a special interest program in the Operations and Support (O&S) phase of the acquisition life cycle. DASD(SE) conducted an FY 2011 PSR on the JSTARS modernization efforts and re-engining at the request of the OIPT.

Mission Description: The JSTARS' primary mission is to provide theater ground and air commanders with ground surveillance and targeting in support of attack operations contributing to the delay, disruption, and destruction of enemy forces. It detects and tracks targets, collects imagery, and relays tactical pictures to ground and air theater commanders. JSTARS performs in all weather conditions and can fly in protected or friendly airspace while looking deep behind hostile borders to detect and track ground (vehicular and non-vehicular) and waterborne targets, low-flying aircraft, and rotating antennas in both forward and rear areas.

System Description: JSTARS is a system of systems consisting of airborne and ground-based segments. The JSTARS is a militarized Boeing 707-300 aircraft with airborne radar, operations and control, and communication subsystems designed to support and be interoperable with existing and planned joint command, control, communications, computers, and intelligence (C4I) systems. The ground-based segment consists of the Common Ground Station (CGS). Also, JSTARS is compatible with the Joint Services Workstation. These systems receive JSTARS complete radar data in near real time and process, store, and display that data, allowing the operators to build and maintain situational awareness of the operational environment through detailed analysis.

Schedule: JSTARS is in the O&S phase. Multiple modernization efforts in various stages of development are under way. Key FY 2011 systems engineering activities included an OIPT-directed PSR, an engine bleed air PDR, radar upgrade implementation, kickoff of a communications upgrade and a Propulsion System CDR.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The JSTARS SEP was initially approved in March 2008 and updated in March 2010 to support post-MS C activities and O&S. A post acquisition-to-sustainment SEP was drafted for review and approval in FY 2012. The objectives of the SEP are being met, and there are no waivers or deviations.
- **Requirements** – The JROC validated the Operational Requirements Document (ORD) in December 2004. The JSTARS program has received several Joint Urgent Operational Needs to support ongoing combat operations. The baseline JSTARS program has eight KPPs. Seven of the KPPs have been fully met. The eighth KPP, net-ready, is partially met. The program requirements are stable and reasonable.
- **Program Protection Plan (PPP)** – The original PPP was approved in 2003. An updated PPP is in work and expected to be complete in 3rd quarter FY 2012. Future updates will be considered in conjunction with major updates and/or as threat information changes.

- **Systems Engineering Support of Life Cycle Management and Sustainability** – The program made significant improvements in engine reliability and availability over the last year through low-cost modifications. The FY 2011 PSR recommended the Service fully fund and complete the JSTARS Service Life Assessment (SLA) recommended by the Fleet Viability Board.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted a late 2010/early 2011 PSR focusing on JSTARs modernization and re-engining. Positive observations included that the Air Logistics Center Reduce Total Ownership Cost program identified initiatives to increase Operational Availability while reducing total ownership costs. The reliability and maintainability aspect of the improvement program was effective in improving engine reliability and availability, resulting in an increase of mission-capable aircraft.
- The PSR concluded that the new JT8D engines do not provide sufficient increase in performance to clearly support the business case for new engines. In addition, future modernization decisions are dependent on the SLA and enterprise Airborne Synthetic Aperture Radar/Moving Target Indicator (SAR/MTI) Analysis of Alternatives (AoA). The results of these studies are needed to form the basis of an enterprise strategy for future investments to include investments in the E-8C JSTARS capability. The SLA is not yet fully funded and not expected to be completed until FY 2014. PSR recommendations included funding Phase II of the SLA and reconsideration of the re-engining effort as the proposed business case was lacking in terms of performance and supportability improvements.
- The program successfully completed the JT8D engine bleed air PDR and the Propulsion System CDR in February and March.
- No systems engineering assessments are planned for FY 2012.

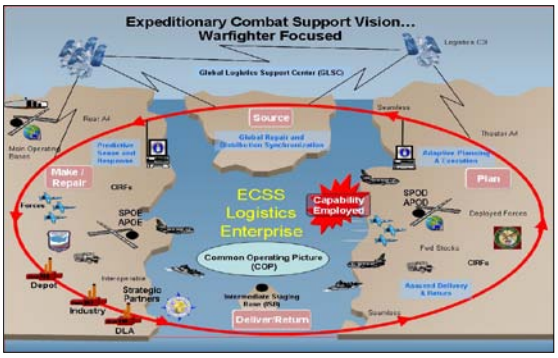
Measurable Performance Criteria

- **Reliability** – The Air Logistics Center Reliability Improvement Program has effectively improved engine reliability and availability through relatively low-cost modifications. Engine non-mission capable rates steadily declined in the past 12 months. Service fleet maintenance standards were improved or met in most cases.
- **Software** – The total equivalent software lines of code for build 6 is 3.2M. There are no known issues in software development or sustainment.
- **Manufacturing** – JSTARS manufacturing is complete. The 17th and final operational aircraft was delivered in 2005.
- **Integration** – The program is developing seven new capabilities. Integration of new capabilities is accomplished in the contractor's systems integration laboratory. These facilities are used to validate interface requirements and verify performance.

Conclusion: The JSTARS program continues to provide incremental warfighter capability, successfully executing to an intricate plan with a series of upgrades. The program needs to complete the platform SLA to inform future decisions.

Expeditionary Combat Support System (ECSS)

Prime Contractor: Computer Sciences Corporation



Executive Summary: ECSS is a logistics initiative providing the Air Force with a single set of Enterprise Resource Planning (ERP)-enabled best business practices and processes allowing universal access and visibility to consistent, real-time information across the Logistic and Financial enterprise. ECSS is in the Technology Development (TD) phase. DASD(SE) identified critical shortfalls in program performance and risk associated with entry into the Engineering and Manufacturing Development (EMD) phase.

Mission Description: ECSS will enhance warfighter capabilities by enabling the transformation of the Air Force logistics and financial operation into an enterprise-wide solution in an integrated data environment. The program will provide universal access to consistent, real-time information, allowing for proactive planning and scheduling, enhanced and standardized reporting, and total asset visibility across the enterprise.

System Description: ECSS will replace 240+ legacy information technology systems and support 250,000 logistics users with a commercial-off-the-shelf (COTS) ERP capability directly interfaced with the Global Combat Support System–Air Force Integration Framework. ECSS will replace Air Force retail and wholesale logistics legacy systems with COTS products supporting commercially refined best practices. These software products, Oracle e-Business Suite, will provide most of the functionality found in the legacy systems and form a "core" ECSS software suite. Increment 1 of a planned four-Increment strategy provides the foundation and core capability in support of Base Materiel and Equipment Management. The program broke Increment 1 into three Pilot releases: Pilot A, Foundation Configuration, Tools Management, and Base Vehicle Management; Pilot B, Base Equipment Management; and Pilot C, Base Materiel Management. Later, the program added a Pilot D, Supply Chain Management, as part of a directed program restructuring effort triggered under a Critical Change Report (CCR) in February 2011.

Schedule: ECSS is still in the TD phase. A DAB / Information Technology Advisory Board held in September 2011 reviewed program performance and status. As a result of the review, the Milestone Decision Authority directed that a joint OSD/AF Assessment Team define and evaluate options for Air Force logistics transformation (including financial system compliance). DASD(SE) identified critical shortfalls in program performance and risk associated with entry into the EMD phase based on poor system performance, scheduling delays, and cost overruns. The next program MS is pending the completion of a critical change evaluations/report and a final decision from the Milestone Decision Authority, USD(AT&L).

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** The Air Force/Program Executive Office approved the ECSS SEP in May 2010 to support MS B during September 2011; the program is planning to update the SEP in 2012. The program has no approved waivers or deviations from the SEP; however, the objectives of the SEP are not being met. ECSS is not tracking to critical metrics

and underestimated the software development effort. The program's mitigation plans for both technical and integration risks were ineffective, which resulted in a 6-month schedule slip and 100 percent cost growth.

- **Requirements** – The ECSS program has four KPPs and three KSAs. Four of the seven KPP/KSAs are not likely to meet threshold values. Increment 1 requirements are not reasonable based on the size and complexity of the system. The program currently is not tracking to the February 2011 CCR success criteria, and overall probability for program success is low based on the assessed level of risk achieving KPP/KSAs. The ADM-directed program assessment will reevaluate threshold requirements in the ECSS CDD.
- **Program Protection Plan (PPP)** An abbreviated ECSS PPP for Increment 1 was approved on April 20, 2010. DASD(SE) reviewed the ECSS abbreviated PPP in July 2011 and recommended it be updated to the latest PPP policy. With lack of achieving MS B and the pending restructure of ECSS, the PPP will be updated once the plan forward for ECSS is established. DASD(SE) provided comments to the program office and drafted language, which required an assessment of the mission-critical functionalities and associated supply chain countermeasures, with associated risk mitigation plans to ensure critical program information is protected.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** DASD(SE) reviewed weekly metrics with SAF/AQ. DASD(SE) comments focused on developmental testing for Pilot C and D for both internal and external interfaces. DASD(SE)'s focus was on actions necessary to improve program performance to achieve the KPP/KSAs with special emphasis on data migration/data quality and user responsiveness.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted no formal systems engineering assessments in FY 2011. DASD(SE) is actively participating in the ongoing ADM-directed program assessment to define and evaluate options for Air Force logistics transformation.

Measurable Performance Criteria

- **Reliability –** The ECSS program has a reliability Mean Time Between Critical Failure (MTBCF) threshold requirement of 168 hours. No measurable MTBCF data exist. Evaluation of Pilot C will include MTBCF as a key metric.
- **Software –** The ECSS program has software requirements linked to the completion of 239 blueprinted Reports, Interfaces, Conversions, Extensions, Forms, and Workflow (RICEFW) objects for the Pilots of Increment 1. Increment 1 is not on track to achieve this requirement, having accomplished 167/239 RICE objects prior to the program assessment. Pilot C accounts for 143/239 RICE objects or 59 percent of the functional requirement of Increment 1. A high failure rate occurred during integration testing, which is attributed to the underestimated size and complexity of Increment 1. This required re-blueprinting and retesting of many RICE objects in the Solution Development Labs which further delayed system fielding.
- **Manufacturing** – ECSS is a software program operating on a COTS infrastructure.
- **Integration** – Significant challenges exist in developing an overarching integrated end-to-end-process-based architecture that successfully collapses 240+ legacy systems into a single Oracle-based solution. There is also risk in ensuring the design will support the Service's vision to the implementation level and will optimize intra-system and inter-system compatibility assurances for a totally integrated system with 62 external trading partners.

Conclusion: The program underestimated the complexity and level of effort of the system design to achieve threshold requirements.

F-22A Modernization

Prime Contractor: Lockheed Martin Aeronautics

Executive Summary: The F-22A is in the Operations and Support (O&S) phase with follow-on modernization efforts ongoing (Increments (Inc) 2, 3.1, 3.2A, and 3.2B). DASD(SE) previously assessed the F-22A modernization as too large and complex to execute as an Engineering Change Proposal. The revised incremental approach, with Inc 3.2B identified as a pre-Major Defense Acquisition Program (MDAP) with planned entry into the acquisition management system at MS B as an ACAT ID program increment, provides reduced technical risk. DASD(SE) supported the FY 2011 Inc 3.2A PDR. DASD(SE) assessed the review as adequate with recommendations for the conduct of follow-on reviews.

Mission Description: The F-22A is a fifth-generation single-seat, twin-engine fighter designed for air dominance and survivable first-day and beyond air-to-ground capability. The primary purpose of the modernization effort is to provide improved ground attack, information operations, counter-air, and capabilities to counter evolving threats.

System Description: The F-22A incorporates advanced offensive and defensive avionics, low-observable characteristics, and a highly maneuverable airframe capable of supersonic cruise. Inc 3.2A, the second in a series of three Increment 3 upgrades, is a software-only development to provide electronic protection, combat identification, and Link 16 enhancements. Inc 3.2B is a hardware and software development to accommodate air-to-air missile upgrades (AIM-120D, AIM-9X), additional electronic protection, geo-location, data link, and stores management system improvements. Selected computer hardware and processors will be replaced to improve throughput and margins.

Schedule: The F-22A is in O&S with follow-on modernization efforts ongoing. Inc 2 and 3.1 are completed or nearing completion. The first aircraft with Inc 3.2A capability is planned for FY 2014 with full capability in 2016. Inc 3.2A will remain within the baseline program and 3.2B will become a separate MDAP with capability to Block 30 and Block 35 aircraft starting in 2018. This approach is expected to be confirmed in a November 2011 Materiel Development Decision. The Inc 3.2B MS B is anticipated in 1st quarter FY 2013. Key FY 2011 DASD(SE) activities included technical support to the Inc 3.2A PDR, Inc 3.2B System Requirements Review/System Functional Review (SRR/SFR) technical interchanges, and various acquisition/systems engineering planning activities.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The Air Force approved the F-22A SEP in January 2008. An update for DASD(SE) approval is planned to support the Inc 3.2B MS B. There are no approved waivers or deviations from the SEP, and the objectives are being met.
- **Requirements** – The baseline program has 11 KPPs, including the Materiel Availability (A_m) KPP established by an April 2011 JROC memorandum. The F-22A meets all of the baseline program KPPs except A_m. The JROC validated the F-22A Enhanced Global Strike Inc 3 CPD in April 2007. The Inc 3 CPD identifies five KPPs and six additional KSAs. Inc 3.1 addressed the

weapons delivery and SAR map KPPs and two KSAs. Inc 3.2A and 3.2B address the remaining KSAs, to include air-to-air functionality, geo-location, and AIM-9X /120D integration. The requirements community will consider establishing KPPs for 3.2B based on DASD(SE)'s recommendation. The top-level requirements are stable. The Inc 3.2B PDR is planned for 4th quarter FY 2012.

- **Program Protection Plan (PPP) –** The Service approved the PPP in September 2001 and November 2008. DASD(SE) is working with the program on an update for the Inc 3.2B MS B.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The baseline F-22A system had historically high sustainment costs and low availability (A_m). A focus of Inc 2 was to establish a basis for improved A_m with increased goals yearly through FY 2015. The program is tracking slightly below the goal for this year due to an extended fleet grounding resulting from on-board oxygen-generating subsystem issues.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted a single assessment on the July Inc 3.2A PDR.
- The Inc 3.2A program satisfactorily completed PDR with no remedial actions to achieve program baseline thresholds. The program provided suitable burn-down plans for PDR open actions to be completed by the 2nd quarter FY 2012 CDR. Although early in the Inc 3.2 program with code development not yet commenced, current progress is adequate. DASD(SE) provided recommendations for improvement in the areas of technical review processes, systems engineering rigor, and metrics.
- The Inc 3.2B PDR is scheduled for 4th quarter FY 2012. DASD(SE) also will support the combined Inc 3.2B SRR/SFR and the Inc 3.2A CDR in FY 2012.

Measurable Performance Criteria

- **Reliability –** Although the F-22A aircraft was grounded for several weeks due to a series of unresolved hypoxia-like incidents that reduced availability, reliability has tracked on or above the legacy requirement. Inc 3.2A has an additional avionics-abort reliability parameter, which the program expects to meet.
- **Software** – There are an estimated 388k new equivalent source lines of codes (ESLOC) for Inc 3.2A. Several technical risks and issues have been identified with mitigation plans in progress. The program is midway through the yearlong detailed design phase of a 3-year development plan, with an integration and test phase planned through FY 2014. The Inc 3.2B has an estimated 488k new ESLOC. The program identified several Inc 3.2B technical risks early in the requirements and design phase. DASD(SE) concurs with the program's overall technical risks and highlighted additional schedule risk due to planned relocation of key labs during development, an aggressive test program, and delays with previous blocks.
- **Manufacturing** – The baseline program has no significant manufacturing issues remaining and is delivering the last aircraft lot. Inc 3.2A has no hardware manufacturing requirements and Inc 3.2B requires only minimal changes (new computer boards and displays). The program does not expect significant manufacturing challenges.
- **Integration** – Inc 3.2A introduces no additional external interfaces. Inc 3.2B requires integration of the AIM-9X and AIM-120D and updated processors. Both increments require software integration and DASD(SE) assesses integration as a program technical risk.

Conclusion: DASD(SE) has worked extensively with the program in FY 2011 to shape the acquisition strategy and balance technical risks with capability. The program is working known issues and is tracking to plan.

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

Prime Contractor: Boeing Defense Space and Security, Huntington Beach, CA

Executive Summary: FAB-T is developing terminals to provide air and ground Nuclear and Non-Nuclear operations communications using the Milstar Extremely High Frequency (EHF) and Advanced Extremely High Frequency (AEHF) waveforms using the new AEHF satellites. DASD(SE) has worked with the FAB-T program office and stakeholders to assess ongoing systems development processes and risks to achieving technical maturity. The FAB-T program is in the Engineering and Manufacturing Development (EMD) phase.

Mission Description: FAB-T will provide protected and survivable communications terminals for strategic and joint tactical airborne command and control (C2) for both nuclear and non-nuclear operations. FAB-T terminals are an essential component of the strategic nuclear execution system.

System Description: FAB-T terminals are planned for the B-2, B-52, and RC-135 aircraft and upgraded Command Post Terminals (CPTs) located on the ground and airborne on the E-4 and E-6 aircraft. They include an Airborne Wideband Terminal, an Operator sub-system, a Large Aircraft Antenna, and command and control software to direct and assign the AEHF satellites.

Schedule: The program is in the EMD phase. Milestone (MS) B was achieved in December 2007. MS C then planned for August 2010 has now been delayed again due to hardware qualification and software integration issues extending development. An Over Target Baseline (OTB) was established in 2010 and anticipated MS C in FY 2012. The program has since slipped one additional year from its OTB MS C date to September 2013. Key FY 2011 DASD (SE) activities included collaboration on two in depth Independent Strategic Analysis Group (ISAG) assessment reviews conducted during FY 2011 and a support review to identify root causes for continual schedule slips, held Dec 2010. The May assessment identified program gaps and opportunities and established baseline understanding of the ability of the restructured program to execute. The August assessment evaluated progress in meeting the new program technical goals established in February 2011.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The FAB-T SEP was approved by OSD in December 2008 to support initial release. An update was published October 2009 to support LRIP. The program is not following the SEP as planned due to significant schedule deviations. Overall, objectives of the SEP are not being met due to technical difficulties and schedule delays.
- **Requirements** – In 2009 FAB-T developed a new CDD to replace the program's original Operational Requirements Documents (ORD). Five KPPs and five KSAs were identified. The program's requirements are both reasonable and stable.
- **Program Protection Plan (PPP)** – The PPP developed for MS B was incomplete and never finalized. However, it is now being updated to address criticality in the supply chain to ensure stability in LRIP design and configuration, for MS C.

- **Systems Engineering Support of Life Cycle Management and Sustainability** – The Air Force is reconsidering KPP availability requirements. In order to achieve this requirement, the program of record must include on-site spares at all operational elements. To meet a Mean Time to Repair of 30 minutes raises the spares and sustainment costs. Classified material handling to maintain needed custody of classified items for repair are similarly driving maintainer costs.

FY 2011 Systems Engineering Assessments

- Three systems engineering assessments were conducted in FY 2011. Two were combined DASD(SE) and OSD Space and Intelligence Office (SIO) Independent Strategic Advisory Group (ISAG) assessments, conducted during May and August, FY 2011. DASD(SE) conducted a separate root cause analysis of the FAB-T program's continuing schedule slips (December 2010). Through ongoing involvement, DASD(SE) is assisting the program in addressing FAB-T engineering issues, to include processor margins, integration, technical maturity, technical performance reviews, and reliability growth.
- As a result of the ISAG reviews and root cause analysis, both the Government and contractor teams have been strengthened. A key DASD(SE) root cause finding was the lack of senior and experienced Government leadership. The Air Force has elevated the top PM leadership position to a full Colonel, added additional Lt Col deputies, and will bring on a GS-15 Chief Engineer in FY 2012. Contractor changes include process and staffing improvements in software and systems integration, but challenges remain in achieving terminal performance for the XDR waveform and AEHF satellite control C2 software. A third review is anticipated in 2nd quarter FY 2012.

Measurable Performance Criteria

- **Reliability** –Software stability supporting complex system capabilities and functions remains a challenge. The program is using a developmental metric of Failures per Million Hours (FPMH) to characterize software reliability. Based on 50 software Critical Defects, the FPMH in September was 8,754 hours FPMH, compared with the software allotment for primary communications functions, expected at the end of the contract, at MS C, of 157 hours FPMH.
- **Software** – After completing approximately 1.3 million lines of code (2002-2010), the FAB-T program is now focused on integration of completed code. A total of 108 software anomaly reports remained open as of September 30, 2011, with closures approximately equal to new discoveries during integration and review. Weekly metrics highlight that the FAB-T program is 4 months behind its planned integration schedule.
- **Manufacturing** – FAB-T program hardware qualification is more than 80 percent complete. Of the 82 open hardware failure reports, 17 were Priority 1s. Difficult hardware qualification tests are accumulating as the program progresses.
- **Integration** – The program is making significant improvements in internal hardware/software integration, but hard issues are accumulating. At the platform level, the program has identified a number of high-risk integration concerns, which will need to be aggressively addressed within FY 2012. In addition to late-starting platform kit designs, several key technology issues will require contract engineering changes for analysis and design.

Conclusion: The FAB-T program faces significant challenges. A number of corrective actions have been initiated, but may be insufficient to meet cost, schedule and performance thresholds without a modified acquisition approach.

Global Hawk (RQ-4B) Unmanned Aircraft System (UAS)

Prime Contractor: Northrop Grumman Aerospace Systems

Executive Summary: The Global Hawk program is simultaneously in the Engineering and Manufacturing Development (EMD), Production and Deployment (PD), and Operations and Support (O&S) phases. The program experienced its second critical Nunn-McCurdy breach in May 2011. DASD(SE) conducted a PSR and focused reviews to support the Nunn-McCurdy certification and improve program execution. The program continues to experience schedule delays to completing operational test and entering FRP.

Mission Description: Global Hawk is a high-altitude, long-endurance UAS with integrated sensor suites to provide intelligence, surveillance, and reconnaissance capability to combatant commands. The system provides high-resolution, high-quality, digital Synthetic Aperture Radar (SAR), ElectroOptic/ InfraRed (EO/IR) imagery, and Signals Intelligence of tactical targets and other critical areas of interest in near real time. Aircraft imagery and signals collection are typically down-linked to the system's Ground Station, but it can be down-linked directly to ground forces.

System Description: The system is composed of ground stations and five separate Block configurations of aircraft:

- Block 10, original design with basic SAR/EO/IR sensor, Air Force has retired but still in operation with the Navy and NASA
- Block 20, with Enhanced Integrated Sensor Suite (EISS)
- Block 30, with EISS and Airborne Signals Intelligence Payload (ASIP)
- Block 40, with Multi-Platform Radar Technology Insertion Program (MP-RTIP) sensor package that replaces the EISS and ASIP
- Battlefield Airborne Communications Node (BACN), the result of a 2009 Joint Urgent Operational Need to convert Block 20 aircraft to host an alternate payload to conduct communications relay missions

Schedule: There is considerable concurrency across the Global Hawk Block increments. Simultaneously, the Block 40 is in EMD, the Block 20/30 is in PD, and the Block 10 is in O&S. Block 30 MS C/FRP Decision and Block 40 MS C are planned for February 2012. Ground Station Re-Architecture (GSRA) MS B is planned for spring FY 2012.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the Global Hawk SEP in July 2011 to support MS C/FRP decisions. The program is executing to the SEP with no waivers or deviations. The SEP captures improved systems engineering processes to address a lapse in discipline resulting in schedule slips, budgeting constraints, and poor test results.
- **Requirements** – The CDD was validated in May 2005. The time-phased requirements of the CDD are being divided into CPDs for Block 30, 40, and GSRA. Approvals of the CPDs are

planned for spring 2012 to support a MS C decision. Of the five KPPs, technical reviews show only one was on track to achieve the required performance. Two KPPs are within marginal limits and are planned to be accepted with waivers. The remaining two (Worldwide Operations and Dynamic Control) cannot be achieved and will be deferred to future increments. Program requirements have been unstable and insufficiently documented due to the original spiraling acquisition strategy that set unrealistic expectations. The updated documents limit additional spiraling and stabilize requirements.

- **Program Protection Plan (PPP) –** DASD(SE) reviewed the program's PPP in August 2011; approval is pending completion of required appendixes.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – Sparing and reliability improvements are needed to meet the Effective Time on Station (ETOS) KSA. Initial findings of a supportability analysis to determine appropriate investment trades in spares and system reliability to meet operational cost goals resulted in budget authorization to correct deficiencies.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted four key engineering assessments in FY 2011: Nunn-McCurdy Reviews, Reliability and Maintainability (R&M) Focused Reviews, End-to-End Metrics establishment and evaluation, and a Manufacturing Readiness Assessment (MRA).
  - DASD(SE) led two technical reviews to support a Nunn-McCurdy certification in May 2011 and subsequent program restructure in July 2011. DASD(SE) initiated two R&M focused reviews in November 2010 and April 2011. R&M growth is approaching planned growth metrics and is substantiated by 9 months of increasing trend data demonstrating a 50 percent improvement since DASD(SE) involvement.
  - DASD(SE) led an Integration Focus Review in August 2011 to address end-to-end performance measures and system maturity. Findings have informed affordability decisions concerning future development, lot procurements, and milestones.
  - DASD(SE) supported SAF/AQ in conducting a MRA in January 2011.
  - The Nunn-McCurdy and Restructure reviews concluded that the program had critical but correctable shortfalls. DASD(SE) recommendations to restructure the program, stabilize requirements documented in separate CPDs, defer ambitious capabilities to follow-on increments, and improve systems engineering processes were accepted and included in the USD(AT&L) certification memorandum. Other technical reviews identified materiel quality issues arising from low-rate production, Diminished Manufacturing Sources (DMS), and R&M. The program is taking action to address these issues in FY 2012.
- Three assessments are planned for FY 2012: R&M, GSRA PSR, and a Nunn-McCurdy follow-up assessment.

Measurable Performance Criteria

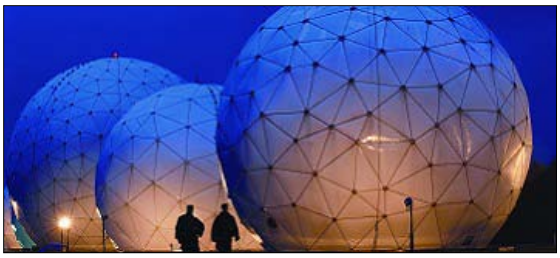
- **Reliability** – The reliability mission requirement is 85 percent ETOS over a 30-day deployment with multi-vehicle control from a ground station. Multi-vehicle control is not achievable without the GSRA. The current single-vehicle control ETOS assessment is 47 percent with a requirement of 55 percent. The program has not collected sufficient/appropriate data to determine if this requirement is achievable at system maturity. R&M parameters are now trending positive and tracking to newly established growth curves.
- **Software (SW)** – The Global Hawk program has developed more than 3.4M lines of code, of which 86-90 percent is reused from each previous Block. Many of the SW development practices are excellent; however, excessive SW builds routinely exceed testing capacity and

complete 6-8 months behind schedule. The program has reduced the number of builds from three to one per year, to synchronize development efforts with capacity. This should put the SW schedule on track by December 2012

- **Manufacturing** – Manufacturing metrics show the program is on track to deliver Global Hawk production lots as planned; however, the MRA concluded 5 out of the 9 manufacturing threads did not meet target readiness criteria. Undocumented variations from parts suppliers has resulted in 13 of 15 sensors providing inconsistent performance. Low-quantity procurement lots of the sensors and other electronics are leading to production inefficiencies and quality issues. Corrective action Manufacturing Maturation Plans to reach target goals have been identified for implementation in FY 2012.
- **Integration** – To realize full capability, the Global Hawk program of record must be integrated into a complete Processing, Exploitation, and Dissemination (PED) network. This end-to-end performance of the integrated system across all connectivity nodes and paths has not been adequately planned, funded, or executed by the AF. Two of the three sensor packages are being developed separately from the program. The program has not matured a methodical build-up of the total system in a controlled environment, and subsystem integration labs are not representative of external systems. The contractor has initiated corrective action to establish Technical Performance Measures to monitor performance contributions to the end-to-end system-of-systems delivering imagery-, radar-, and multi-intelligence.

Conclusion: Global Hawk is addressing technical challenges with a comprehensive program restructure, requirements stabilization, and engineering process improvements.

Global Positioning System (GPS)
Next Generation Operational Control System (OCX)



Prime Contractor: Raytheon Intelligence and Information Systems

Executive Summary: OCX is the next generation command and control system for the modernized GPS currently in the Technology Development (TD) phase. DASD(SE) conducted a Joint Independent Program Assessment (IPA)/PSR in September 2011 to assess the technical planning and management of the program in support of MS B.

Mission Description: The GPS mission is to provide and maintain the best navigation services worldwide to military and civil users and to maintain the capability for space-based nuclear detection. The OCX portion will provide a modernized satellite command and control (C2) system for the overall GPS capability.

System Description: The GPS OCX program is a modernized satellite C2 system capable of operating all GPS III and legacy satellites. OCX replaces the current GPS Operational Control System (OCS). The new system will include increased information assurance protection and computer security. OCX will be delivered in blocks to support the evolution of new GPS III capabilities. An interim delivery of the Launch and Checkout System will support launches of GPS III satellites prior to delivery of the OCX initial capability.

Schedule: The program is in the TD phase. The FY 2011 MDA Annual GPS Enterprise Review (AGER) reviewed MS B readiness and deferred the MS B decision to allow for completion of the PDR. The FY 2012 AGER and MS B are currently scheduled for spring 2012. Key FY 2011 systems engineering activities included the PDR, the PDR assessment, and the Joint IPA/PSR in support of MS B.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) initially approved the OCX SEP on August 13, 2009, in anticipation of a MS B decision. An update is currently in coordination to support program changes since the original approval. There are no approved waivers or deviations. The objectives of the updated SEP currently in coordination are being met.
- **Requirements** – The CDD was validated in 2009 with eight KPPs. These KPPs were assessed to be achievable at the June 2011 PDR. Near-term requirements are stable and reasonable; however, the program manager is assessing Engineering and Manufacturing Development (EMD) affordability options, which may defer some lower level requirements. Future incremental capability requirements are under review.
- **Program Protection Plan (PPP) –** USD(AT&L) approved the PPP in December 2010. The program is addressing recent policy changes and has conducted pilot Criticality and Vulnerability Analyses with results included in the next PPP update planned in support of the FY 2013 AGER.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – The OCX program has a Sustainment KPP, which is composed of a Materiel Availability KPP, Materiel Reliability KSA, and an Ownership Cost KSA.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted two systems engineering assessments in FY 2011, including a PDR assessment and a Joint IPA/PSR to support an OCX MS B decision as part of the FY 2012 AGER.
- DASD(SE) and DASD (S&I) conducted a Joint IPA/PSR in September 2011 to support an OCX MS B decision, which assessed the technical planning and management of the program prior to entering the EMD phase. The program has a disciplined acquisition approach, mature technologies, and a well-designed incentive fee structure. The review identified schedule risk associated with software development and transition activities that will likely delay the Block 1 Ready for Transition to Operations date. Other major recommendations of the review included strengthening the system integration functions, a restructured CDR approach to properly address the iterative development of OCX software, and a more active use of the risk management process in program management decisions. The program has taken action to address these recommendations, and a follow-on review is planned for FY 2012 to support the FY 2013 AGER.
- The PDR was conducted in June 2011 to establish the allocated baseline. The program manager closed the PDR on August 29, 2011, with three remaining PDR Issue Notices addressing incomplete requirement allocations in reliability, maintainability, and availability; fault management detection; and navigation integrity monitor. The program is working to resolve these issues. DASD(SE) is currently completing the PDR assessment in support of the FY 2012 AGER.
- Two systems engineering assessments are planned for FY 2012. These include the CDR assessment and a follow-on Joint IPA/PSR in support of the FY 2013 AGER.

Measurable Performance Criteria

- **Reliability –** GPS Enterprise reliability requirements were not adequately allocated to OCX configuration items at the PDR. The program took action to fully allocate these requirements to the configuration item level with a planned closure date of October 15, 2011. Also, the program's current analysis of system reliability assumes an unrealistic software reliability of 1.0. DASD(SE) is working with the program to improve their reliability analysis and tracking.
- **Software –** The OCX program will be delivered in two blocks. Block 1 is estimated at 725k equivalent source lines of code (ESLOC), and Block 2 at 92k ESLOC. The program manages and tracks software metrics, which have identified work being deferred to later iterations. The program is taking action to address the resulting schedule risk as identified by the Joint IPA/PSR.
- **Manufacturing –** The OCX program uses COTS and heritage hardware.
- **Integration** – The OCX program has 35 Interface Control Documents (ICD) and Interface Specifications (IS) to define external interface connections. All 35 ICD/ISs were approved and baselined at the PDR. The planned delivery of OCX lags the availability of GPS III space vehicles, which requires OCX in order to make the GPS III satellites operational. The program is actively evaluating mitigation plans for operating the initial GPS III satellites if they are needed to maintain the constellation before OCX delivery.

Conclusion: DASD(SE) identified schedule risks as part of the IPA/PSR and made recommendations to mitigate them. The program is working to address these recommendations prior to MS B.

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

Prime Contractor: Lockheed Martin Missile and Fire Control

Executive Summary: JASSM (baseline) is a highly survivable, long-range standoff missile for attacking fixed and relocatable, highly valued targets. JASSM-ER is an extended-range variant of the baseline missile. In FY 2011, DASD(SE) completed an Engineering and Manufacturing Development (EMD) phase PSR on the JASSM-ER program in support of the January 2011MS C. The PSR identified technical risks, which the program has addressed.

Mission Description: JASSM is a highly survivable, long-range standoff missile for attacking fixed and relocatable, highly valued targets. JASSM, designated AGM-158A, is in FRP. JASSM-ER, designated AGM-158B, is a variant of the baseline to add extended range. These missiles provide fighter and bomber aircraft with the capability to strike critical, heavily defended targets early in a campaign.

System Description: JASSM-ER adds a turbofan engine and additional fuel capacity within the same outer mold line and low observable design to maintain the baseline capabilities. These modifications more than double the range over the baseline missile.

Schedule: The program is in the Production and Deployment (P&D) phase. The JASSM-ER MS C was accomplished successfully in January 2011, and FRP is planned for FY 2013.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SEP in August 2010 to support planning for the P&D phase. The program is planning an update in 2013 to support FRP. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The JROC validated the CPD in April 2010. All four KPPs and 23 KSAs are on track to be demonstrated by the end of Initial Operational Test and Evaluation (IOT&E) in late FY 2012/early FY 2013. The program requirements are stable and reasonable.
- **Program Protection Plan (PPP) –** The USD(AT&L) approved the PPP in December 2010. The next PPP update is planned to support the FRP decision.

FY 2011 Systems Engineering Assessments

- DASD(SE) completed the MS C JASSM-ER PSR in FY 2011.
- Much of the PSR was accomplished in FY 2010 but completed in November 2011. The review indicated the program was on track to enter Low-Rate Initial Production (LRIP). Positive observations included a strong management team and significantly improved oversight since the 2007 Nunn-McCurdy assessment; integration with production schedules and earned value; and successful completion of Process Failure Modes Effects and Criticality Analysis. Key findings and recommendations included addressing shortfalls in the JASSM-ER reliability assessment strategy; fuze reliability, availability, and quality concerns; the lack of a low-cost easily installed Common Test Instrumentation Kit/Flight Termination System (C-TIK/FTS); and procurement at less than Economic Order Quantities (EOQ). The program accepted and mitigated the majority

of the PSR recommendations; however, action on key recommendations is pending business case/funding decisions (e.g., C-TIK and EOQ).
- No assessments are scheduled for FY 2012.

Measurable Performance Criteria
- **Reliability –** Recent missile testing has been successful. Risk is reduced significantly since JASSM-ER is highly common with the baseline missile and benefits from previous reliability improvement programs. Reliability risks identified during the PSR included an inadequate reliability tracking and predicting methodology and the contractor's practice of assigning personnel to monitor the production of each missile in the initial lots, potentially leading to artificially increased reliability results. The methodology concern has been addressed. The PSR recommendations for the Service to pursue development of a reliable fuze and low-cost C-TIK also were tied to reliability concerns. Fuzes have long been an issue, and the C-TIK is needed to provide a means to continue surveillance testing of JASSM-ER. The C-TIK design effort is expected to begin in FY13 and is scheduled to be operationally available in FY16. JASSM Program Office is working with the prime contractor to develop an Electronic Safe and Arm Fuze scheduled to be operational in FY16.
- **Software –** JASSM-ER software is stable and mature; it is 95 percent common with the baseline. JASSM-ER uses mature software development processes established by the baseline program. Metrics are in place and change control processes are adequate. Changes associated with the introduction of JASSM-ER are minimal. Mission planning software completed qualification testing and is approved for release. Software modifications affect only four software configuration items associated with engine performance and missile six degree-of-freedom model weight and performance changes.
- **Manufacturing –** The JASSM-ER program conducted an internal Manufacturing Readiness Assessment for MS C and assessed all areas as ready for LRIP. The PSR team agreed with the assessment and supported entry into LRIP. Nineteen JASSM-ERs were delivered as of September 2011, and the program is on track for the 2013 assets available date.
- **Integration** – No new interfaces were introduced with JASSM-ER and the missile is 70 percent common with the baseline. The B-1B is the threshold platform and there are currently no funded plans to integrate the system onto the objective platforms. One concern with the objective platforms relates to extended external carriage of the weapon (i.e., B-52) and the impact of continuous wind-milling of the turbofan engine, which could reduce system reliability. Wind tunnel testing indicates the design is sufficient.

Conclusion: JASSM-ER has entered IOT&E and is on track to meet requirements.

Joint Space Operations Center (JSpOC) Mission System (JMS)

Prime Contractor: N/A

Executive Summary: DASD(SE) conducted a combined PSR/Independent Program Assessment (IPA) in February 2011 to assess readiness for a MS B decision. The review assessed the technical planning and management of the program prior to entering Engineering and Manufacturing Development (EMD) and found the program to be unexecutable. The Air Force accepted the assessment and is currently restructuring the program to address issues identified.

Mission Description: The JMS will provide the capability for planning, execution, and management of space forces and to protect space capabilities supporting the United States, allied, and coalition operations.

System Description: The JMS will establish a net-centric, service-oriented architecture consisting of hardware, software, data, databases, services, and equipment to provide integrated capabilities. The JMS capabilities will include a command and control infrastructure; a user-defined operational picture; battle space information; a dynamic, scalable database of space objects and assets; and threat identification and notification services.

Schedule: The JMS program is a Major Automated Information System (MAIS) program in Technology Development. The Materiel Development Decision was approved December 16, 2010, and established the funds-first-obligated (FFO) date as March 27, 2009. MS B was planned for March 2011; however, as the result of the combined IPA/PSR, the MS was postponed pending a significant program restructure. A new acquisition strategy is under development.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) reviewed the draft SEP in Jan 2011 and provided critical comments. The program office is updating the SEP to address the pending program restructure and will deliver a final SEP to be approved by OSD prior to the next milestone. There are no approved deviations or waivers.
- **Requirements** – The JMS CDD was validated in October 2010. The program has five KPPs. The ability to deliver all the KPPs by the FFO date is currently under review. Requirements are reasonable and stable.
- **Program Protection Plan (PPP) –** The draft PPP was last reviewed in February 2011. The program is currently updating the PPP to address the restructure and will submit it for approval prior to the next milestone.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The JMS life cycle management strategy includes procurement of data rights to provide options for the sustainment method.

FY 2011 Systems Engineering Assessments

- A combined PSR/IPA was conducted in February-March 2011 in support of a MS B decision and program entry into the EMD phase. The PSR/IPA assessed the technical planning and management of the program and determined JMS was not ready for MS B. Positive observations included successful delivery of Capability Package (CP) 0. Major findings of the review included identifying major shortfalls in areas such as development planning, system integration, and technical maturity. The review found that the program office was not organized or staffed to take on the role as systems integrator, and overall, assessed the program as unexecutable. As a result, the Air Force is currently restructuring the program to address these findings.
- The number of FY 2012 assessments is to be determined pending the JMS restructure.

Measurable Performance Criteria

- **Reliability –**The program has reliability requirements for Mean Time Between Critical Failure, Mean Down Time, and Operational Availability. Progress and metrics will be evaluated following the program restructure.
- **Software –** The program has software requirements and is tracking progress using software metrics. JMS Release 0 has been delivered and has approximately 300k source lines of code for core mission services/capabilities.
- **Manufacturing** – JMS manufacturing requirements are being defined to account for extensive use of commercial off-the-shelf hardware/software.
- **Integration** – JMS has a net-ready KPP that will be considered in restructuring the program. Integration metrics will be evaluated following program restructure.

Conclusion: Challenges with the acquisition approach require a program restructure. A revised approach is pending.

Reaper (MQ-9) Unmanned Aircraft System (UAS)

Prime Contractor: General Atomics Aeronautical Systems Incorporated (GA-ASI)

Executive Summary: The Reaper UAS program is in the Engineering and Manufacturing Development (EMD) phase. The Reaper is a medium-to-high altitude, hunter-killer and intelligence, surveillance, and reconnaissance (ISR) UAS with long endurance and multiple sensor and weapons capabilities. DASD(SE) participated in and conducted an assessment of the program's CDR for the Block 5 increment and conducted a PSR to support a MS C decision planned for June 2012.

Mission Description: The Reaper's primary role is that of hunter-killer, with ISR as a secondary role. Weapon interfaces and automated processing of target data allows the application of actionable precision-guided munitions. Future smart weapons capable of updating information in flight will permit precision strikes against critical high-value assets or moving targets. A modular architecture permits mission tailoring to employ specialized weapons or sensor payloads.

System Description: The system consists of an Air Vehicle (AV) with an array of sensors, weapons, and communications systems, a ground control station (GCS), and the support equipment and personnel to operate, maintain, and sustain the aircraft. Urgent warfighter need has necessitated the acceleration of deployment via a Block 1 configuration with a limited set of CPD capabilities. Block 1 is currently deployed; full CPD capability (Increment 1) is expected in FY 2014.

Schedule: The program is in the EMD phase. The program transitioned from an ACAT II to an ACAT ID program, becoming a Major Defense Acquisition Program in July 2009 at an advanced level of development. A MS C is currently planned for June 2012. The system is incrementally adding capability through software and hardware enhancements to support full Increment 1 capability and a MS C decision.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** A SEP to support MS C is in formal coordination for approval. This is the first SEP since becoming an ACAT 1D program. There are no planned waivers or deviations to the SEP that is in coordination. The objectives in the SEP are being met. A supplement addressing reliability, availability, and maintainability (RAM) program planning is required prior to MS C.
- **Requirements –** The Increment 1 CPD was approved in January 2007. The program has three KPPs. The killer KPP has been demonstrated, and verification of the hunter and net-ready KPPs are planned to be demonstrated in FY 2014. Urgent Operational Needs (UONs) are addressed through a requirements analysis and prioritization process to balance immediate needs against planned development. Requirements instability, due to operational demands and UONs, has contributed to schedule overruns and reliability shortcomings.
- **Program Protection Plan (PPP)** – The program submitted a PPP to OSD in September 2011 in preparation for the MS C decision; approval is pending completion of required appendixes.

- **Systems Engineering Support of Life Cycle Management and Sustainability** – The program currently uses Contractor Logistics Support and is conducting a Business Case Analysis (BCA) to determine long-term strategy. This BCA is scheduled to be complete by September 2012.

FY 2011 Systems Engineering Assessments
DASD(SE) conducted three key assessments: a MS C PSR completed in February 2011, Increment 1 Block 5 CDR in January, and a delta CDR in April.

- DASD(SE) and SAF/AQ jointly conducted a PSR beginning in October 2010 to support entry into MS C. The MS C decision was delayed based on the risk assessed during the PSR.
- DASD(SE) participated in and conducted an assessment of the program's CDR in January 2011 with a follow-up delta CDR in April to close open items from the January review. These assessments supported entry into the System Capability and Manufacturing Process Demonstration phase of the Increment 1 Block 5 UAS.
- The PSR indicated a need to increase emphasis in several critical areas prior to the MS C decision. The CDR revealed design immaturity in the Predator Primary Data Link, Remotely Operated Video Enhanced Receiver (ROVER) encryption, and dual ARC-210 radio integration that necessitated a delta CDR in April. These reviews indicated an increased level of risk due to an incomplete product baseline. Concurrent capability additions to comply with UONs impacted execution of the program of record. The most significant risks to the program are the lack of design maturity, compounded by the addition of new capability to meet emergent user requirements, and reliability shortfalls. A follow-up review is planned prior to MS C.
- Four assessments (RAM, CDR follow-up, Block 50 GCS incremental design review (IDR), and Block 5 Air Vehicle IDR) are scheduled for FY 2012.

Measurable Performance Criteria

- **Reliability –** The program's original Mean Time Between Critical Failures requirement of 500 hours has been deferred. The Air Force is analyzing this requirement's reasonableness and achievability. The current estimated values are 99 hours for the AV and 118 hours for the GCS. The plan to improve reliability includes definition of a valid mission set, analysis of operational data, identification of high failure items, and reliability engineering efforts.
- **Software (SW) –** Total lines of code being developed is approximately 800k. The program has a sound process for incrementally adding capability through software versions. GA-ASI continues to improve its ability to estimate and develop software, but contractually the Government is constrained in its insight into these processes. The program formed a SW Tiger Team in July 2010, and the team's recommendations are being implemented. GA-ASI SW processes are currently at Capability Maturity Model Integration Level 3 with a goal of Level 5.
- **Manufacturing** – A Manufacturing Readiness Assessment was accomplished as part of the PSR in early FY 2011. Significant in-house capabilities include: circuit board fabrication, composites cable manufacturing, and systems integration, resulting in approximately 75 percent organic production.
- **Integration** – The program maintains interface control documentation between major components of the system. The contractor makes effective use of systems integration laboratories to mitigate hardware and software integration risk before new components and systems are added to the UAS.

Conclusion: The Reaper UAS program is having operational success but faces challenges balancing the addition of new capability to address emergent requirements in support of deployed systems while concurrently spiraling capability to meet CPD threshold requirements.

7.4 DASD(SE) Assessments of DoD Programs

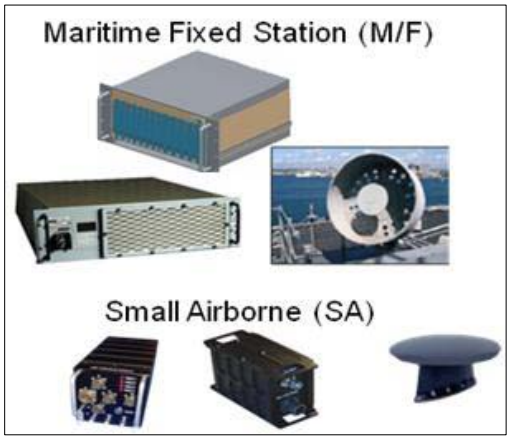
Assessments are as of the end of FY 2011 (September 30, 2011); however, some assessments may include information on program status through the 1st quarter FY 2012 (December 31, 2011). The section includes summaries on the following nine programs:

- Airborne and Maritime/Fixed Station Joint Tactical Radio System (AMF JTRS)
- Assembled Chemical Weapons Alternatives (ACWA)
- F-35 Lightning II (Joint Strike Fighter)
- Joint Air-to-Ground Missile (JAGM)
- Joint Lightweight Tactical Vehicle (JLTV)
- Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)
- Joint Tactical Radio System Handheld, Manpack, Small Form Fit (JTRS HMS)
- Multifunction Information Distribution Terminal Joint Tactical Radio System (MIDS JTRS)
- Small Diameter Bomb II (SDB II)

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

Service: Army (lead)

Prime Contractor: Lockheed Martin



Executive Summary: The AMF JTRS is a software-defined radio, based on the JTRS Software Communications Architecture. In April 2011, the USD(AT&L) conducted a program review in response to reported contract cost growth and an FY 2011 RDT&E Congressional budget reduction that significantly impacted AMF JTRS execution. DASD(SE) supported the AMF program office during a May 2011 Integrated Baseline Review (IBR). The review found management, organizational, and structural gaps that rendered the program not executable as currently structured. Subsequent requirements reviews with Service and OSD stakeholders showed support for elimination of the Maritime/Fixed Station (MF) form factor and use of the Small Airborne (SA) form factor to meet the majority of MF requirements. In September 2011, the USD(AT&L) directed AMF to seek JROC relief of the MF. Development of a program restructure plan for a subset of the agreed-upon capabilities is in progress. AMF JTRS is seeking relief of the MF requirement from the JROC.

Mission Description: The AMF JTRS supports Joint Service operations by providing the capability to transmit, receive, route, and retransmit voice and data between similar and diverse waveforms and network protocols used within the Radio Frequency (RF) spectrum (2 MHz to 2 GHz) and across Service, operational, and organizational boundaries.

System Description: The AMF JTRS is a scalable and modular networked RF communication capability designed to meet Joint and Service requirements. It consists of software-defined Joint tactical radio sets with common ancillary equipment for both the management and control required for multiple Joint Tactical Radio configurations.

Schedule: The program is in the Engineering and Manufacturing Development (EMD) phase based on a March 24, 2008 MS B decision. Key FY 2011 systems engineering activities included delivery of an Integrated Master Schedule, containing preliminary impacts of the $60 million congressional mark on FY 2011 work. As a result, the program submitted a Program Deviation Report in February 2011 notifying the Milestone Decision Authority of program schedule deviations for MS C, M/F Low-Rate Initial Production, and Initial Operational Capability. AMF delivered an EMD demonstration model to the Apache (AH-64) System Integration Lab in July 2011, which is now conducting risk-reduction early system integration activities in the AH-64.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** The SEP, approved July 2007 by the JTRS Joint Program Executive Office (JPEO), is not executable due to performance and schedule shortcomings. The SEP needs to be updated during program restructure efforts resulting from the May 2011 IBR.

- **Requirements –** The 10 KPPs from the CPD v3.5 dated October 2010 are not achievable under the current program structure. The KPPs will need to be revised based on the outcome of the restructure effort and the revision is scheduled for JROC approval in FY 2012.
- **Program Protection Plan (PPP) –** The PPP was approved by the JTRS JPEO in August 2007 and is under revision as a result of the May 2011 IBR. The update will be submitted to OSD for review and approval after the restructure effort has been finalized.
- **Systems Engineering Support of Life Cycle Management and Sustainment** – The JPEO and program PM have concluded that the performance KPPs/KSAs are not currently achievable and will have to be reevaluated during program restructure.

FY 2011 Systems Engineering Assessments

- DASD(SE) supported the IBR conducted in May 2011. In addition, DASD(SE) conducted a comprehensive review of the JTRS Enterprise, including a focus on AMF, and identified a number of factors contributing to inadequate program performance. The key waveform, Mobile User Objective System (MUOS), is late to need and partial releases are unsupportable, creating uncertainty in processor margin availability and other systems engineering concerns.
- Key findings are that the prime contractor is unable to manage program execution and synchronize its efforts between the key subcontractors for effective performance. Work Breakdown Structure reviews identified discrepancies, lack of cohesion, and mismatches between the various efforts.
- FY 2012 assessments will be scheduled in coordination with the program restructure.

Measurable Performance Criteria

- **Reliability –** The AMF JTRS program has a reliability requirement of 1,500 hours Mean Time Between Effective Functional Failure (MBEFF) for hardware and 500 hours for software. The program has not yet progressed to a point where actual measured data has been recorded. DASD(SE) is working with the program manager to develop a reliability growth plan and document it in the SEP for the restructured program.
- **Software –** The program shows a 500k growth of source lines of code over the estimate (1.5M vs. 1M). Code growth is a watch area for DASD(SE). SW Build 2.1 coding and unit testing is behind schedule. Software trouble reports against SW Build 2.1 are not being mitigated at a rate that supports planned delivery. The AMF restructure effort has halted current software efforts.
- **Manufacturing** – The majority of manufacturing processes have been defined and characterized, but there are still significant engineering/design changes. Producibility considerations continue to shape system development plans to meet demanding Space, Weight, and Power constraints in the SA form factor radio. Long-lead and key supply chain elements have been identified. The AMF restructure effort has halted the current manufacturing plan.
- **Integration** – The Link 16 waveform was ported to Engineering Development Model hardware for integration in the AH-64 Apache and C-130J Hercules System Integration Labs. The Army Concept of Operations for use of Link 16 in the Apache remains uncertain. Munitions safety for the concurrent use of Link 16, Soldier Radio Waveform, and Wideband Network Waveform (WNW) in the Apache is a risk. Porting of the WNW into the SA has started but resulted in radio memory issues. Work on WNW porting has been halted during planning for program restructure.

Conclusion: The program is challenged and pursuing restructuring to balance technical requirements, cost, and schedule. Due to delay in delivery of the MUOS waveform from the Network Enterprise Domain JTRS effort, this key capability will need to be deferred into an incremental release. An update to the acquisition strategy is planned.

Assembled Chemical Weapons Alternatives (ACWA)

Service: Army (lead)

Prime Contractors: Pueblo – Bechtel National, Inc. /
Blue Grass – Bechtel-Parsons Blue Grass, A Joint Venture

Executive Summary: During FY 2011, the ACWA program breached Acquisition Program Baseline (APB) cost by 37 percent and went through a Nunn-McCurdy assessment. DASD(SE) participated in the assessment and provided recommendations in the areas of risk burn-down plans, performance metrics reporting, designing for reliability, and program protection.

Mission Description: ACWA is intended to ensure the safe and environmentally sound destruction of chemical weapons (CWs) stored at the Blue Grass Army Depot near Richmond, Kentucky, and the Pueblo Chemical Depot near Pueblo, Colorado.

System Description: ACWA will acquire the services, systems, and equipment to develop, refine, and demonstrate alternative chemical agent destruction technologies while destroying the CWs stored at Pueblo and Blue Grass. The Pueblo plant will use neutralization followed by biotreatment and the Blue Grass plant will use neutralization followed by supercritical water oxidation.

Schedule: ACWA is conducting Engineering and Manufacturing Development (EMD) phase-type activities. A Nunn-McCurdy assessment began on January 18, 2011. The program was certified to go forward June 14, 2011, as follows:

- Pueblo – Systemization: Machinery will be installed into the 80 percent constructed plant and then integrated and tested; the next key milestone is Full System Integration in 2015.
- Blue Grass – Construction: The plant is being constructed (35 percent complete); machinery is being fabricated and is in early systemization; the next key milestone is Full System Integration in 2020.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP) –** The SEP was approved in July 2007 by USD(AT&L) to support the first Nunn-McCurdy certification. There are no approved waivers or deviations from the SEP; the program is executing to plan. The SEP is to be updated in 2012.
- **Requirements** – The JROC waived the requirement for a CDD in February 1996; there are no formal KPPs. The program does have characteristics within the APB that it monitors: (1) compliance with safety laws, (2) minimal chemical agent releases, (3) minimal chemical agent exposures, and (4) compliance with environmental laws.
- **Program Protection Plan (PPP) –** The program will provide a PPP in support MS B in 2012.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted no assessments in FY 2011.
- The program notified Congress of a critical cost breach December 16, 2010. DASD(SE) conducted an assessment between December 2010 and June 2011. Positive observations included improved risk management and site systems engineering, and the establishment of performance metrics. Major areas of concern included risk management, reliability, and program protection. The program has taken action to address DASD(SE) recommendations in those areas.

- The Bechtel Pueblo Team (BPT) site contractor conducted two technical reviews in FY 2011.
  - The BPT successfully conducted the Projectile Mortar Disassembly (PMD) Technical Review in May 2011 to assess the readiness of this machine to be implemented at Pueblo. It was an event-driven review, which, after meeting entry and exit criteria, indicated that the PMD was ready for implementation.
  - The BPT conducted a Parts Monitoring Equipment/Munitions Monitoring Equipment (PME/MME) Technical Review in May 2011 to assess the readiness of this equipment to be implemented at Pueblo. This was an event-driven review, which indicated that the PME/MME required additional time for fabrication and testing. Design gaps at the review concerned real-time monitoring at the Burster Detection Station, a needed hazard analysis, and updated design criteria to address leakers and rejects. These gaps are being addressed through Integrated Product Team review. The BPT will conduct a follow-on review once the additional criteria are met; this review should occur in FY 2012.
- Nunn-McCurdy assessment key findings included the program developing risk burn-down plans, reporting performance metrics to oversight, and conducting reliability and program protection analyses. Key findings from the PME/MME Technical Review included addressing real-time monitoring at the Burster Detection Station, conducting a hazard analysis, and updating design criteria to address leakers and rejects. Program actions are adequate and appropriately phased.
- DASD(SE) plans no assessments for FY 2012.

Measurable Performance Criteria

- **Reliability –** Neither Pueblo nor Blue Grass has a reliability requirement; however, each plant design is first-of-a-kind and has a conservative reliability approach based on Technical Risk Reduction Program and throughput analysis results. No reliability growth curve exists but is under consideration for FY 2012.
- **Software –** Software for each site primarily falls within the Facility Control System (FCS) with linkage to the process equipment. Software performance for the Blue Grass FCS was uncertain at the beginning of the fiscal year. The program conducted an unplanned System Reliability Test to ensure system performance meets Blue Grass design requirements. Results showed the system should meet performance requirements.
- **Manufacturing** – The program is tracking each plant phase (i.e., Construction, Systemization, Full System Integration, and Demonstration and Operations) and how well each is leading to the next phase using turnover skylines. For example, Pueblo is tracking Construction to Systemization turnover. When the expected turnover is complete, the next phase can begin. This approach is acceptable.
- **Integration** – Each ACWA site is composed of facilities with machinery for processing CWs. Each machine is fabricated, tested, and shipped during the EMD/Construction phase. Each plant was modeled in 3D to clarify interfaces between machines and the FCS. During Systemization, all process equipment will be integrated for full system testing. This phase spans multiple years, making integration a low risk.

Conclusion: The decision to begin operations with simulated munitions is planned for Pueblo as early as FY 2015 and Blue Grass as early as FY 2020. Known challenges remain, but the program is addressing them and is on track.

F-35 Joint Strike Fighter

Service: Air Force (lead)/Navy/Marine Corps

Prime Contractor: Lockheed Martin Aeronautics (partners Northrop Grumman and BAE)

Executive Summary: The F-35 is a three-variant family of multi-role fighter aircraft. It is an ACAT ID joint, multinational program of the U.S. Air Force, Navy, and Marine Corps, eight cooperative international partners, and one Foreign Military Sales (FMS) partner. FY 2011 DASD(SE) activities included participation in the Technical Baseline Review (TBR) and the Independent Manufacturing Review Team (IMRT) following the FY 2010 Nunn-McCurdy critical breach. DASD(SE) provided TBR oversight as a member of the Executive Steering Group. Although Low-Rate Initial Production (LRIP) continues, the program is in Technology Development, following the Nunn-McCurdy MS B rescission.

Mission Description: The F-35 is a single-seat, single-engine aircraft capable of performing and surviving lethal strike missions using advanced technologies to meet an advanced threat, while affordably improving lethality, survivability, and supportability. The F-35 will be operated by the U.S. Air Force, Navy, and Marine Corps, and nine partners including the United Kingdom, Australia, Canada, Denmark, Italy, the Netherlands, Norway, Turkey, and Israel (FMS).

System Description: The program will provide three variants: the Air Force Conventional Takeoff and Landing (CTOL), the Marine Corps Short Takeoff and Vertical Landing (STOVL), and the Navy Carrier Variant (CV). All variants have requirements to interoperate with air, land, and sea nodes of U.S., joint, and combined force structure operating within the projected C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) architecture.

Schedule: The MS B Recertification DAB planned for November 2010 is now expected in February 2012 due to comprehensive review and revision to the Integrated Master Plan and Schedule and more recently potential changes in production profiles due to uncertainty in the FY 2013 budget. The program is nearing completion of an updated program baseline resulting from the Nunn-McCurdy and recommendations from the TBR and IMRT.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the SEP in December 2009. An update to include changes to risk management was approved in November 2010. There are no approved waivers or deviations from the SEP. The objectives of the SEP are being met. A SEP update is necessary to reflect the new baseline and organizational and process changes.
- **Requirements** – The JROC validated the MS B Operational Requirements Document in March 2000. The program has eight KPPs: combat radius, STOVL performance, CV recovery, RF (radio frequency) signature, reliability, sortie generation rate, logistics, and interoperability. There are several technical risks that continue to threaten several of the KPPs (e.g., STOVL Vertical Lift Bring Back capability). Mitigation plans are in place or being updated. Program-level requirements are stable, but additional lower-level derived requirements emerged as a result of the dual helmet path and the remaining developmental work discovered by the TBR.

- **Program Protection Plan (PPP) –** USD(AT&L) approved the PPP in December 2010 with a caveat that the next update would address supply-chain risks and vulnerabilities. DASD(SE) is working with the program on the update.
- **Systems Engineering Support of Life Cycle Management and Sustainability –** The program is tracking below goals but has an established plan to achieve the reliability, availability, and maintainability requirements. Mitigation plans are in place to address numerous risks and issues with training, sustainment software, publications, and spares.

FY 2011 Systems Engineering Assessments

- Two systems engineering assessments were initiated in FY 2010 and completed in FY 2011.
- DASD(SE), the program office, and Air Force and Navy engineering organizations co-led a joint-Service TBR to reassess work-to-go in development. The TBR was completed and assessments, including 127 specific recommendations, were provided to the program and USD(AT&L) in November 2010. Results showed challenges in software development and resources, engine and electrical power, mission system architecture, test resources, sustainment, and contractor systems integration management. The program incorporated all but a few of the recommendations.
- The IMRT also reported follow-up recommendations in 22 areas relative to prior 2009/2010 reviews. The program has made progress on identifying and correcting manufacturing issues and risks, but still needs to address fundamental challenges with key supplier readiness, parts shortages, quality, rework, and traveled work. The IMRT recommended aggressive implementation of affordability initiatives to enable reduced costs in future production.
- The updated IMP/IMS incorporated recommendations from the Nunn-McCurdy, TBR, IMRT, and other 2010/2011 risk-review activities. Pending an Integrated Baseline Review, to formally assess schedule risk, the new plan is expected to offer stability. However, software development and test, manufacturing, and sustainment engineering require close monitoring.
- No formal assessments are planned in FY 2012. DASD(SE) will continue technical support and engagement with the program on software, risk, manufacturing, and engineering reviews.

Measurable Performance Criteria

- **Reliability** – Air vehicle reliability is well below goals, as may be expected early in development. The program will need to aggressively address and fund reliability growth.
- **Software** – The program has implemented TBR recommendations for schedule, resources, and overall block planning to better align capabilities with deliveries and milestones. However, software delivery will remain a challenge and will likely pressure the new baseline. For example, Block 1B (LRIP 3) capabilities will likely be delayed 3 months or more due to difficulties with security implementation. Delays will likely cascade to follow-on blocks and resource allocations.
- **Manufacturing** – The program completed an annual Production Readiness Review in December 2010 to support the LRIP 5/6 DAB. Although progress has been made since the 2009 review, most suppliers are still rated "yellow" or "red" for high-rate production.
- **Integration** – The program has mitigation plans to address integration issues and risks in helmet, mission systems architecture and fusion, pilot-vehicle interface, structures, STOVL propulsion, and contractor systems integration management. The program completed a System Requirements Review for the Helmet Mounted Display System (HMDS) in February 2011. Although assessed as successful, the program will need to complete low-level derived requirements for the HMDS.

Conclusion: F-35 is nearing completion of major baseline changes to extend schedules and add resources needed in development and test. The program's risk management process is improved and is actively addressing numerous technical risks in development, manufacturing, and sustainment.

Joint Air-to-Ground Missile (JAGM)

Service: Army (lead)

Technology Development (TD) Phase Competitive Contractors: Lockheed Martin Missiles and Fire Control vs. Raytheon Missile Systems/Boeing Team

Executive Summary: JAGM is a precision-guided munition for use on rotary and fixed wing platforms and unmanned aerial vehicles. The program is nearing completion of the TD phase. In FY 2011, DASD(SE) conducted a PSR in support of an FY 2012 MS B decision. The review was conducted in conjunction with the program's competitive PDRs and identified several low to moderate technical risks, which are being addressed.

Mission Description: JAGM is a precision-guided munition designed to provide improved lethal effects against both heavy armored vehicles and an expanded, nontraditional target set. The missile will allow engagement via precision point targeting, fire-and-forget, Lock On Before Launch and Lock On After Launch guidance from increased ranges over current Hellfire, Maverick, and air-launched TOW (Tube-launched, Optically-tracked, Wire command data link, guided) missiles.

System Description: JAGM uses advanced seeker and guidance technologies incorporating a multi-mode seeker (millimeter wave, infrared, and laser) to improve targeting and resistance to enemy countermeasures.

Schedule: The program is in the TD phase. MS B was originally planned for November 2010 but now is planned for February 2012.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DASD(SE) approved the MS B SEP in February 2011. There are no approved waivers or deviations. The program is meeting the objectives of the SEP.
- **Requirements** – The JROC validated the CDD in September 2011. All six KPPs are on track to be demonstrated by the end of Initial Operational Test and Evaluation in FY 2018. The PSR recommended the requirements be updated to include expected success criteria across the entire target set and to provide clarity for expected environmental conditions (e.g., Adverse Weather and Obscured Battlefield).
- **Program Protection Plan (PPP) –** DASD(SE) supported PPP development in FY 2011. Formal submission and USD (AT&L) approval are expected to support MS B in FY 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – JAGM will be a certified round requiring no field-level maintenance other than preventive maintenance, checks, and services, and ammunition lot surveillance procedures. The missile has established Materiel Availability requirements of 0.90 at initial fielding and 0.95 at system maturity, which the program anticipates achieving. System maturity is defined as Initial Operating Capability + 2 years.

FY 2011 Systems Engineering Assessments

- DASD(SE) completed one PSR in FY 2011.
- The PSR was conducted to support MS B with the support of the Army Program Executive Office (Missiles and Space) technical staffs. The review was conducted in conjunction with the contractors' PDRs. The PSR identified sensor, motor, and integration risk. Positive observations included the Joint Service teaming approach, technical review strategy, and risk reduction effort. Key findings and recommendations included a reduction in the number of threshold platforms (6), development of a formal Concept of Operations, the addition of a post down-select delta PDR to definitize the allocated baseline, and work to establish strong metrics.
- DASD(SE) will provide an assessment of the PDRs, based on DASD(SE) participation in the contractor PDRs, to support the MS B in FY 2012.

Measurable Performance Criteria

- **Reliability** – JAGM has an established reliability plan and appears on track to achieve the missile reliability requirements of 0.92 at initial fielding and 0.94 at system maturity. The program updated the Reliability Program Plan, SEP, and Test and Evaluation Master Plan to incorporate reliability growth for the missile, launcher, and training missile. DASD(SE) will participate in reliability growth monitoring during Engineering and Manufacturing Development (EMD). The program is proactively performing Highly Accelerated Lifecycle Testing on critical components.
- **Software** – JAGM contains more than 150k source lines of code and is currently on track to support integration on each of the six threshold platforms. There are two moderate risks related to software: software/algorithm maturity and platform software qualification. The core mission software, or Operational Flight Program, is included in the Integrated Flight Simulation (IFS). The IFS simulates complete "life" of a missile, from power-up to target impact.
- **Manufacturing** – The contractors each conducted a manufacturing readiness assessment for PDR as a contract delivery. DASD(SE) assessed manufacturing readiness in concert with the PSR and PDR. The program's producibility assessment demonstrated manufacturing processes and procedures were defined and manufacturing planning is sufficient for production of systems to support EMD.
- **Integration –** The PSR identified integration risk related to the large number of threshold aircraft requiring integration. Using integration labs, the Interface Control Documents, and the IFS, JAGM will develop software and verify integration.

Conclusion: The program is on track to enter EMD, and moderate risks associated with the sensor, motor, and missile integration are being mitigated.

Joint Lightweight Tactical Vehicle (JLTV)

Service: Army/Marine Corps

Technology Development (TD) Phase Competitive Prototyping Contractors: BAE, Lockheed Martin, General Tactical Vehicles

Executive Summary: The JLTV program is a light truck intended to increase protection and regain lost payload and performance over the High Mobility Multipurpose Wheeled Vehicle (HMMWV). The Joint Army and Marine Corps program is nearing the end of the competitive prototyping TD phase. DASD(SE) conducted a PSR and the program utilized effective Knowledge Point (KP) reviews and engineering working groups to refine a Request for Proposal and specification for the Engineering and Manufacturing Development (EMD) phase.

Mission Description: The JLTV mission is to provide protected, sustained, networked light tactical mobility to ground combat forces. Compared with the HMMWV, the JLTV will travel farther, carry more payload, remain engaged longer, survive when engaged, and maintain awareness of the operational environment. Units will employ the JLTV with adaptive levels of force protection.

System Description: The JLTV Family of Vehicles (FoV) will consist of two mission role variants, the Combat Tactical Vehicle (CTV) and the Combat Support Vehicle (CSV) with 3,500 lbs and 5,100 lbs of payload, respectively. Objectives include increased performance, payload, and protection over the current HMMWV fleet while maintaining transportability and minimizing ownership costs. Configurations and mission variants will maximize commonality of parts and further tailor a set of mission-specific components. Variants requiring more internal volume and payload-carrying capacity (e.g., ambulances) may be developed in future increments.

Schedule: MS A occurred in 2007 and MS B is planned for 3rd quarter FY 2012, with an accelerated EMD phase enabled by stable requirements.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – DUSD(A&T) approved the TD phase SEP in December 2007 to support the MS A decision. The program is fulfilling the objectives of the SEP without waivers or deviations. The program office is updating the SEP to support the MS B decision.
- **Requirements** – The Army and Marine Corps are staffing the draft CDD, with eight KPPs, for Joint Staff approval in 2nd quarter FY 2012. The KPPs are assessed as achievable after demonstrating mature technologies and stabilizing key requirements (e.g., transportability, mobility, and reliability) through collaborative KP review efforts between users and the program office.
- **Program Protection Plan (PPP) –** DASD(SE) facilitated the initiation of a PPP and the program is updating the draft PPP for the MS B decision.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – TD phase efforts refined the sustainment and reliability requirements. JLTV design for reliability efforts should enable nearly a 50 percent increase in reliability over the HMMWV. An expected 25 percent improvement in fuel efficiency at engine idle over the HMMWV will also help lower life cycle costs. The Analysis of Alternatives found a JLTV-equipped Heavy Brigade Combat Team would use 37 less fuel tanker loads in a 180-day operational scenario.

FY 2011 Systems Engineering Assessments

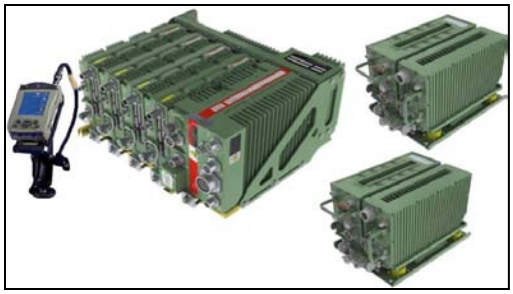
- DASD(SE) performed two assessments in FY 2011. Key FY 2011 systems engineering activities included three requirements KP reviews, a PSR, and a Government-only PDR.
- DASD(SE) conducted a PSR in support of MS B to assess the technical planning and management risks of the JLTV entry into the EMD phase. The review indicated that the program has sufficiently matured technology and requirements and is ready to enter EMD. Positive observations included: a requirements management knowledge point review process assessed as a best practice; successful management of multiple vendors in the competitive TD phase; and a process to achieve affordability through use of a cost-informed trade assessment process.
- Key PSR findings included the following: the EMD focus on production costs versus life cycle support costs; deferral of maintainability and logistics support development; and limited performance verification (including reliability) for the CSV based on assumed commonality between the CTV and CSV. The review also identified integration risks for Government-furnished equipment. As a result, the program is considering modifications to the reliability test strategy and elimination of high integration risk equipment.
- The program conducted a Government-only PDR in September 2011 and established a Government allocated baseline based on TD phase competitive designs. This allowed the program to optimize design specifications for a draft EMD phase Request for Proposals. The DASD(SE) PDR assessment will support the MS B decision.
- DASD(SE) will complete the PDR assessment in FY 2012 and will participate in the EMD System Requirements Review, technical interchange meetings, and design understanding reviews.

Measurable Performance Criteria

- **Reliability** – The Services reduced the draft reliability requirement from 4,500 to 2,400 Mean Miles Between Operational Mission Failure (MMBOMF) for the base vehicle based on insights gained in the TD phase. The program developed a proactive EMD reliability growth strategy and curve to manage reliability growth. This strategy includes design for reliability efforts, three phases of reliability growth testing, and two corrective action periods.
- **Software** – TD phase vendors delivered software with the prototype vehicles. The EMD phase software size is expected to be approximately 120k lines of new code, plus approximately 210k lines of reuse or modified code. The program plans to track software productivity, defects, releases, and reuse metrics in EMD.
- **Manufacturing** – The program identified 12 key subsystems requiring full process control plans and is planning two manufacturing and quality assessments during EMD. They will use these assessments to gauge vendor manufacturing and quality control plans and also to review supply chain management documents and supplier quality checks. The program plans several EMD manufacturing activities such as Failure Mode and Effects Analysis, quality score cards, integration and packaging reviews, and sampling plans for incoming material.
- **Integration** – The program office identified technical risk in six of 58 component interfaces. These interfaces will require close management attention because of incomplete interface descriptions or size, weight, power, and cooling concerns. The program has developed mitigation strategies to address these risks. The program identified underbody armor and the hull frame as TD phase critical technologies due to their correlation with weight and an adverse effect on the ability to transport them. The Army assessed both technologies as mature.

Conclusion: Based on TD phase insights, the JLTV program is positioned for a successful EMD phase with stable requirements and disciplined systems engineering processes.

Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)



Service: Army

Prime Contractor: Boeing

Executive Summary: The JTRS GMR is a 4-channel software-defined radio based on the JTRS Software Communications Architecture (SCA). The JTRS GMR program, which was in the Engineering and Manufacturing Development (EMD) phase, experienced a critical Nunn-McCurdy cost breach in March 2011. The Nunn-McCurdy review will be completed in October 2011, likely resulting in a restructured program or an alternative acquisition strategy followed by a modified acquisition approach to meet warfighter requirements.

Mission Description: The JTRS GMR will provide critical communications capabilities across the full spectrum of operations in a Joint environment. JTRS GMR will provide the warfighter with mobile Internet-like capabilities such as voice, data, networking, and video communications, as well as interoperability with current force and other JTRS radios across the battle space.

System Description: The JTRS GMR will enable the Services to acquire and field a family of affordable, scalable, high-capacity, interoperable radio sets based on a common set of JTRS Application Programming Interfaces developed in accordance with the JTRS SCA. JTRS GMR will provide networking capability using JTRS-developed Wideband Network Waveform (WNW) and Soldier Radio Waveform (SRW), as well as Single Channel Ground and Airborne Radio System (SINCGARS), Enhanced Position Location Radio System (EPLRS), High Frequency (HF) and Ultra High Frequency Satellite Communication (UHF SATCOM) to connect warfighters and unmanned sensors to decision makers "on the move" to reduce decision cycle time.

Schedule: The program was nearing the scheduled completion of its EMD phase in late FY 2011. MS B was held in June 2002 and MS C was planned for September 2011. As a result of the Nunn-McCurdy critical breach, in which the MS B was rescinded, the USD(AT&L) directed the JTRS Joint Program Executive Office (JPEO) to propose a program to manage delivery and test of a non-developmental item (NDI) to meet a reduced set of capabilities, affordably, with fielding to operational units in FY 2014.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The JTRS GMR SEP was initially approved by the JPEO in 2007 to support MS B. Root cause analysis of the critical Nunn-McCurdy cost breach attributes ineffective communication of requirements and requirements analysis and refinement as both direct and indirect factors contributing, in part, to the critical cost breach. Iterative requirements feedback with design is a primary system engineering objective of the current program's SEP.
- **Requirements** – The initial draft CPD to support the planned September 2011 MS C is under revision to incorporate reduced capabilities that will facilitate NDI solutions, and potentially open competition beyond the program of record solution for production. The previous requirements set included challenges of mobile ad hoc networks and scalability that were not well understood

due to immaturity of technology at that time. In addition, the program subsequently experienced increased information assurance requirements. Ongoing requirements adjustments are informed by JTRS GMR EMD phase results, industry surveys and Army Network Integration Evaluation outcomes. The revised CPD is planned for approval in February 2012.
- **Program Protection Plan (PPP)** – A PPP was updated in September 2010. It is currently in the OSD approval cycle and no further updates are pending until the planned FRP review.

FY 2011 Systems Engineering Assessments
- DASD(SE) is supporting the USD(AT&L) Integrated Process Team Nunn-McCurdy Review.
- DASD(SE) reviewed several aspects of the program. The PMO has begun actions to address DASD(SE) findings, including the following: (1) address critical system of system inter-dependencies, specifically coexistent radios required by the Concept of Operations and the effect on SWaP, co-site Electromagnetic interference, and personnel and munitions safety; (2) define trade space by establishing a clear understanding of capabilities to support trade analysis in cost, schedule or performance; (3) support Milestone Decision Authority decisions with a clear set of knowledge points, artifacts, and technical analysis; (4) reduce the constraints to innovation by eliminating unneeded interoperability requirements and providing vendors maximum time to optimize their offering while adhering to the desired schedule; (5) restructure the PM office to add the required skill sets and manpower to effectively carry out the next phase of acquisition.

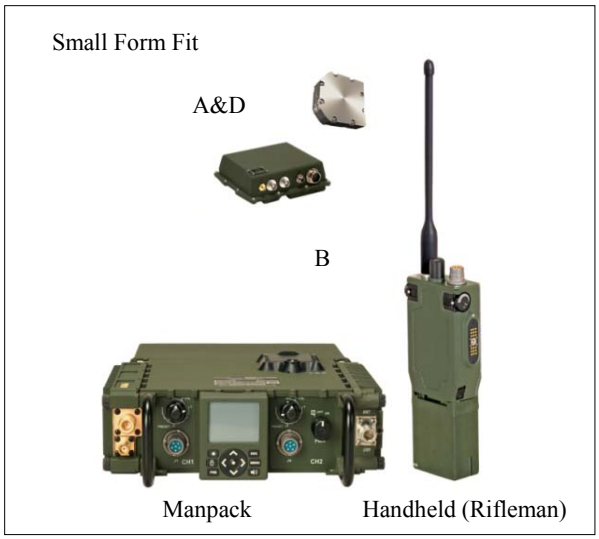
Measurable Performance Criteria
- **Reliability –** The JTRS GMR program had a 1,200-hour Mean Time Between Effective Functional Failure (MTBEFF) through early FY 2011, but failed to meet the 500 MTBEFF entry point planned for its reliability growth curve as expected. The requirement was subsequently reduced to the current requirement of 477 MTBEFF. The program attained 125 MTBEFF as assessed by the Director of Operational Test and Evaluation at the Army's Network Integration Evaluation (NIE) 11.2 test in June 2011.
- **Software –** The program has incorporated incremental software releases for its baseline, including the Operating Environment, JTRS Wideband Networking Manager, WNW, SRW, SINCGARS, EPLRS, HF and UHF SATCOM. These are provided for various test and evaluation events, contributing to performance feedback for continuous improvement. Software immaturity has contributed to effectiveness and suitability challenges for the program. While repetitive integration and recursive testing costs may be a burden on the program, optimizing and updating software will occur throughout the life cycle of this and similar software-defined data networking radios in order to upgrade or enhance performance and improve reliability.
- **Manufacturing** – The contractor has demonstrated early capability to manufacture the existing GMR radio in a pilot production line used to satisfy requirements for the Network Integration Kit used in the Army's NIE. This knowledge and expertise may not effectively transfer to other vendors if this solution is not chosen for production.
- **Integration** – The JTRS GMR program leveraged the Army's NIE at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, with representative brigade traffic and deployments in both a benign and Electronic Warfare/Computer Network Operation (EW/CNO) environments. These exercises provide integration and interoperability insights—both with some potential host platforms and in a representative operational environment. Key areas of evaluation are platform size, weight, power and cooling constraints, safety, antenna placement, and co-site interference. Feedback and engineering for key platforms is an ongoing effort.

Conclusion: The Nunn-McCurdy Review is likely to result in a restructured program or an alternative acquisition strategy followed by a modified approach to meet warfighter requirements.

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

Service: Army (lead)

Prime Contractor: General Dynamics, C4 Systems



Executive Summary: An Acquisition Decision Memorandum dated May 2011 granted the JTRS HMS a MS C decision and authorized a Low-Rate Initial Production (LRIP) procurement of 6,255 Rifleman Radios and 100 Manpack radios. These LRIP quantities will also establish an initial production base to enable an orderly ramp-up to FRP for delivery.

Mission Description: The JTRS HMS program provides the warfighter with a software reprogrammable, networkable multi-mode system of systems radio capable of simultaneous voice, data, and video communications to satisfy Joint Service requirements for HMS applications.

System Description: The JTRS HMS radios are a Software Communications Architecture (SCA)-compliant hardware system hosting SCA-compliant software waveforms as applications. HMS provides the warfighter with two main variants, a handheld radio (Rifleman Radio) and a Manpack radio. The key Rifleman Radio waveform is the Soldier Radio Waveform (SRW), providing voice and data combat networks for small dismounted formations at ranges up to 2 kilometers, line of sight. The Manpack radio provides the SRW waveform, as well as the Mobile User Objective System (MUOS), Single Channel Ground and Airborne Radio System (SINCGARS) and SATCOM (Satellite Communications). The program is developing Small Form Fit (SFF) radios (A, B, and D) for use in various platforms.

Schedule: The program is in LRIP authorized by a MS C decision on May 18, 2011. Key FY 2011 systems engineering activities included the HMS MUOS appliqué CDR completed December 2010, the Net-Centric Functional Capabilities Board completed in March 2011, and the HMS Program Managers Review held in September 2011.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The JTRS HMS SEP approved in May 2011 supported the MS C decision for the Rifleman Radio, Manpack, SFF-A, and SFF-D. The objectives of the SEP are being met without waivers or deviations. No further update is required.
- **Requirements** – The Rifleman Radio CPD revision 1 was approved April 14, 2011. The Manpack radio CPD is scheduled for approval in 2nd Quarter FY 2012. The HMS program has nine KPPs. The upcoming CPD revision is expected to include changes to the mounted and dismounted requirements for the Manpack program.
- **Program Protection Plan (PPP)** – DASD(SE) reviewed a draft PPP with the program office on May 11, 2011. The final PPP is due for the FRP decision scheduled for May 2012.

- **Systems Engineering Support of Life Cycle Management and Sustainability** – The Rifleman Radio is meeting all of its KPP requirements as set forth in the draft CPD, whereas the CPD for the Manpack radio is being revised by the JROC. The Integrated Logistics Support Plan for both radios is under development to address the maintainability and sustainment criteria.

FY 2011 Systems Engineering Assessments

- DASD(SE) conducted an assessment in FY 2011 for the HMS program as part of the JTRS Enterprise review.
- Key findings included the need to improve reliability and synchronize the Manpack radio development with the MUOS waveform completion. The MUOS waveform is in development by the JTRS NED effort. There is no defined schedule for completing the MUOS or a plan for how the Red and Black sides of the waveform will be integrated. The Manpack radio hardware appliqué to operate the MUOS waveform is completed; however, the program has not completed full throughput testing because of the delay in the MUOS waveform delivery by the JTRS NED effort. The delay adds risk if Manpack or appliqué hardware modifications become necessary after the waveform is delivered.
- DASD(SE) plans two system assessments for FY 2012.

Measurable Performance Criteria

- **Reliability** – The HMS program reliability requirement is 477 hours Mean Time Between Effective Functional Failure (MTBEFF) for both the Riflemen Radio and Manpack. The current reliability achieved by the radios is 220 hours for the Riflemen Radio and 40 hours for the Manpack. The program has initiated a reliability growth plan.
- **Software –** The Rifleman Radio in currently on track with their software development plan using SRW. The Manpack is scheduled to use the SINCGARS, SATCOM, SRW, and MUOS waveforms. The NED effort continues to incrementally develop upgrades and error correction releases for the JTRS Enterprise, to include the Rifleman and Manpack radios.
- **Manufacturing** – The Rifleman and Manpack have successfully developed a production process that is currently producing 1,065 Rifleman Radios for use at the Army's Network Integration Evaluation 12.1 and 12.2 events, and 100 Manpack radios for waveform integration testing. The Production Readiness Review documents have yet to be finalized.
- **Integration** – Integration of the MUOS waveform on the Manpack is the main integration challenge. The Rifleman Radio has successfully integrated the SRW into the radio for testing in an operational environment.

Conclusion: The program is aware of, and mitigating, challenges associated with radio reliability and synchronizing radio and waveform development. The MUOS waveform delivery and integration is the primary challenge for FY 2012.

Multifunctional Information Distribution System Joint Tactical Radio System (MIDS JTRS)

Service: Army (lead)

Prime Contractors: Competitive prime contractors with collaborative technical exchange: ViaSat and Data Link Solutions (DLS), LLC (BAE Systems & Rockwell Collins)

Executive Summary: The MIDS JTRS product provides all Services with a software defined radio with Link 16, J-Voice, and Tactical Air Navigation (TACAN) functionality plus three additional 2 megahertz to 2 gigahertz programmable channels. The MIDS JTRS product office is correcting deficiencies identified during its 2011 Initial Operational Test and Evaluation (IOT&E) assessment. The outcome of the program's Verification of Correction of Deficiencies (VCD), ending in January 2012, will inform the Full Production and Fielding (FP&F) decision planned for March 2012.

Mission Description: MIDS JTRS provides support to the Combatant Commander, the Joint mission areas, and computer environments by enabling secure, mobile, ad-hoc, wideband, and cross-band Radio Frequency (RF) Link 16 connectivity capabilities. MIDS JTRS supports Joint mission/Joint mission tasks listed in the CJCSM 3500.04, Universal Joint Task List, and Service-specific planning guidance requiring information exchanges using radio frequency transmissions.

System Description: The MIDS JTRS design is plug-and-play interchangeable for all Service platforms using the MIDS-LVT Space, Weight, and Power specifications. The MIDS JTRS design will also add improvements such as Link 16 Enhanced Throughput, Link 16 Frequency Remapping, and programmable cryptography. In addition to the Link 16 and TACAN functionality, MIDS JTRS will provide three additional 2 megahertz to 2 gigahertz programmable channels to accommodate incremental delivery of the advanced JTRS waveforms through MIDS JTRS Platform Capability Packages.

Schedule: MIDS JTRS is in Limited Production and Fielding (LP&F), which was granted September 2009. FP&F originally planned for December 2011 is now delayed until March 2012.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan** – The MIDS JTRS SEP was approved in October 2007 by the JTRS Joint Program Executive Office to support the LP&F Decision. No update is planned. The objectives of the SEP are currently being met without waivers or deviations.
- **Requirements** – The JROC validated the MIDS JTRS CPD in 2008. The MIDS JTRS product has seven KPPs. All except KPP 4 (4-channel operations) have been demonstrated in operational test. The demonstration of the three Joint Tactical Radio channels using SINCGARS (Single Channel Ground to Airborne Radio System) was executed in September 2010 in a developmental test assist and documented by the Navy's Operational Test Agency through a Letter of Observation. Full operational demonstration and test will occur when the next funded waveform is selected, developed, and integrated into MIDS JTRS and targeted platforms.

- **Program Protection Plan** – The PPP was approved by the JTRS JPEO in August 2007. The PPP will be updated for Defense Acquisition Executive approval to support the FP&F decision planned for March 2012.
- **Systems Engineering Support of Life Cycle Management and Sustainability** – MIDS JTRS product Life Cycle Management and Sustainability is on track.

FY 2011 Systems Engineering Assessments
- DASD (SE) conducted a systems engineering assessment to inform the need for added LP&F quantities and to inform the VCD planning, execution, and manufacturing reviews, and sustainment analysis.
- One of the two terminal vendors corrected a manufacturing process linked to excessive terminal failures identified during IOT&E. Corrective actions were identified and bolstered by adding inspection and testing regimens to the process. That vendor is now producing acceptable terminals. The other vendor continues to produce acceptable terminals.

Measurable Performance Criteria
- **Reliability –** The MIDS JTRS product has a reliability requirement of 220 Mean Flight Hours Between Operational Mission Failure (MFHBOMF) (Terminal) and 25 MFHBOMF (System). The MIDS JTRS was not on track to meet reliability requirements by the end of IOT&E. During IOT&E, 10 terminals were returned to the manufacturers for corrections, and 21 systems/software failures were cited. The Reliability Growth Plan documented in the SEP is being used to improve reliability and meet reliability requirements. A focus on the manufacturer responsible for the bulk of the deficiencies in IOT&E is expected to address the needed reliability concerns.
- **Software –** The first MIDS JTRS Link 16 capable terminal is configured with a core software version integrated into supporting operating environment software as Integrated Builds. Integrated Build 1.7.4 is implemented in the current Production Transition Terminals and LP&F terminals under test. Integrated Build 1.7.4 includes corrections required to address deficiencies identified in the IOT&E and re-tested in the VCD.
- **Manufacturing** – Detailed system design is complete and sufficiently stable to enter FP&F. The MIDS Program Manager has assessed both manufacturers' processes to be adequate to meet their production schedule. All materials are available to meet the planned FP&F schedule.
- **Integration** – The MIDS JTRS has been successfully integrated into the F/A-18E/F, E-8C, and RC-135. Integration into other required platforms (i.e., EC-130E/H) is ongoing.

Conclusion: The MIDS JTRS suffered reliability issues during the Initial Operational Test, resulting in its unsuitable assessment. The program is completing a VCD, implementing fixes and retesting to validate the corrections. The program has an acceptable path toward its FP&F decision in March 2012.

Small Diameter Bomb II (SDB II)

Service: Air Force (lead)/Navy

Prime Contractor: Raytheon Missile Systems

Executive Summary: SDB II is a 250-lb class glide weapon designed to attack moving targets in adverse weather. The program is an ACAT ID in the Engineering Manufacturing and Development (EMD) phase. In FY 2011, DASD(SE) provided technical support to subsystem CDRs and the system-level CDR and conducted the required CDR assessment.

Mission Description: SDB II addresses the following warfighter requirements: attack moving and stationary targets, adverse weather operations, multiple kills per pass, multiple ordnance carriage, precision munitions capability, reduced munitions footprint, increased weapons effectiveness, minimized potential for collateral damage, and reduced susceptibility of munitions to countermeasures. SDB II provides a network-enabled weapon capability via Link 16 and Ultra High Frequency Weapon Data Link.

System Description: SDB II is a 250-lb class glide weapon designed to attack moving targets through weather. The threshold aircraft are F-15, F-35B, and F-35C. The weapon has three principal attack modes: normal, laser-illuminated, and coordinate attack.

Schedule: The program is in the EMD phase. MS B was held in July 2010 and MS C is planned for 4th quarter FY 2013. Key FY 2011 systems engineering activities included participation in the subsystem and system-level CDRs, and a formal CDR assessment.

FY 2011 Systems Engineering Activities

- **Systems Engineering Plan (SEP)** – The SEP was approved by DASD(SE) in May 2010 to support MS B. The program office will submit an update to support MS C. The program is fulfilling the objectives of the SEP without waivers or deviations.
- **Requirements** – The JROC validated the CDD in July 2009. All five KPPs are on track for demonstration on the F-15E by FRP in 2016. The requirements are reasonable and stable.
- **Program Protection Plan (PPP)** – The USD(AT&L) approved the MS B PPP in July 2010.

FY 2011 Systems Engineering Assessments

- DASD(SE) completed one major assessment in FY 2011.
- The SDB II program office successfully conducted the system-level CDR in January 2011 to establish the initial product baseline. DASD(SE) conducted an assessment of the CDR and concluded that the SDB II program was ready to enter the second portion of EMD, System Capability and Manufacturing Process Demonstration.
- No assessments are planned for FY 2012.

Measurable Performance Criteria

- **Reliability** – The SDB II program has reliability requirements and metrics. System reliability predictions indicate all reliability, availability, and maintainability requirements will be met at weapon maturity with margin in accordance with the system's reliability growth plan. Maturity is defined as production Lot 5 by the SDB II CDD.
- **Software** – The SDB II program has limited software metrics. The size of the software is approximately 1.3M source lines of code, which fall mainly across three Computer Software Configuration Items to be accomplished in six major builds. No significant software development risks exist.
- **Manufacturing** – Although the program is not in production, a manufacturing assessment conducted in conjunction with the January 2010 CDR indicated the program is on track to affordable and executable manufacturing processes to support a 4th quarter FY 2013 MS C. Air Armament Center Engineering assessed manufacturing readiness during the CDR with the same conclusion.
- **Integration** – The SDB II program uses several integration labs to evaluate interface requirements: software and hardware integration labs, Electronic Systems Integration Lab, Tower Testing, Eglin Guided Weapons Evaluation Facility, and Seeker Captive Flight Testing to simulate interfaces with 13 elements. One technical risk being monitored is concurrent development with F-35B and F-35C and the potential for unknown design changes that could affect the weapon and/or carriage interface. Specifically, F-35B and F-35C availability lags SDB II development by approximately 2 years. The SDB II program is working closely with F-35 to mitigate this risk.

Conclusion: The SDB II program is on track and progressing to schedule.

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APPENDIX A

Department of the Army
Systems Engineering Self-Assessment

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DEPARTMENT OF THE ARMY
ASSISTANT SECRETARY OF THE ARMY FOR ACQUISITION, LOGISTICS AND TECHNOLOGY
(ASA(ALT))

U.S. Army Report to the DASD-SE in support of the FY11 Annual Report to Congress Regarding the Implementation of the Weapon Systems Acquisition Reform Act

Advancing the State of Systems Engineering for the Army

ASA(ALT) Office of the Chief Systems Engineer

3/13/2012

Service Assessment Summary:

In Fiscal Year 2011 (FY11) the Army made significant strides in implementing the systems engineering aspects of the Weapon Systems Acquisition Reform Act (WSARA) of 2009 and continues to evolve the practice of systems engineering in support of the Army acquisition community. The Army reports real advancements in the state of systems engineering processes in support of the design, development, acquisition and delivery of Army systems are being achieved. The Army is exercising solid systems engineering principles and best practices to help the Army more efficiently meet its goals. The Army is continuing to maximize the resources it has been given, but is shy of the requisite quantity of trained system engineering professionals it needs and actually saw a reduction of personnel in this area. As the Army enters a more resource constrained environment, it will be increasingly important to leverage available resources as efficiently as possible.

The Army identified three areas that have shown constructive results within the implementation of systems engineering:

(1) Systems engineering within the programs of record and system-of-systems engineering across the programs of record

(2) Reliability, availability, maintainability (RAM) and sustainability as an integral part of design and development; and

(3) Establishment of the Assistant Secretary of the Army (Acquisition, Logistics and Technology) (ASA(ALT)) System-of-systems Integration Directorate (SoSI) and Office of the Chief Systems Engineer (OCSE)

The Army has also identified three areas to focus on improvement:

(1) Establishing processes and tools to help address our system-of-systems integration challenge

(2) Better linkages between our system-of-systems efforts and our business decision forums

(3) Building the systems engineering through bench-human capital development

ASA(ALT) Vision:

Highly efficient, effective, agile organization responsible for acquiring, developing, delivering, supporting and sustaining the most capable affordable systems and services for our Soldiers:

- *Enabling our Soldiers to dominate the battlespace, safely and securely*
- *Enabling our Soldiers to achieve first look, first strike advantage with unprecedented speed and accuracy*

ASA(ALT) Mission:

Provide our Soldiers a decisive advantage in any mission by developing, acquiring, fielding and sustaining the world's best equipment and services and leveraging technologies and capabilities to meet current and future Army needs.

As part of our continuous effort to ensure the most efficient and effective delivery of our products and services, ASA(ALT) updated their Strategic Plan this year. The system-of-systems and systems engineering and integration missions were identified as critical to achieving; improved cycle time and reduction of risk, development of system-of-systems management tools and processes, and reductions in life cycle costs during the sustainment phase of Army programs.

In support of these goals, and as part of a broader review of ASA(ALT), the system-of-systems engineering mission and function within ASA(ALT) was realigned to the Deputy for Acquisition and Systems Management (DASM). On 30 Jun 11 the System-of-Systems Engineering (SoSE) Directorate in ASA(ALT) stood down and on 1 Jul 11 the Office of the Chief Systems Engineer (OCSE) was established provisionally. Additionally, the Program Executive Office (PEO) Integration stood down and the System-of-Systems Integration (SoSI) Directorate was provisionally established on 1 Oct 11. The SoSI Directorate is also aligned under the DASM. These organizations are currently developing their concept plans for formal approval.

Systems Engineering Activities

1.0 Progress and Plans for Improved Service Systems Engineering Capability

1.1 Pre-Milestone A and Pre-Milestone B Rigorous Systems Analysis and Systems Engineering Process:

In FY11 the Army has provided rigorous systems analysis and systems engineering to many of the 514 programs (ACAT I, II and III) within ASA(ALT), at 12 PEOs and five other agencies (U.S. Army Chemical Materials Agency, U.S. Army Medical Research and Materiel Command, U.S. Army Materiel Command, U.S. Army Research, Development and Engineering Command, and the Missile Defense Agency).

An example of this analysis and system engineering is the work performed in support of the Ground Combat Vehicle (GCV) Infantry Fighting Vehicle (IFV) program (ACAT ID) which is currently a post-Milestone (MS) A program in the Technology Phase. Achieving MS A required trade space analysis, requirements analysis, conceptual engineering design, analysis of alternatives (AoA), and other key system engineering activities. For requirements analysis, the Dynamic Object-Oriented Requirements System (DOORS) environment provided traceability to the parent Capability Development Document (CDD) requirements, and the mapping of GCV performance specification requirements. The DOORS provided the baseline management and configuration control needed to maintain traceability, perform what-if excursions and implement necessary changes. In addition, a system-level design concept was developed to provide a physical representation which supported various engineering analyses and the AoA. This model represented the baseline design concept used to develop the GCV Cost Analysis Requirements Description document. The cost data informed the trades process and resulted in specific, quantifiable capability reductions that allowed a reduction of average unit manufacturing cost from $13.74 M to $10.10 M by defining 64 requirements with sub-threshold values. This moved 82 percent of the threshold requirements into the trade space (tiers 1, 2, 3) to be explored in the Technology Demonstration phase and allowed 20 requirements to be fully deferred to follow-on increments.

The GCV program uses an incremental acquisition approach which employs an open system architecture and specific growth requirements to enable the integration of additional capabilities over time. Specific growth requirements, defined within the GCV IFV performance specification, require performance margins within the baseline (threshold) design, measured at the Production Readiness Review, to ensure sufficient system capacity. To that end, growth requirements are defined to ensure availability of system

power, computing capacity, cooling capacity and the ability to support additional vehicle weight associated with future requirements without impacting baseline design of the system or degrading system performance.

In response to the WSARA and subsequent Office of Secretary of Defense (OSD) directives, the Army has actively participated in the OSD Development Planning Working Group and has established a core Development Planning activity at the headquarters level. A long-term approach and methodology has been developed to implement Development Planning across the Army PEO and Science & Technology communities. In FY11, the Army initiated two Development Planning pilot efforts: 1) Integrated Base Defense (IBD) and 2) Contingency Basing (CB) Community of Practice. These initiatives are represented by system equities and technologies that span the Army mission areas and require a system-of-systems engineering approach to ensure coordinated, effective, and efficient analysis to support acquisition decision making. The FY11 IBD effort produced reference architecture and associated materiel baseline that supported execution of an Integrated Weapon System Review (IWSR). This review and subsequent refinement of the acquisition approach for POM 14-19 was framed by the IBD reference architecture and supporting analyses (requirements, operational, cost, capability shortfalls and system trades).

The CB Community of Practice focused on early systems engineering to support a Materiel Development Decision and other pre-MS A activities. Working with the U.S. Army Training & Doctrine Command (TRADOC), the team completed functional requirements decomposition, Capabilities Based Assessment, Initial Capability Document, CB Campaign Plan, and other critical system engineering products.

Another important system engineering effort was executed by PEO, Intelligence, Electronic Warfare, and Sensors. The Common Infrared Countermeasure Program obtained approval for its Systems Engineering Plan (SEP) from OSD and preliminary System Performance Specification, entrance & exit criteria for MS A technical reviews (System Requirement Review, System Functional Requirement, Preliminary Design Review), Risk Management Plan, Program Protection Plan and Critical Technology Elements. The PEO is working with all subordinate Project Managers (PM) to determine the status of their SEPs and ensure they are executing sound systems engineering practices.

1.2 Reliability, Availability, Maintainability, and Sustainability as an Integral Part of Design and Development

A primary ASA(ALT) OCSE responsibility is to ensure that system reliability, availability, maintainability, and sustainability are addressed throughout the life cycle.

To mitigate reliability shortfalls for materiel systems, ASA(ALT) OCSE supported the implementation of new reliability policies. These reliability policies include: OSD Directive-Type Memorandum (DTM) "Reliability Analysis, Planning, Tracking, and Reporting"; ASA(ALT) Reliability Policy," Improving the Reliability of US Army Materiel Systems"; and Army Regulation 70-1, Army Acquisition. These policies amplify procedures in the Department of Defense (DoD) Instruction 5000.02, institutionalize reliability planning methods and reporting requirements timed to key acquisition activities to monitor reliability growth, require an early Engineering and Manufacturing Development (EMD) reliability test threshold, and require early engineering-based reliability program reviews. The Army is committed to enhancing reliability in the acquisition process consistent with the recent OSD DTM.

To continually improve weapons system reliability, the Army has several venues to discuss policy, reliability and maintainability tools, acquisition language, training/workforce development, and recruitment. These venues include:

(1) The U.S. Army Research, Development and Engineering Command (RDECOM), the U.S. Army Test and Evaluation Command (ATEC), and the U.S. Army Materiel Systems Analysis Activity (AMSAA). These organizations host reliability workshops such as the reliability and maintainability Technical Interchange Meeting hosted by the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC);

(2) The AMSAA & ATEC reliability training workshops;

(3) The RDECOM Mobility and Logistics Technology Focus Team meetings; and

(4) Society of Reliability Engineers-Huntsville Chapter sponsored a reliability, maintainability, and conditioned maintenance workshop with participation across the Army reliability and maintainability systems engineering technical community

A consequence of Acquisition Reform in the mid 1990s was the elimination of a large portion of the government and contractor Reliability, Availability, and Maintainability (RAM) workforce. The Army has recognized the reliability and maintainability engineering shortfall and the need to retain, recruit, and train reliability and maintainability engineers. The Army has pursued consortiums with universities that have reliability and maintainability focused curriculums in order to gain access to the universities' top reliability and maintainability engineering graduates. For example, the U.S. Army Aviation & Missile Research, Development, and Engineering Center (AMRDEC) joined consortiums with the University of Tennessee-Knoxville and University of Alabama-Huntsville to evaluate/recruit potential reliability and maintainability engineers. In spite of these efforts, the Army still has a shortfall of trained reliability and maintainability engineers. In 2011, the DoD, with the Army as the lead organization, established a comprehensive Specialty Engineering Education & Training (SE2T) pilot program in Huntsville, Alabama under the Defense Acquisition University (DAU). This 24-month program provides extensive reliability and maintainability training for new engineers.

The Army PEOs have integrated reliability and maintainability principles into major development/acquisition programs.

(1) The PEO Missiles and Space included the RAM Strategy as one of their inspection areas in the FY11 Organizational Inspection Program. All PEO Missiles and Space project offices were inspected for the presence and efficacy of their RAM Strategy. Typical documents reviewed prior to the face-to-face inspections included the Failure Definition/Scoring Criteria, RAM Analysis Reports, Combat Developer Analysis, and RAM Models and Assessments. The RAM Strategy is described initially in the System Engineering Plan (SEP) and then later in the Test and Evaluation Master Plan (TEMP). This excluded many numerous PEO Missiles and Space legacy systems which pre-date the requirement for SEPs. All project office-managed programs have an ongoing RAM program that appropriately corresponds to the weapons system's life cycle phase. The project offices apply a tailored set of contract language for RAM based on the weapons system's acquisition phase, whether development or production. All project office programs have an ongoing Failure Reporting, Analysis, and Corrective Action System (FRACAS) to include in their Contractor Logistics Support contracts. Where appropriate, the project offices conduct maintainability demonstrations on all of their programs and use the Failure Modes, Effects and Criticality Analysis (FMECA) report for selection of faults to be tested in the equipment.

(2) The PEO Aviation also uses the RAMFRACAS and Trend Mitigation programs to accurately identify reliability drivers of the utility fleet and identify corrective action and/or redesign required to

address reliability challenges. Root cause failure analysis is performed using actual field data and analysis of parts. Subsequently, they can target reliability improvements based on data, not just part failure.

The Army benefited from these efforts across the life cycle. These capabilities led to the use of a comprehensive reliability and maintainability program included in the Engineering, Manufacturing, and Development (EMD) Phase scope of work language and SEP & TEMP for the Joint Air-to-Ground Missile (JAGM) and CH-47 programs.

The Army continues to reduce operating and support costs by aggressively pursuing reliability improvement programs. For example, the Army's Aviation System Assessment Program provided significant data/information across Army aviation platforms to identify needed areas of reliability improvement. The Army and Defense Logistics Agency provided funding for multiple reliability improvements across Army aviation platforms, such as the Apache blade track/balance project which is expected to improve blade reliability by 30 percent.

The Army continues to institutionalize the culture of innovation and continuous improvement of Design for Lean Six Sigma (DFLSS) to assure Design for Reliability is an integrated approach to design, systems, and supportability engineering. For example, the U.S. Army Armament Research, Development and Engineering Center (USAARDEC) and PEO Ammunition have successfully developed, taught and applied the DFLSS approach to improve reliability of the armament system technologies and product developments. All USAARDEC and PEO Ammunition project engineers are Green Belt certified to properly execute disciplined project management.

Several Army reliability and maintainability organizations are recognized within the technical community for their expertise. For instance, AMSAA continues to be recognized as the leader in reliability growth modeling. ATEC continues to examine reliability testing efficiencies. USAMRDEC provides reliability expertise to the multiple government agencies, such as support to the Air Force in a Nunn-McCurdy breach for Global HAWK and Missile Defense Agency for Terminal High Altitude Area Defense (THAAD) & Sensors materiel release to the U.S. Army. USAMRDEC, ATEC, and AMSAA are key members in the OSD reliability and maintainability team and are shaping reliability and maintainability policy throughout the acquisition life cycle. As part of this effort, an update to the Defense Acquisition Guide is under development to address reliability, maintainability, analysis, planning, tracking, and reporting for Major Defense Acquisition Programs.

The Army's plan for the future is to improve the existing workforce through reliability and maintainability mentoring, partnering with academia, working closely with Department of Energy National Labs, and through specialized DAU training. Given the success of the SE2T Program, the Army will continue to resource the program to meet Army needs for reliability and maintainability engineers. Technical interchange meetings between the R&D Centers, TRADOC, ATEC, and AMSAA will continue to address resources and personnel requirements. The Army will strive to improve the reliability and maintainability system requirements generation process via technical interchange and policy/regulations with the materiel developer, independent tester/evaluator, and user representative. The reliability and maintainability workforce growth may be constrained by future budgets. However, the Army will evaluate workforce structure to ensure critical reliability and maintainability requirements are met.

1.3 Systems Engineering Requirements during the JCIDS Process and in Contract Requirements for each MDAP

One of the most significant changes to the acquisition life cycle process was moving the Program Design Review (PDR) to pre-MS B. This drove more in-depth analysis of the system requirements and design earlier in the process and improved the ability to identify technology risk. It also resulted in improved quality of the request for proposal (RFP) used in post-MS B contracting. The Army is executing this process and, from a system-of-systems perspective, began to work with TRADOC and the Army, G-3 to ensure that system-of-systems interdependencies are identified and coordinated during the requirements generation process. One example is the trades and design performed for the network across the Army formations. This effort resulted in the Joint Program Executive Office (JPEO) Joint Tactical Radio Systems (JTRS) Ground Mobile Radio (GMR) program having a Nunn-McCurdy breach. It also resulted in the review and approval of the associated requirements and an Army acquisition strategy that will be more effective and efficient in establishing a mid-tier networking vehicular radio (MNVR) program.

The Army is adopting the network integration "Agile Process" for effectively assessing and acquiring solutions for the network. This process will provide a holistic and integrated approach for the acquisition, testing, evaluation, and fielding of capability solutions across the Army's range of operations. The Agile Process will create efficiency through the minimization of steps, tasks, work, and problems that arise as a result of rapidly changing requirements due to speed of war, pace of information technology development, and changes in the Army Force Structure. This seven-phased Agile Process is an effort to procure critical capabilities more rapidly, while ensuring technical maturity and integration, and reducing the integration burden from deployed units and Soldiers.

Under the Network Integration Evaluation (NIE) effort, the Army has established a realistic operational environment at Fort Bliss/White Sands Missile Range, supported by laboratory analysis at Aberdeen Proving Ground, Maryland to introduce and evaluate commercial technologies in a controlled setting. The end state of the Agile Process and Network Implementation Plan is to procure systems that meet a pre-defined operational need and demonstrate success through Soldier-led evaluations during the NIEs and support subsequent Capability Set fielding.

1.4 Service-Specific Identified Area(s) of Progress and Improvement

The tables below illustrate FY11 accomplishments (Table 1A) and FY12 priority areas (Table 1B) that are focused on improving the systems engineering and development planning capability.

Table 1A. Army Service Self-Assessment – FY11 Highlights

Army FY11 Highlights	
Implementation of System-of-Systems Engineering	• Continued to organize the system-of-systems space with the involvement of various integrated project teams and governance structures. With the publishing of the Common Operating Environment (COE) Implementation Plan, the six Computing Environment (CE) Execution Plans, and the establishment of the associated governance structure, significant efficiencies have been realized. • Directly linked system-of-systems engineering efforts with associated program planning and execution through close coordinating with DASA for Plans, Programs, and Resourcing. Executed Integrated Weapon Systems Reviews for the COE CE and the Integrated Base Defense portfolio. These reviews are a significant step forward in integrating system-of systems engineering processes with the Planning, Programming, Budgeting, and Execution (PPBE) process.

Army FY11 Highlights	
	• Implemented tools and processes for the development of integrated system-of-systems architectures organized by Army formation, and used in support of network design trades, platform integration, requirements synchronization, portfolio management alignment, and the PPBE process. • Created efficiencies through partnership with the OSD DDR&E/Systems Engineering Acquisition Document Streamlining Task Force. A primary initiative was a streamlined Systems Engineering Plan (SEP) that ensures that needed program systems engineering data is documented while minimizing SEP development burden to program management offices. • Leveraged cross-Army governance bodies to achieve the Army network plan and supporting system-of-systems engineering process. The forums are led by Army's G-3 LandWarNet (LWN) via the 1) Capability Set Management Board (CSMB) and 2) the LandWarNet 1-2 star General Officer Steering Committee (GOSC). These forums consist of cross-Army Staff (ARSTAF) senior leaders and facilitate a coordinated position in preparation for the Capability Portfolio Reviews (CPRs) held by the Vice Chief of Staff of the Army (VCSA). • Established an integrated architecture system-of-systems engineering construct for the Army network. The Army's network design is based on core tactical networking waveform principals combined with a thorough review of all Army formations and voice and data needs. These two products serve as the foundation for the Army's major network related decisions. These products are continuously updated to reflect lessons learned and fact-of-life changes from the field, NIE events, and programmatic changes. Additionally, these products are the foundation for our system-of-systems architecture products. • ASA(ALT), TRADOC, Army G-3, and Army G-6 established a process to maintain the network design, associated architecture data products and synching of these products with the network implementation at the NIE and Capability Set (CS)13 bridging architecture fielding. The NIE 11.2, 12.1, 12.2, and CS13 network architectures have direct lineage to these "reference architectures." • Recently the Secretary of the Army and Chief of Staff of the Army co-signed a policy memo formally establishing a portfolio management process in the Army G-8. ASA(ALT) has been working with the Army G-8 to align our systems-of-systems engineering processes and tools with the Army G-8 portfolio management construct. We are aligning the network design and architecture data products to the CS management construct, so adding the capability to "view" the data by commodity portfolio will enable Army G-8 to map the CS construct to their portfolios.
Creating efficiencies through the application of focused SE	• The COE Implementation Plan was completed in 2011 and provides guidance to government and industry partners in order to standardize end-user environments and software development kits. It also established streamlined enterprise software development processes that rely on common, pre-certified, reusable software components and deployment strategies that give users direct

Army FY11 Highlights	
activities	access to new capabilities. Given the diversity of systems within the Army enterprise, a single technical solution for the COE is not achievable. Thus the problem space has been architecturally categorized into six computing environments (CEs) which when combined form the COE. • Developed the IBD reference architecture and materiel baseline using system-of-systems engineering tool and processes. These products have influenced the development of an integrated and synchronized capability across multiple programs and organizational boundaries. It is also linked into the appropriate COE CE execution plans and used to create efficiencies across the programs supporting this mission. • Established the Network Operations (NetOps) IPT which is co-chaired by the CIO/G6 and the ASA(ALT) Office of Chief System Engineer. The IPT is exercising system-of-systems engineering processes to capture requirements, identify systems, and develop a recommendation for an integrated NetOps capability. This effort will influence the PPBE planning cycle and is directly identifying efficiencies (programmatic and operational) in fielded NetOps systems. • ASA(ALT) sponsored development of architectures and standards to enable more flexible and efficient system integration onto our platforms. The Vehicular Integration for C4ISR/Electronic Warfare Interoperability (VICTORY) architecture and standard matured significantly in FY11 and is being reviewed as a proposed Institute of Electronic Engineers standard. Additionally, an effort was initiated that is focused on airborne platforms in collaboration with the Air Force. The Future Airborne Capability Environment initiative leverages understanding gained in development of the VICTORY architecture and is expected to mature over the next two years. The expected benefits are significantly more flexibility in integration of new systems and software on aviation platforms while reducing the time and costs associated with safety certification.
Institutionalize development and delivery of capability packages in accordance with the LandWarNet\ Brigade Combat construct	• The Military Deputy (MILDEP) and the Army Acquisition Executive (AAE) have provided direct support to synchronizing our system-of-systems engineering and Capability Set governance processes through their involvement with the VCSA Capability Portfolio Reviews (CPRs), direct support and guidance in support of the COE, and standard Army decision making forums (Army Systems Acquisition Review Council (ASARC), Budget, Requirement and Program (BRP) Board, etc.). • The Capability Set Management Board (CSMB) is a key senior leader decision forum to guide the goals, objectives and activities of related Capability Set segments, sub-segments, HQDA and Army Command (ACOM) institutional process owners to deliver relevant, affordable, and interoperable Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities (DOTMLPF) solutions that provide the greatest operational value with the resources available. The CSMB provides strategic planning, prioritization, and guidance for the development and implementation of LWN/BC Capability

Army FY11 Highlights	
	Set solutions that satisfy operational and generating force requirements across the full spectrum of Joint operations. The CSMB oversees the synchronization activities that strategically inform, enable and direct force generation processes supporting the development and delivery of integrated LWN/BC Capability Sets over time. OCSE is a standing member of the CSMB responsible for system-of-systems engineering. • OCSE and/or SoSI represent ASA(ALT) on the Army G-3 LWN 1-2 star GOSC. This forum governs the Army Network, Mission Command, and Global Network Enabling Construct (GNEC). Every major Network, Mission Command, and GNEC decision has come through this forum on its way to the VCSA for approval and prioritization. Recent topics include the COE, review and approval of the Network Synchronization Working Group (NSWG) Capability Set 13-14 architectures, and Agile Acquisition Decision Points associated with the NIE decision points on the Agile Process.
Updates to policies, handbooks and processes for inserting Development Planning initiatives earlier in the program life cycle	• ASA(ALT) OCSE developed a draft handbook in FY11which reflects COE implementation, guidance and processes. This handbook is expected to be finalized FY12. • As part of the DoD Open Architecture Team, the Army's Data Rights Guidebook was used to help developed the DoD Open System Architecture (OSA) Contract Guidebook

Table 1B. Army Service Self-Assessment – FY12 Focus Areas for Improvement

Army FY12 Focus Areas for Improvement	
Establishing processes and tools to help address our system-of-systems integration challenges	• ASA(ALT) will continue to foster and mature the Army's system-of-systems engineering, integration, tools and governance processes.
Better linkages between our system-of-systems efforts and our business decision forums	• ASA(ALT) will continue to foster and mature the Army's system-of-systems engineering and integration capabilities with the Army's decision-making forums and portfolio management processes.
Building the systems engineering bench through human capital development	• Promotion of Systems Planning, Research, Development and Engineering (SPRDE) certification across the systems engineering workforce and systems engineering awareness across the Army acquisition workforce. • Coordinate with OSD SE on training and education opportunities

2.0 Army Systems Engineering Workforce

2.1 Workforce Development Initiatives

The SPRDE and Program Systems Engineering (PSE) requirements were identified in the FY08 National Defense Authorization Act (NDAA) Section 852 (i.e. number of SE and PSE resources required and funding requested).

Section 852 of the NDAA for FY08, Public Law Number 110-181, directed the establishment of the Defense Acquisition Workforce Development Fund. This fund permits the Department of Defense to recruit, hire, train, develop and retain its Acquisition workforce. The U.S. Army Acquisition Support Center is responsible for identifying and overseeing the Army's Section 852 initiatives.

In Apr 2009, the Secretary of Defense (SECDEF) directed the growth of 20,000 defense acquisition workforce positions by FY15. The department-wide Grow the Workforce Taskforce was established to lead and integrate program requirements and execution of Secretary of Defense's Grow the Acquisition Workforce Directive. The DoD (Carter-Hale Numbers) allocated 1,885 new hire growth positions to Army Acquisition, funded with Section 852 funds. The SPRDE community hired the following via Section 852:

(1) FY09 – 14 SE allocated intern positions; 14 SE interns hired (one intern departed early); 11 allocated SE journeyman positions; nine SE journeymen hired (three journeyman departed early). No PSE allocated intern positions; no PSE interns hired; no allocated PSE journeyman positions; no PSE journeymen hired

(2) FY10 – 20 SE allocated intern positions; 22 SE interns hired (one intern departed early); no allocated SE journeyman positions; 13 SE journeymen hired (three journeyman departed early). No PSE allocated intern positions; no PSE Interns hired; no allocated PSE journeyman positions; no PSE journeymen hired

(3) FY11 – 6 SE allocated intern positions; 3 SE interns hired; no allocated SE journeyman positions; 15 SE journeymen hired; no PSE allocated intern positions; no PSE interns hired; 22 allocated SE journeyman positions; no PSE journeymen hired

(4) For FY12-15, the SPRDE community has been allocated the following growth via Section 852:
   a. FY12 – 7 SE interns, no PSE interns; no SE journeymen, two PSE journeymen
   b. FY13 – 5 SE interns, no PSE interns; no SE journeymen, no PSE journeymen

Training: The PEOs use multiple methods to recruit, educate and train new and mid-level engineers in an effort to build the bench in support of systems engineering. To educate and train the systems engineering workforce, the PEOs and other organizations use a variety of resources offered by DoD, academia, industry and industry associations. PEOs take full advantage of the acquisition courses offered by the Defense Acquisition University in the area of SPRDE. Specific Developmental Planning training is planned for FY12 to broaden awareness of the WSARA requirements and the Army plan for FY12. Developmental assignments will be offered in both the Development Planning core team and the individual projects (Integrated Base Defense, Base Infrastructure, and Communications and Computing Infrastructure).

Specific actions taken by the CP-16 Functional Chief's Representative (FRC) and the Army Materiel Command's (AMC) Research, Development, and Engineering Command (RDECOM) to develop an enhanced systems engineering workforce are:

(1) Partnered with the Naval Post Graduate School with funding under Section 852 for a Master of Science in Systems Engineering degree. As of fall 2011, 48 RDECOM engineers are working towards their degree completion with the first class of 23 scheduled to graduate in the spring of 2012.

(2) The RDECOM established a cooperative research and development agreement with the Systems Engineering Research Center (SERC) under the OSD System Engineering University Affiliated Research Center (UARC). This agreement establishes a number of collaborative efforts to develop techniques and approaches that addresses complex system-of-systems problems.

(3) The RDECOM worked with the SERC to develop an intermediate and advanced course that focuses on techniques and approaches to apply systems engineering principles on solving complex system -of-systems problems. Under CP-16 Army Civilian Training Education and Development System funding, two courses have been conducted with RDECOM Systems Engineers, one intermediate and one advanced, with a focus on enhancing these critical skills. The effort established courseware that can now be used by all RDECs and local universities that are part of the SERC to continue to broaden the system engineering talent.

(4) The RDECOM worked with OSD and DAU to refine the coursework contained in SYS 350A (course is required for achieving Level III certification in SPRDE PSE). The course incorporates the systems engineering competencies identified by the International Council on Systems Engineering (INCOSE). The RDECOM selected seasoned system engineering personnel from across the community to participate in the pilot offering to ensure constructive assessment of the course.

(5) Finally, RDECOM established a systems engineering IPT across the command which focuses on establishing corporate processes for executing systems engineering discipline. This effort looks at skills, tools and methods, and includes application of these efforts on command S&T and engineering programs to ensure we develop and mature them across the command.

2.2 Additional Authorities or Resources Needed

As of 31 Dec 10, the Secretary of the Army has put on hold all acquisition civilian conversion (in-sourcing) efforts until appropriate justification can be made for increases to the civilian structure. These policy memos put our contractor to civilian conversion efforts on hold until further notice.

2.3 Impact of FY12 Budget on Systems Engineering Workforce

During FY11, the Army operated under Continuing Resolution Authority (CRA) with significant uncertainty. Although we continue to support the Defense Acquisition Workforce Development Fund (DAWDF) objectives, local hiring freezes and hiring restrictions have hampered our ability to hire at our projected rates. The previously planned objectives for growing the systems engineering workforce were reduced and contractor to civilian conversions were suspended for the time being.

2.4 SE Workforce Positions in the Army as Reported by USAASC

During FY11, the total acquisition workforce assigned to SPRDE positions decreased from 10,647 in FY10 to 10,071 in FY11. The primary reasons contributing to this decrease were personnel losses associated with Base Realignment and Closure Commission (BRAC) workforce moves, Voluntary Separation Incentive Pay and Voluntary Early Retirement Authority, and other types of attrition. A couple of notable BRAC related moves were the closure of Fort Monmouth, New Jersey and the move of Army Material Command Headquarters to Redstone Arsenal, Alabama from Fort Belvoir, Virginia.

Additionally, target hiring levels for civilian acquisition workforce personnel in the SPRDE career fields of Systems Engineering and Program Systems Engineer have been reduced due to budgetary uncertainty. Military positions coded SPRDE are expected to remain steady.

The planned growth in civilians changed from those reported in FY10. The primary reason for this change is the Feb 11 Secretary of the Army directive halting in-sourcing across the Army. For acquisition positions, in-sourcing must be approved by ASA(ALT) and the Secretary of the Army. Additionally, in-sourcing decisions must comply with the Under Secretary of Defense for Acquisition, Technology and Logistics and Undersecretary of Defense, Comptroller/Chief Financial Officer guidance issued on 16 Mar 11.

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APPENDIX B

Department of the Navy
Systems Engineering Self-Assessment

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DEPARTMENT OF NAVY

Systems Engineering
FY11 Annual Self-Assessment Report

28 February 2012

Prepared by the Office of the Assistant Secretary of the Navy

(Research, Development and Acquisition)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Department of Defense Deputy Assistant Director for Systems Engineering (DASD (SE)), along with the Director, Developmental Testing and Evaluation is required to submit an annual joint report to Congress on the activities pursuant to subsections (a) and (b) of Public law 111-23 section 139. DASD (SE) tasked ASN(RDA) to develop the Naval system engineering portion of this annual report in General Tasker 020101c of 9/30/2011. This document responds to the DASD (SE) request.

1.0 Progress and Plans for Improved Service Systems Engineering Capability

Naval Systems Engineering analysis and process is the responsibility of four Naval Commands: Naval Sea System Command (NAVSEA), Naval Air Command (NAVAIR), Space and Warfare Command (SPAWAR) and Marine Corp System Command (MARCORSYCOM). DASN(RDT&E) CHSENG supports policy development. The Naval System Commands collaborate through the System Engineering Stakeholders Group (SESG). In this working group, a System Command that has developed a new process is able to share the process and their experience with using the process with the other System Commands. The SESG then decides whether to incorporate this process as a Naval process, and issues the appropriate instructions to do so.

SECNAV Instruction 5000.2E was issued 1 Sep 2011 and describes the Naval systems engineering policy that supports Department of Defense acquisition instruction DoDI 5000.02. Numerous changes to system engineering were described in this revision, and plans to incorporate those changes into Naval guidance and process instructions will occur in FY 12.

1.1 Pre-Milestone A and Pre-Milestone B Rigorous Systems Analysis and Systems Engineering Process

In an effort to introduce system engineering processes early in the acquisition process, updates to pre-Milestone A activities and events have been included in SECNAV Instruction 5000.2E. Specifically, Naval Gate Review 3, which requires a draft Capability Development Document, DoDAF Operational Views, a System Requirement Technical Review and a System Functional Technical Review is now part of the pre-milestone A activities for all ACAT programs. This allows the translation of operational context to performance requirements to start during the Materiel Solution Analysis phase, where trade-space can be assessed, technology gaps identified, and it provides a better understanding of how cost relates to performance. Additionally, many government system engineering documents, such as the System Engineering Plan and the Test and Evaluation Strategy are provided as Government Furnished Information to bidders when the Milestone A request for proposal is released. The four Naval System Commands are assessing their processes to support the early system engineering opportunity presented by SECNAV Instruction 5000.2E. The Naval System Commands have been offering support to OPNAV and the PEOs to put system engineering rigor into the pre-Milestone A technical activities.

SPAWAR has been tasked by OPNAV N2/N6 to support pre-Milestone A activities by developing an Information Dominance Roadmap to define the Naval capabilities needed to maintain information dominance of a battlespace. As the principle technical architect for OPNAV N2/N6, SPAWAR developed and assisted in several capability-based roadmaps such as Maritime Ballistic Missile Defense, Undersea Dominance and Maritime Domain Awareness that comprise the Information

Dominance Roadmap. These roadmaps offer alignment of capabilities to systems acquisition and functionality useful for both fiscal and engineering decisions.

1.1.1 Ship Design Manuals

NAVSEA's *Ship Design Managers and Systems Integration Managers Guidebook* and the *Concept Design Handbook* describe the implementation of pre-Milestone A engineering analysis and system engineering processes. These Guidebooks present a cradle-to-grave view of the design process for acquisition to serve as a framework for the discussion of Ship Design Manager's responsibilities during the individual phases in the process. They explain that effective concept formulation is structured, continuous collaboration between the design, acquisition, and war fighting communities. Exploratory Design and Force Architecture studies precede Milestone A in the ship acquisition process, and have great impact on eventual program costs. The Guidebooks describe how to examine alternative force architecture concepts, future mission definition, conduct mission analyses, and develop technology assessments.

1.1.2 Systems Engineering

ASN(RDA) established the System Engineering stewardship at the Senior Executive service level by assigning the responsibility to DASN(RDT&E). This assignment aligns system engineering with research, development, test and evaluation efforts to support Naval acquisition. In support of OSD (AT&L)'s Better Buying Power initiative, System Engineering Plans (SEP) for MDAPs are reviewed for compliance with the 20 April 2011 System Engineering Plan guidance provided by OSD (AT&L). Metrics defined in the SEP are reviewed at the Naval Gate Reviews prior to each acquisition Milestone.

NAVSEA has several initiatives in the areas of SE policy development, System Engineering Plans and SETR guidance, SE process governance, and SE workforce development. NAVSEA Directorate of Research and Systems Engineering is now a competency-aligned organization (CAO). The Chief Engineer (CHENG) utilizes the DON's technical authority and Competency Aligned Organization construct to provide the best systems engineering value to support program execution and warfighting capability delivery. NAVSEANOTE 5400, published in FY11, links technical authority and competency alignment policies, roles and responsibilities in the Research and Systems Engineering (R&SE) Competency. There are strong relationships between existing DOD, Navy, and NAVSEA policies and directives for systems engineering (SE) and technical authority. In NAVSEANOTE 5400, the responsibilities of the NAVSEA CHENG, DEPUTY CHENGs and CHENG DEPUTY are established. Deputy Warranting Officer (DWO) technical domains have been re-aligned, and DWOs who are Chief Systems Engineers (CSEs) are clearly distinguished. The NAVSEA Chief Engineer and the R&SE Competency are focused on increasing the SE capability, service delivery and improving SE workforce competency to support NAVSEA programs.

In FY11, NAVSEA Systems Engineering initiatives included proactive engagement in the DOD, Naval and cross-SYSCOM efforts to re-establish Systems Engineering standards, policy, processes, tools, and best practices; promulgate DOD and SECNAV policy and guidance; and develop NAVSEA SE policy, guidance and governance of SE processes. NAVSEA Systems Engineering policy and guidance is compliant with the intent of the Weapon Systems Acquisition Reform Act which is currently being implemented across NAVSEA. Cross coordination of systems engineering processes and critical specialty engineering area processes (e.g., Reliability, Maintainability, HSI, systems safety, T&E) is being accomplished. Communities of Practice and engineering workforce in those areas are working across the enterprise to address standards, policy, integration of analysis and reviews, System Engineering Technical Review (SETR) criteria and certifications. Critical specialty engineering and technical warranted area reviews are now integral to the review of NAVSEA Program Systems Engineering Plans.

NAVAIR continued to be an active participant and to provide leadership in the NAVAL Systems Engineering Stakeholders Group (SESG) whose purpose is to promote standardized SE process, policy, standards, training, education and tools across the Naval SYSCOMs. NAVAIR is in the final phase of development of the "RACER" process which uses commercial SE tools to regain a disciplined requirements development and management process across NAVAIR programs. NAVAIR has commenced phase II of populating its' Technical Authority Data Base which includes Airworthiness certification, Aviation certification and Technology Readiness Assessment processes.

During FY11, SPAWAR initiated a deckplate review of SE processes to reflect standards and best practices of Systems Engineering and to improve documented guidance for Systems Engineering Process across Team SPAWAR. As part of that effort, SPAWAR complemented already existing process improvement efforts at its systems centers to update process and create a Process Asset Library (PAL) for all stakeholders to populate and to capitalize on subject matter expertise.

The Marine Corp Systems Command (MARCORSYSCOM) in conjunction with the Systems Engineering Stakeholders Group and in support of the development of MARCORSYSCOM Order 5400.5 (Naval SYSCOM Systems Engineering Policy), supported the development of a common System Engineering Technical Review (SETR) process within the DON. MARCORSYSCOM Technical Review Handbook 1.04 was developed to provide guidance on the preparation and conduct of technical reviews throughout a program's lifecycle and is used heavily as source material by the SESG. MARCORSYSCOM is an active participant in the SESG and working on enhancements to the SETR process in FY 11 to develop evaluation criteria for SETR events.

The Marine Corp Systems Command uses technical experts and independent system engineers to support a thorough system engineering process. Current processes that involve ACAT I and II programs undergo a rigorous methodology, process, and documentation review at each milestone. Qualified Systems Engineering professionals assigned to programs initiate the engineering

acquisition process within the programs while independent Systems Engineering professionals review and provide input to the ongoing processes and results at Systems Engineering Technical Reviews (SETR) and pre-Milestone events. Technical Area Experts (TAE) and Subject Matter Experts (SME) drawn from core engineering disciplines and from other Naval System Commands are used by the programs and by the command's technical authority organization to ensure system analysis, certifications, and system engineering processes are employed to the benefit of the end product.

1.2 Reliability, Availability, Maintainability, and Sustainability as an Integral Part of Design and Development

The Department of Navy established a proactive Reliability and Maintainability (R&M) Engineering directorate within the DASN(RDT&E) Chief Systems Engineering office to re-energize R&M Engineering as an integral part of the Systems Engineering process. The DON supported the development of the new DoD R&M Engineering policy by chairing the working group that produced the Directive Type Memorandum 11-003 and its initial supporting guidance. DON continues to support the DoD effort by actively participating with the other Service R&M Engineering Leads in DoD's efforts to provide the detailed guidance envisioned as the new policy was being developed.

FY11 DON R&M activity focused on motivating each SYSCOM to organize an R&M Engineering IPT or Working Group within their Systems Engineering organization. The near term goal is to have an R&M Engineering point of contact in each program and PEO and an R&M Engineering Lead in each SYSCOM. NAVAIR has a mature R&M Engineering organization staffed with approximately 220 people deployed in program offices, test facilities and regional maintenance centers throughout the CONUS. NAVSEA established a working group in FY11 and is aggressively taking on the challenge of reinstating R&M Engineering into their policies and procedures as it was decades ago. This effort has their top management support and the numbers of R&M Engineering contacts within NAVSEA is steadily increasing. SPAWAR has identified an R&M Engineering Lead and is in the process of establishing an R&M Engineering Working Group. MARCORSYSCOM's R&M Engineering Lead has organized an R&M Engineering Working Group and is reviewing the Marine Corps policies and procedures to identify opportunities for the inclusion of the new R&M Engineering policies. The MARCORSYSCOM SETR and milestone review processes ensure that programs plan and implement the systems engineering requirements including all R&M Engineering activities and requirements. A similar SETR and gate review process is used throughout the DON. Additionally, the DON Probability of Program Success (PoPS) process encompasses the R&M activities as well as any deficiencies they identify throughout all DON acquisition and sustainment programs.

A specific DON R&M Engineering policy is being developed to implement and expand the scope of the DOD R&M Engineering policy and guidance. To assure consistency with the DOD guidance that we are presently supporting the DOD to develop, formal DON policy and guidance has not yet been

issued. The DON R&M Engineering Lead, along with the SYSCOM Leads and the DON T&E leadership are working together to develop a joint R&M and T&E policy, tailored to the ACAT level. This joint policy is to assure a cohesive and coordinated process is in place to implement both discipline's obligations under the new DTM 11-003. Even prior to the issuance of the joint policy, a coordinated process is evolving to assure the SEP and TEMP planning documents and implementation are consistent and compliant with the demands of their associated signatories. DON policy requires all ACAT programs (ACAT I, II, III, and IV) to prepare SEPs. The newest DOD-provided SEP Outline contains all of the associated R&M Engineering policy requirements and is the reference document for these SEPs.

To facilitate communications and provide an opportunity for every member of the R&M Engineering workforce to participate, an R&M Engineering collaboration site has been established on the Naval Systems Engineering Resource Center (NSERC) website. The main or all-DON area contains legacy and current policy, guidance and references as well as notices and links to tools and training plus collaboration tools. The SYSCOMs each have an area within this site for their working group documents and projects. In addition to the SharePoint collaboration website, the DON provides a collection of R&M Engineering tools through the Integrated Reliability Software Suite (IRSS), also hosted on NSERC. The IRSS tools are available to the DON workforce, at no fee to the user, to assure a standard and efficient approach to the many facets of R&M Engineering. The centerpiece of the tool set is the ReliaSoft Reliability Growth Analysis (RGA) 7.0 tool used by DOT&E that enables reliability growth planning, tracking, and data sharing with the operational test and evaluation activity that also uses these tools. There is far more to R&M engineering than growth curves, so there are many more tools supporting the activities and techniques that are necessary to improve or grow the reliability of Naval systems. The IRSS is used by engineers throughout the lifecycle including the in-service engineers at our Regional Maintenance Centers.

Reinstating R&M Engineering policy requires the workforce to learn skills they may not have been exposed to if they joined the workforce after the Acquisition Reform of the 1990's. There are a limited numbers of DON engineers who were once active in R&M engineering practices that were stood down or transitioned from the government to the developing contractor. The new policy requires the Navy to transition these engineering activities back into the government systems engineering processes which require training and tools to rapidly fill the experience gap we have. The DON's IRSS can help us achieve the necessary effectiveness quicker and more efficiently, but only if engineers are deployed and trained to implement the new DoD R&M Engineering policy using these tools. Efforts are underway to develop and provide basic R&M Engineering fundamentals training as well as training for the specific activities now required by the DTM. A "train the trainer" approach is also underway for the tools in the IRSS. Filling the experience gap and the raw numbers of engineers is a recognized problem in all areas of systems engineering, especially in the R&M Engineering discipline.

1.3 Systems Engineering Requirements in JCIDS and Contracts

In FY 11, DASN(RDT&E) CHSENG updated the Net Ready KPP Guidebook, which provides a method for developing measurable and testable Net Ready Key Performance Parameters in support of the JCIDS process. The Net Ready KPP Guidebook is posted on NSERC at https://nserc.navy.mil.

SPAWAR, NAVAIR, MARCORSYSCOM and NAVSEA rely on their Competency Aligned Organizations to derive system engineering requirements from operational requirements during execution of the JCIDS process, and ensuring these SE requirements are defined in the procurement and sustainment contracts. In FY 11, SPAWAR Technical Authorities participated in the Procurement Planning and Strategy Meetings (PPSMs). The purpose of the PPSM is to allow the Technical Authorities an opportunity to review documentation in support of an RFP. This allows the Technical Authorities to insert the appropriate language (where necessary, as in CDRLs or DIDs) in order to ensure system engineering concerns are part of the contractual request. PPSM's were conducted for the following programs:

1. Environmental Satellite Receiver Processors (ESRP)
2. Battle Force Tactical Network (BFTN)
3. Advanced Time Division Multiple Access (TDMA) Interface Processor (ATIP)

MARCORSYSCOM Order 4200.2C (Command Procurement Request Process) mandates reviews by all competencies. The engineering competency participates on the review teams to ensure Request For Proposals (RFP) contain sufficient requirements to provide the required products. The policy is published but implementation of the policy remains a milestone for full compliance.

In addition, The Principal Deputy Under Secretary of Defense (AT&L) published a memorandum (Improving Milestone Process Effectiveness) on 23 June 2011 mandating that a new review be instituted, depending on the milestone, to review the readiness for a program to generate an RFP. The Naval System Engineering team will continue under this new direction to provide the necessary expertise to ensure RFPs meet requirements.

1.4 FY 11 System Engineering Focus Areas for Improvement

This section addresses the progress made in FY 11 on the improvement areas cited in the FY 11 Annual System Engineering- Self Assessment.

1.4.1 Implementation of SoS Engineering in FY 11:

SPAWAR has instituted System of Systems (SoS) SE Technical Reviews. SPAWAR's technical experts conducted an in-depth technical review of the AEGIS Ashore program, a complex SoS responsible for delivering missile defense to Europe. The review spanned multiple programs across several agencies and Navy SYSCOMs and identified technical risks to drive SoS design. This improved focus also included newly developed questions designed to improve the interoperability of Naval systems. The review, focusing on the ability of the SoS to satisfy an overarching Mission

Thread, emphasized a mission focus for systems engineering at both component system and SoS levels.

The concepts and fundamentals of technical and certification authority are being fully used to strengthen fielding interoperable systems of systems aboard naval platforms and among naval strike forces. The complex interfaces between C4I and weapon systems require both system engineering processes and good execution of them. SPAWAR developed processes, checklist criteria, and conducted systems of systems testing. A SPAWAR end-to-end testing capability linking geographically distant testing labs is being utilized. The SPAWAR Net-centric and Integration competency was established and populated with engineers focused on SoS/platform integration and interoperability

While most SETR events are being conducted at the system level, rather than the SoS level, the Naval SYSCOMs collaborated in FY 11 to define evaluation criteria for SETR events that identify System of System technical maturity. This effort is continuing in FY 12 to identify evaluation criteria for networks within a platform and the interoperability between the platform, system, and systems external to the platform.

1.4.2 Improve awareness and implementation of HSI practices in FY 11

NAVSEA has chartered and convened a cross-NAVSEA enterprise Human Systems Integration Integrated (HSI) Product Team. This team provides a forum for the NAVSEA Systems Engineering, Hull, Mechanical and Electrical, Integrated Warfare Systems, and related Engineering and Technical Authority areas to collaborate toward developing sound NAVSEA-wide HSI related policies, processes and domain area standards. The purpose of the HSI IPT is to support the implementation of DOD, SECNAV, OPNAV, and NAVSEA HSI policy and to develop integrated processes with SE across the acquisition framework processes and reviews. The HSI IPT initiated an HSI guide, an HSI workforce gap analysis study, a contract language guide book for HSI and will work on NAVSEA HSI policy improvement. HSI Subject Matter Experts (SMEs) are now fully engaged in System Engineering Plan and Test and Evaluation Master Plan reviews to ensure risks related to human performance, usability, and safety are considered early and throughout the program lifecycle.

MARCORSYSCOM retains HSI services from Naval Service Warfare Center (NSWC) Dahlgren Division (DD) (a NAVSEA Field Activity) to act as its Technical Area Expert (TAE) and representative to DON Naval SYSCOM as the Marine Corps representative. NSWC DD provides bi-weekly reports on USMC issues in relation to HSI. NSWC DD has been instrumental in the development an HSI instruction for use by USMC. Programs are reviewed for inclusion of HSI in their SEPs. This program is well instituted at MARCORSYSCOM and development of an HSI instruction is continuing. Continued review and enlightenment of programs remains a prime review factor in system engineering documentation and procedures. The MCSC Program Guide to HSI has

been staffed to the command. The TAE for MARCORSYSCOM in the HSI arena is updating the guide for issue. Additionally, the TAE has developed a draft HSI order that is in review.

1.4.3 Support the implementation of open architecture in FY 11

ASN(RDA) assumed stewardship of Open Architecture policies and guidance by transferring the responsibility to DASN(RDT&E) from PEO(IWS). From this position, the Navy has the ability to work across all PEO's and SYSCOMS to support the institutionalization of open architecture concepts into system design and system technology insertion.

DASN(RDT&E) CHSENG updated the *Open Architecture Contract Guidebook for Program Managers*, which is in the review and approval process. Additionally, DASN(RDT&E) is leading a DoD OA team to promote competition by requiring open systems architectures and setting rules for the acquisition of data rights.

DASN (RDTE is collaborating with the OAET to develop an OA Testing Guide for OPNAV N091. The OAET focused on instrument test strategies, building testing tools into OA, reuse of tools across multiple platforms, and standardization of test recording to enable fast debugging.

NAVSEA produced a Program Manager's Open Architecture Implementation Guide to assist Program Managers with developing systems with open architectures.

1.4.4 Continuous improvement of software engineering practices in FY 11

In conjunction with the SESG, DASN(RDT&E) CHSENG updated the Software Process Improvement Initiative Guidebook to reflect latest DoD acquisition policy and best practices. This document is available on https://nserc.navy.mil.

MARCORSYSCOM programs are implementing ASN (RD&A) Memorandum on Department of the Navy Policy for Acquisition of Naval Software intensive Systems. The MARCORSYSCOM Order is currently in routing for final signature, however, during program technical reviews; compliance to draft policy is enforced. Two Computer Based Training Projects have been completed: Requirements Management, and Implementation of Software Process Improvement Initiatives.

1.4.5 Support the implementation of prototyping in FY 11

The SESG produced a Prototyping Guidebook which captured lessons learned from mature programs and best practices for prototyping. The information in this Guidebook can be used to support competition in prototyping which will also support competition in other stages of acquisition in support of the OUSD(AT&L) Better Buying Power memorandum of 14 Sept 2010.

1.4.6 Support the development of a mission focus in Systems Engineering in FY 11

Naval SYSCOMS worked with the acquisition Program Managers to provide DoD Architecture Framework products that are integrated from the solution level to the DoD Integrated Enterprise

Architecture. The Naval Architecture Repository System website, https://nars.navy.mil, was redesigned to make storing and searching for architecture products and policy more intuitive.

1.4.7 Improve the interoperability of Naval systems in FY 11

The Navy process of establishing Joint C4ISR requirements, implementing Joint standards, configuration management of C4ISR standards, and certifying C4ISR systems for standards conformance supports Joint interoperability. Mandates exist to ensure C4ISR systems achieve Joint certification prior to Full Rate Production (FRP), or prior to Joint operational use. New Navy systems and changes to existing systems that must interact with or be integrated into the DOD C4ISR. Navy infrastructure will use Joint information technology standards. Navy unique standards will be used only when no other standards satisfy C4ISR systems Information Technology (IT) requirement and when approved through the requirements review process.

In early FY11, the Navy recognized that standards alone would not guarantee interoperability and, in January 2011, the Vice Chief of Naval Operations (VCNO) convened an Integration and Interoperability (I&I) Summit. Six major actions were identified:

- Action 1: Identify effect chains of interest. Through close coordination with USFF/CPF/5th Fleet, twelve effect chains have been identified crossing critical Air, Surface and Undersea warfare areas to include Command and Control. This action is closed.

- Action 2: Establish SYSCOM Force Level I&I Executive Leads. This was accomplished in FY11. Mr. Carl Siel (NAVSEA), Mr. Scott O'Neil (NAVAIR),) and Mr. Mike Spencer (SPAWAR) have been identified by their respective commands. This action is closed.

- Action 3: COTF baseline critical warfighting capabilities are being identified by USFF/CPF - COTF has established a Warfare Capability Baseline Team (WCB) from a diverse list of critical stakeholders to include; SYSCOM Mission Engineers (ME), Principal Investigators (PI), COTF Mission Integrators and Warfare Centers of Excellence (WCOE) representatives. This action is closed.

- Action 4: Establishment of Capability Management Teams (CMTs) and process for capability management. CMTs are envisioned to be the mechanism for bridging the WCOE operational expertise of warfighting capability with the SYSCOM/Warfare Center technical expertise of warfighting capability. A CMT has been established and meets at least quarterly. This action is closed.

- Action 5: I&I Governance construct. This action is in process, with continuing discussions between OPNAV N8 and ASN (RDA). In June 2011, a meeting was held between OPNAV, COTF, FFC, and ASN(RDA) to discuss an I&I Governance construct that would support the

next POM cycle. The attendees assessed the functionality of I&I concept activities and products and recommended refinements to concept and critical activities with focus on organizational alignments, accountability and capability to pass results between steps. A process flow chart was developed and is being executed for POM 14. Documentation of and policy development for this process will be accomplished in FY 12.

- Action 6: Convene a CNO Executive Board chaired by VCNO (CEB-V) to provide an update on I&I progress and summit actions. This CEB initiated on 20 April 2011. This action is closed.

In the fourth quarter of FY 11, DASN(RDT&E) funded four tasks to support the Capability Management team established by Action 4, above. Tasks will be completed in FY 12 and are described below:

1. Propose solutions, based on system engineering analysis, to close the gaps identified in three of the effect chains of interest defined in Action 1, above.

2. Develop an integrated framework to enable Integration & Interoperability (I&I) activities.

3. Develop I&I criteria and inject into current acquisition review processes such as SETR, Gate Reviews and Probability of Program Success (PoPs).

4. Develop survey and data base to poll SYSCOMs to determine the existence of organic tools and processes related to I&I. Define how those tools and processes can be integrated across the Navy.

1.4.8 Improve Documented Guidance for Systems Engineering Processes in FY 11

In FY 11, the System Engineering Stakeholder Group commenced updating the Naval Systems Engineering Guide to reflect current DOD policy. The revised Engineering Guide will include guidance for developing SEPs, will document the processes to develop and manage the technical baseline, provide new guidance for development of a System Design Specification, and describe how operational requirements are translated into specifications and designs.

1.4.9 Standards for Systems Engineering in FY 11

The SESG participated in DOD and Cross-Service teams to identify and prioritize the military standards and specifications previously cancelled that need to be re-instated to improve systems engineering rigor at system developers. The Standards Working group has recommended implementation of revised versions of MIL-STD 499 and MIL-STD 1521 to improve the Systems Engineering Management Process and Systems Engineering Technical Review Process, respectively. Re-establishing these standards will provide contractually binding guidance for procurements to reduce the government technical risk during execution.

1.4.10 Systems Safety in FY 11

NAVSEA has established governance for the Principal for Safety (PFS) to ensure the Program safety risk is fully understood and mitigation strategies are in place. Systems Safety and the HSI community are now working in tandem and across the community of practice working groups and IPTs. NAVSEA has representatives from SE, System Safety and HSI on Defense Safety Oversight Council Task Forces. NAVSEA Division Head, for Systems Engineering, Systems Safety and Assurance Policy co-chairs the Naval Systems Safety Advisory Council and ensures Systems Safety processes are integrated into SE processes and coordinated with the HSI, R&M and Test and Evaluation communities. SETR evaluation criteria have been developed for Systems Safety and HSI.

1.5 FY12 System Engineering Focus Areas for Improvement

Plans for FY 12 include:

1. Develop an integrated framework to enable Interoperability and Integration activities. I&I activities being conducted at all of the SYSCOMs for multiple sponsors are being evaluated to determine best practices and the means to integrate the output. A framework is needed to integrate the processes, facilities, workforce capabilities, and Fleet needs to support integrated acquisition, design and test. Guidance will be issued third quarter of FY 12.

2. Actively engage the SYSCOM technical authorities in all phases of the acquisition process, including early developmental planning. The SYSCOM technical authority structure has been fully established, PEO's will be encouraged to use this structure to support programs. DASN(RDT&E) CHSENG will use the SYSCOM technical authority structure in all of its technical tasking. The technical authority structure will be posted on the NSERC collaboration site 2nd quarter FY12.

3. Continue improving guidance and best practices for Reliability and Maintainability. The establishment of the SYSCOM R&M working groups will support the complete integration of R&M into all system engineering products that support acquisition. A draft joint DON R&M and T&E policy to implement the R&M DTM 11-003 at all ACAT levels will be developed in 4th quarter FY 12.

4. Integrate SETR evaluation criteria with the other system engineering processes. The Naval System Engineering Guide is being revised by the System Engineering Stakeholder Group to link processes. Estimated completion date of this revised guide is 31 Dec 2012.

5. Document the Integration and Interoperability governance process that allows the Fleet to use SYSCOM system engineers in conjunction with Fleet experts to analyze current gaps in I&I effectiveness. A policy memorandum will be released in the fourth quarter of FY 12.

6. Continue developing guidance and processes that support System of Systems (SoS) design and procurement. Space and Warfare Command is actively engaging in a System of System process in FY 12 supported by guidance developed by DASN(RDTE) CHSENG. Lessons learned from SPAWAR's application of a System of Systems engineering process in pre-milestone A development planning will be consolidated into additional SoS guidance and DASN(RDTE) CHSENG's guidance will be revised in 4th quarter FY 12.

2.0 Systems Engineering Workforce

2.1 Workforce Development Initiatives

The DASN RDT&E and the SYSCOMS are committed to excellence in Systems Engineering Workforce Development. In FY11, the Navy focused on training, certifications, and education. In addition, some organizations within the Navy developed specific SE workforce strategy, implemented structural changes to support the SE workforce, and provided policy on career development for Systems Engineers.

2.1.1 Analysis, Guidance, and Policy

The DASN RDT&E CHSENG Office collaborates among many groups in order to provide an interface for DASN RDT&E, to be a resource by sharing information and best practices, and to be a sounding board for initiatives in order to eliminate redundancy and consolidate efforts. The Director, Systems Engineering Human Resource Management, participates on the Systems Engineering Stakeholders Group (SESG) led by members representing the SYSCOMs; the Systems Engineering Education Council (SEEC), a working group of the SESG; the Acquisition Career Field Council led by the DACM; and SE & PSE Functional Integrated Product Team and Software Acquisition Training and Education Working Group led by the Office of Secretary of Defense for Systems Engineering. In FY12 DASN RDT&E was designated as DoN Functional Community Manager for Engineering (non-construction), whose role is to lead and monitor the integration of competency-based strategic human capital planning into the full spectrum of employee lifecycle management within the functional community.

A Workforce Competency Assessment of SPRDE Career Field was conducted and survey results were analyzed. The survey had a 27% response rate. Competencies impacted by attrition of senior workforce were identified and recommendations on how to mitigate impact have been made. The CHSENG office is coordinating with stakeholders to develop gap-closure strategies for high importance and to develop proficiency standards for the SPRDE Career Field.

According to the SPRDE Workforce Competency Assessment Report released by CNA this year, six competencies will be greatly impacted by projected retirement of 11% of SPRDE workforce over next five years: Systems Engineering Leadership, Problem Solving, Strategic Thinking, Professional Ethics, Communication, and Integration. The Navy is mitigating the impact of senior systems

engineers retiring by improving the workforce through a portfolio of training curricula, experiential development, and personal/professional leadership assignments. Through this portfolio, we specifically target portions of the identified competencies. The Navy stresses systems engineering practices and innovations and draws a thread through these high level disciplines to all technical skills. We also mitigate the impact of senior engineer retirements and attrition through multiple activities and strategies.

First, the Navy plans to continue to attract and hire talented individuals to the extent that we are able. Our SYSCOMs are creating opportunities for new employees to gain knowledge quickly and learn from more mature engineers' experience. In an effort to streamline their organizational structure, we are participating in the new Recent Graduates program and the SMART program. NAVAIR pairs experienced journey level and successor candidates with our most senior systems engineers, engaging in key roles such as integration team leadership, airframe leads, battle space architectures and interfaces, weapons integration, and interoperability/integration across diverse systems such as network enabled weaponeering and air-ship integration. This creates a solid pool of replacement candidates and smooth transitions to the highest levels of responsibility available to the SPRDE workforce. Opportunities to develop expertise are promoted via command initiatives in areas such as Interoperability and Integration (I&I).

Sixteen percent growth was planned for the SPRDE Career Field between 2010 and 2015, according to the DoN Acquisition Workforce Strategic Plan (AUG 2010). As of FY11, the career field has experienced a 2% growth. In addition to supporting the obtaining of DAWIA certifications, the Navy has developed and will continue to develop educational programs that supplement experience to improve the workforce competencies. Targeted training in systems engineering, senior systems engineering and senior logistics management were offered.

For example, NAVSEA ran a Marine Engineering Lecture series last year that provided basic knowledge on key shipboard equipment and systems. The SYSCOMs host advanced leadership development programs. The Marine Corps promotes an Executive Leadership Development Program. Ethics and Communication skills are pursued command-wide at NAVAIR through a mix of mandatory training, voluntary seminars, and dedicated training in our Naval Leadership Development Program (NLDP). Strategic Thinking is not specifically addressed through any one venue, but is inherent in command initiative teams, NLDP training, and I&I pursuits to achieve warfighting wholeness.

The Navy advocates advanced education programs to develop critical thinking and problem solving skills in our engineers. We provide opportunities to pursue a Master of Science in Systems Engineering via a partnership with the Naval Postgraduate School and other esteemed institutions of advanced learning, funded in part by AWTAP and CTAP.

The Navy feels confident in our ability to replace our departing senior engineers without adverse impacts, and we are addressing the portfolio of skills and competencies identified in the SPRDE Workforce Competency Assessment Report with initiatives in place and strong leadership support.

Another development was to revamp strategy to meet the current needs of the workforce. A SE and Engineering Workforce Development Strategy is being developed under the NAVSEA CHENG DEP. In addition, NAVSEA Warfare Centers are currently assessing the health of the SE workforce and establishing training and education requirements. NAVSEA has initiated an SE and Engineering Workforce Development senior leadership team across the NAVSEA R&SE competencies to develop a Workforce Development Strategy.

Another way to address changing needs was to identify goals and reorganize according to new priorities. In FY 11 SPAWAR assessed the need for a systems engineering workforce that can support the acquisition of system of systems. SPAWAR's engineering competency FY12 goals include: 1) Creation of a System-of-Systems (SoS) construct for Information Dominance; 2) Development of an effective operating model that supports the SoS construct; and 3) Development of the people, processes, and tools that support the SoS operating model. As organizational changes arise from implementation of these strategic goals, focus areas will include alignment of the workforce to support the SoS construct; defining and designing the environment to support the workforce, and employing the needed tools and processes to provide the strongest possible support to the fleet.

2.1.2 Training

Using 852 funds, the Acquisition Workforce Tuition Assistance Program (AWTAP) supported 703 students taking 1125 courses, averaging $2.6K per student, with 86% in Master's courses. Thirty-eight percent were members of the SPRDE Career Field, taking 271 courses in FY11.

The Navy supports many students in the Masters of Science in Systems Engineering (MSSE) Program at the Naval Postgraduate School. The MSSE program is designed to prepare graduates to meet technical challenges by giving them the education needed to design, build, operate, maintain, and improve reliable capable, effective, and affordable complex systems of systems.

Courses were developed at many of the SYSCOMs to meet their local training needs, supported by Section 852 funds. NAVSEA oversaw the formation of three courses: Marine Engineering Lecture Series (194 employees attended at least 1 class, 61% attended more than 1 class), NPS Cost Estimating (Master's program), and NPS Human Systems Integration (Master's program). Three more are currently in development: Engineering Management and Technology Transition, Risk Management, and Composite Materials.

NAVSEA SE and TA policy and guidance is being translated into training packages for NAVSEA enterprise workforce to be delivered throughout FY12 and FY13. NAVSEA R&SE Directorate is

planning a SE and Engineering indoctrination course to be launched in FY12 for new hires, and opened to the entire workforce. The training will address Technical Authority, Risk Management, and Systems Engineering and Critical Specialty Engineering training.

The NAVSEA Warfare Centers have formed partnerships with civilian institutions, such as Virginia Tech and Penn State, to provide SE courses and certifications. Training is available in classroom and on line via NSERC and INAVSEA. Training requirements are being incorporated into the competency development models (CDMs) for the employee's career development.

To meet the NAVAIR Chief Engineer career path requirements, NAVAIR provided risk management, ECPs for engineers, Systems Engineering Technical Reviews, System Engineering Plans and Technical Project Management training modules to its engineering and science workforce in FY10. Further, NAVAIR has developed Systems Engineering training, tailored to specific domains/product areas, and deployed that training throughout the 4.0 workforce. The guiding principle being that ALL IPT members utilize systems engineering concepts and processes.

In FY11 NAVAIR Research and Engineering Competency funded several training initiatives via 852 funding: reliability growth management and contracting; application of reliability growth models in DT and fielded systems; cost and schedule; systems engineering overview; "weaponeering" overview; project management for engineers and scientists working in project offices; and modeling and simulation fundamentals principals.

SPAWAR's on-going development of standard systems engineering processes forms the basis for competency training. Supplementing DAU training these standard processes will be available through the Naval SYSCOM Engineering Resource Center (NSERC) and incorporated into the competency development models (CDMs) that guide employee's career development. Computer based, classroom, and web conference training called out in these CDMs form the individual development plans for all SPAWAR employees.

USMC has yearly leadership development for the SE workforce through the Executive Leadership Development Program. They also selected a senior engineer to attend a nine month Fellowship for a program sponsored by the MITRE Corporation. They plan to increase training and development outlays by 5% in FY12. In addition, they intend to offer rotational assignments to current employees and career broadening assignments.

Other than where performance, ownership costs, and safety of flight have been the motivating factors, focus on government R&M Engineering has been dormant for over 15 years. Few experienced R&M Engineering practitioners have remained in the federal workforce. Reconstituting an R&M Engineering workforce under the present manpower and budget constraints is a challenge. Before a quantitative estimate of necessary manpower can be made, an assessment of the current level of engagement and the effectiveness of that effort must be made on each program. Estimates of new

activity based on each program's current mile stone will also have to be compiled. That assessment is underway.

The DON will issue policy that requires an R&M Engineering point of contact in each program and PEO. This will most likely be a collateral duty for an existing systems engineer who may not be as experienced or as trained as we prefer, however it is the starting point of developing a new R&M Engineering workforce. The intensity of government R&M Engineering activity required is greatest from the materiel development decision to Milestone A. This activity is critical to getting the war fighter requirements translated into design controllable technical specifications that can be put on contract, measured and enforced. Many of today's problems labeled as reliability problems are the result of not doing this critical translation but simply passing the war fighter requirements to the contractor in terms that do not adequately describe a design requirement. The contractor's interpretation of those contract requirements has too often not produced the required level of reliability or maintainability. The DTM clearly puts the responsibility for this translation on the government. Training for this critical process is the highest priority and is being addressed at the DoD level by the R&M Engineering Lead with the support of the Component R&M Engineering Leads. There is unified agreement that the most experienced and knowledgeable R&M Engineers should be assigned these tasks. The limited number of new starts reduces the numbers of engineers that need to be proficient at this high skill level. Developing a team who would do this translation for all the programs is one approach being considered.

Currently available DAU R&M training was developed for the Logistics workforce when they were unable to obtain the reliability and maintainability estimates from R&M engineers to do their sustainment planning and Availability calculations. That training is adequate for their purposes, but it is not adequate for the R&M Engineering workforce. It does not focus on the translation discussed above or the engineering activities that impact the design. The basic discussion is informative but it does not go into sufficient detail to equip the R&M Engineer with the necessary tools to implement the new policy. This shortfall is being addressed by DoD with the support of the Component R&M Engineering Leads.

DON planning includes R&M Engineering fundamentals training that was developed and used by the DON, prior to the stand down. This legacy course material is being updated and will be available to all SYSCOMs by the end of the year. Additional training and reference materials are available online at both commercial and DON websites. Training for platform specific considerations and processes may be handled at the SYSCOM level.

To mitigate the impact of limited experience of some of the R&M workforce, and to increase the efficiency of the experienced R&M Engineers, the DON has invested in commercial software specifically developed for the R&M Engineering community. ReliaSoft Reliability Growth Analysis (RGA), Weibull++, and BlockSim are the initial investments in the DON Integrated Reliability Software Suite (IRSS). These software tools and anticipated additions to the IRSS will enhance our

ability to implement the DTM and expedite the learning and experience of our workforce. The IRSS is available to all DON including program and senior management to help them understand the process and their program's progress. As R&M Engineering activities and processes become routine, many of the specialized training modules will also be modified for program management and systems engineering courses.

2.1.3 Education

In FY11, the DASN RDT&E Office funded the first year of a new cohort in addition to the final year of a previous cohort in the Systems Engineering Management- Product Development Leadership Education for the 21st Century (SEM-PD21), a program at the Naval Postgraduate School (NPS). Each cohort last two years and has seven billets which were distributed among NAVSEA (2), NAVAIR (2), SPAWAR (2), and MARCORSYSCOM (1). This program meets system engineering degree core requirements with a balanced mix of engineering and management courses focused on understanding and improving product development (acquisition) from both Defense and commercial industry perspectives.

NAVSEA's Systems Engineering policy lead co-chairs the Naval Post Graduate School (NPS) Systems Engineering Oversight Board (SEOC) for the Masters in Systems Engineering programs. The SEOC effort is focused on aligning the NPS SE and Systems Engineering Management education, and enhancing the value of the NPS graduates to the Navy. The NAVSEA Co-Chair ensures NAVSEA SE workforce needs and education requirements are addressed in the NPS curriculum.

NAVSEA also has sponsored civilian programs at the bachelors, masters and certificate levels to enhance the skills of our workforce. NAVSEA has sponsored courses with the Massachusetts Institute of Technology Professional Summer courses, Naval Post Graduate School, and other renowned organizations and schools.

In partnership with the Naval Postgraduate School (NPS), NAVAIR continues to sponsor a Master of Science and Systems Engineering (MSSE) program and has graduated its first two cohorts this year while maintaining 100 students in the program. NAVAIR provides single funding source for the MSSE program with Title 10; section 852 resources. Preservation of this DOD initiative is considered to be responsible for the current and future success of the NAVAIR MSSE program as well as to meet emerging requirements of its technical work force. NAVAIR continues to work closely with NPS to establish advanced degree and certificate programs in physics, mathematics, and other technical disciplines including the Joint Executive Systems Engineering Management graduate degree program.

The workforce development strategy of the USMC included many employees taking college level classes towards degrees. They added a nine person cohort to the SE Master's program at NPS and will continue targeted training by expanding into requirements management and CMMI classes.

2.1.4 Certifications

DASN RDT&E CHSENG continues to work on an achievable career path model for Scientists & Engineers (S&E) in the acquisition workforce (AWF). The Navy is working with Defense Acquisition Career Manager (DACM) Office to establish criteria for professionalization that will impact this model.

The DoN Director Acquisition Career Management (DACM) in July 2010 established four overarching goals targeted to key areas of the DON Defense Acquisition Workforce Improvement Act (DAWIA). Each quarter, the Acquisition Competency Council reviews the progress by SYSCOM and career field in order to track progress.

The first goal is for 95% of AT&L Workforce members to be certified to the level required by their position within the 24-month grace period. SPRDE-SE is at 88% and SPRDE-PSE is at 81%. The second goal is for 75% of AT&L Workforce members to have current Continuous Learning certificates. SPRDE-SE/PSE is at 54%. The third goal if for 85% of Critical Acquisition Positions (CAP) to be Acquisition Corps members at the time of assignment to a CAP. SPRDE-SE is at 82% and SPRDE-PSE is at 83%. The fourth goal is in regards to Program Managers and does not apply to the SPRDE career field. The SYSCOMs continue to work towards these goals, balancing the requirement with supporting the needs of the warfighter.

NAVAIR Instruction 12338.1A, Systems Engineering Personnel Qualification and Certification Process of March 6, 2009, implements policy, outlines the process, and assigns responsibilities for training, qualification, and the certification and certification of NAVAIR Research and Engineering (AIR 4.0) system engineering personnel associated with engineering and technical authority policy. This includes defining the process and documentation for System Engineering certificate holders while supporting program managers and the fleet in providing engineering and technical products. NAVAIR developed SE courseware that aligns with the NAVAIR SE certification policy which includes the following courses: SETR process; Risk Management, Engineering Change Proposals; SE Indoctrination; Integrated Program Team staffing; and Leadership and Communication skills.

OSD released a memo on 25 August 2010 regarding Government Performance of Critical Acquisition Function. MDAP/MAIS positions (Acquisition Categories I and IA), when the function is required based on the phase or type of acquisition program, are identified as Key Leadership Positions (KLPs). Quarterly the Director of Acquisition Career Management (DACM) has tracked the progress of identifying the Program Lead Systems Engineer and ensuring that they met the minimum qualifications. Of the 101 programs, only three are currently not filled due to attrition.

The SYSCOMs approached the requirement in slightly different ways. NAVSEA implemented the requirement for Program Lead Systems Engineers via NAVSEANOTE 5400, DTD 7 OCT 2010, which lists the Chief Systems Engineers (CSEs) who are identified as having Key Leadership Positions in their Position Descriptions (PDs) and in their DAWIA record. Marine Corps Systems

Command (MCSC) Workforce Development (WD) has developed and implemented a process by which they meet with the MCSC Engineering Competency on a quarterly basis to review and ensure engineering positions are appropriately designated as KLP positions and that the personnel in those KLP positions meet the DAWIA criteria for that role.

Prior to release of the 25 August 2010 memo, NAVAIR published NAVAIRINST 12338.1A, "Systems Engineering Personnel Qualification And Certification Process", 6 Mar 2009, which laid the framework for certification of DAU SPRDE-PSE qualification for SYSCOM Chief/Lead Systems Engineers. Systems Engineering Technical Authority (TA) and Personal Management is competency aligned to the Systems Engineering Dept. (AIR-4.1) within the NAVAIR organizational structure. Upon release of the 25 August 2010 memo, efforts were taken to update and align the governing NAVAIRINST, coordinate designation of Chief/Lead Systems Engineers as KLPs, and certify existing personnel as SPRDE-PSE qualified. Technical Warrant Holders were designated to perform this certification, positions requiring certification were identified, and personnel currently assigned to these positions were evaluated for certification. NAVAIR is currently in the final phase of this effort and expects to complete certification of this initial cadre of SPRDE-PSE engineers by 31 Jan 2012.

2.1.5 Developing, Recruiting and Hiring Future Workforce

The National Defense Authorization Act (NDAA) of 2008, Section 852 established the Defense Acquisition Workforce Development Fund (DAWDF) The DAWDF provides funds for the recruitment, training, and retention of acquisition personnel. The purpose of the fund is to ensure that the acquisition workforce has the capacity needed to properly perform its mission, provide appropriate oversight of contractor performance, and ensure that the Department receives the best value for the expenditure of public resources. DAWDF has provided an unprecedented opportunity for DoN and its SYSCOMs to invest and connect the precepts of SECNAV goals to reinvigorate the acquisition workforce.

In FY11 the Navy offered 140 student loan repayments totaling $5.6K and 147 recruiting incentives totaling $7.1K. NAVAIR primarily applied 103 of the 131 recruiting incentives used for SPRDE positions. The Navy also offered 101 PCS/relocation incentives totaling $18.2K to its workforce, with 25 of them applied to employees in the SPRDE career field, primarily from SPAWAR. Six retention incentives totaling $5.5K were approved, with NAVAIR sponsoring one for a SPRDE member.

The Naval Acquisition Development Program, encompassing both the Naval Acquisition Intern Program (NAIP) and the Naval Acquisition Associates Program (NAAP), are paid entry level and journeyman programs. The NAIP improves the Naval SE Community by providing funding for the development of entry level engineer through systematic development, career broadening assignments, and graduate education through a structured systematic career development process. In FY11 the Navy hired 81 interns, 19 more than originally planned. The NAAP is designed to recruit and develop mid-career professionals with significant experience in the public or private sector through a two-year

career development program to meet mid-level DoN Acquisition Workforce manpower requirements in various acquisition career fields. Thirty-three were hired in the SPRDE Career Field in FY11.

The Navy supported the Science, Mathematics and Research for Transformation (SMART) program in FY11. The SMART Program improves the Naval S&E Community by attracting high caliber candidates in areas of academic specialization based on National Security and war-fighting mission needs. The program is academically very broad (covering AS, BS, MS and PhD) which provides the Navy a greater flexibility in workforce planning and shaping. By participating in the SMART Program the hiring managers are able to pace their staffing needs, which will become increasingly beneficial with mandated personnel caps. Because the SMART program is a very competitive program and each candidate is matched with a mentor within their technical field it enables us to groom the next generation of engineers in support of the war fighter and mission requirements. Some SMART students have been part of the STEM initiative prior to their selection for the program by interning at DOD facilities through the Science & Engineering Apprentice Program (SEAP) and Naval Research Enterprise Intern Program (NREIP) Programs or have been civilian employees that were selected as retention participants. In essence by participating in the SMART Program the Navy is ensuring that their future engineers are the "best of the best" and the field of research and engineering will continue to grow. As a requirement of the SMART Program students whose SMART scholarships are longer than one year will intern for at least one summer at their respective labs. This internship not only strengthens the relationship between the student and the mentor it enables the student to have a better understanding of the Navy interest in their academic field of specialization. There is concern that funding will not be available in FY12 for each SYSCOM to hire as many graduates as originally planned.

SPRDE growth has been impacted by the In-sourcing halt. NAVSEA has compensated by using Warfare Center or contractor support to handle non-headquarters government functions. The Marine Corps is impacted by not being able to hire about 106 engineers in FYs 12-15, a 20% increase in the engineering workforce, two times the impact of retiring civilians. Expected consequences are increases in schedules, less oversight of contractors, and an increase in costs. They diligently sought out Warfare Center support in those areas where a particular expertise was needed. NAVAIR experienced only minor impacts to SPRDE growth. In-sourcing provided a pathway to bring aboard selected, qualified contractors onto Government roles, but it was never the primary pathway. NAVAIR was able to use other hiring vehicles to bring aboard those personnel.

2.2 Additional Authorities or Resources Needed

Hiring flexibility is needed to fill high priority and critical positions. Budgets have been frozen at or below the FY10 levels. USMC has 73 vacancies of which 48 are considered high priority and 20 of those are categorized as critical. The SYSCOMs are currently managing their needs through available waivers to hire engineers as new positions or existing opportunities are identified. However, the existing pool of candidates does not consist of trained engineers able to meet the position

requirements, although in-house training sometimes compensates for this lack.

SPAWAR has identified the following needed resources to satisfy the needs of the Service related to emergent areas such as:

1) Information Dominance-related SE areas; especially difficult to increase number of System of Systems (SoS) engineers;
2) Establishment of the workforce skill sets to anticipate the technical pace of IT, including:
    a. Service Oriented Architecture (SOA)
    b. Cloud
    c. Services (i.e., Apps)
3) Helping establish governance and infrastructure to adequately support Integration and Interoperability (I&I) for systems in development, and transitioning legacy systems into a System of Systems operational construct.

2.3 Impact of FY12 Budget on Systems Engineering Workforce

The President's budget is sufficient to support planned programs. Systems Engineering becomes more critical in a fiscally constrained environment. Training demand to increase the knowledge and skills of the workforce continues to challenge the budget.

SE Workforce Positions in the DoD as of 30 September 2011 and as planned from the Presidential Budget (PB) FY13 and PB23

Total Number of Civilian and Military Acquisition-Coded SPRDE-SE/PSE Personnel				
Fiscal Year	**Year Ending**	**US Navy**		**Notes**
FY05	30-Sep-05	16,745		Data as of 30 Sep 2011 from DACM MIS
FY06	30-Sep-06	16,670		
FY07	30-Sep-07	16,785		
FY08	30-Sep-08	16,495		
FY09	30-Sep-09	18,086		
FY10	30-Sep-10	19,279		
FY11	30-Sep-11	19,327		
Planned Growth in Civilian and Military Acquisition-Coded SPRDE-SE/PSE				
Fiscal Year	**Year Ending**	**US Navy**		**Notes**
As Reported In:		**FY10***	**FY11****	
FY12	30-Sep-12	146	282	*Data from PB12/PB23. Accounts for In-sourcing and Section 852 only. **Data from PB13/PB23 JAN 2012 Accounts for in-sourcing and Section 852 only
FY13	30-Sep-13	225	160	
FY14	30-Sep-14	88	94	
FY15	30-Sep-15	164	79	
FY16	30-Sep-16		35	

Planned Total Number of Contractor Positions In-sourced to SPRDE-SE/PSE Positions			
Fiscal Year	**Year Ending**	**US Navy**	**Notes**
FY11	30-Sep-11	17	Numbers represent positions to be hired and not contractor positions eliminated as implied by the title. Data from PB13/PB23 JAN 2012.
FY12	30-Sep-12	190	
FY13	30-Sep-13	76	
FY14	30-Sep-14	56	
FY15	30-Sep-15	79	
FY16	30-Sep-16	35	
Total Number of DoD Personnel Recoded to SPRDE-SE/PSE Positions (actual)			
Fiscal Year	**Year Ending**	**US Navy**	**Notes**
FY11	30-Sep-11	-188	DON defines a recode as a change in the position category of a billet from a non-acquisition billet into an acquisition position (a gain(+)) or from an acquisition to a non-acquisition position (a loss(-)). Changes within the acquisition workforce from one career field designation to another are not considered recodes.
FY12	30-Sep-12	----------	
FY13	30-Sep-13	----------	
FY14	30-Sep-14	----------	
FY15	30-Sep-15	----------	
FY16	30-Sep-16	----------	
Planned Total Number of SPRDE-SE/PSE New Hires (Section 852)			
Fiscal Year	**Year Ending**	**US Navy**	**Notes**
FY11	30-Sep-11	115	DON does not track a specific category known as new hires. For the purposes of this report, only Section 852 hires are provided here. A combination of in-sourcing and section-852 could also be considered "new hires" as provided in planned growth section of this table. Adding Section 852 and Insourcing numbers gives the total provided in Planned Growth in Civilian and Military in SE/PSE.
FY12	30-Sep-12	92	
FY13	30-Sep-13	84	
FY14	30-Sep-14	38	
FY15	30-Sep-15	0	
FY16	30-Sep-16	0	
Planned End-State Total Number of Civilians and Military Acquisition-Coded SPRDE-SE/PSE			
Fiscal Year	**Year Ending**	**US Navy**	**Notes**
FY16	30-Sep-16	20,703	-Planned end-state is based on PB13/PB23 FY11 planned number (19,398 civ+262mil) and not the FY11 actuals. Add insourcing+852 (planned growth from above—650 cum) then add other growth (393--cum from FY12-FY16). -Other growth is growth that is not attributed to insourcing or Section 852 growth -Does not factor in recodes

Table 1. SE Workforce Positions in the DoD as Reported by Service SEs and DASD(SE) as of 30 September 2011 and reflected in PB13/PB23 as of 23 January 2012

APPENDIX C

Department of the Air Force
Systems Engineering Self-Assessment

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Headquarters United States Air Force

Department of Defense Systems Engineering FY 2011 Annual Report

Prepared by the Office of the Assistant Secretary of the Air Force
(Acquisition)
Total Hours for Preparation: 210

1060 Air Force Pentagon
Washington DC 20330-1060

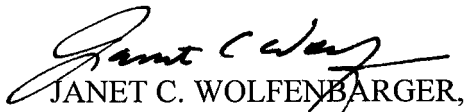
February 22, 2012

"These are challenging times, but we have a unique opportunity to shape the future of America's Air Force, and we are committed to doing everything possible to balance fiscal responsibility with our investments in our people and the nation's defense."
General Norton A. Schwartz, Chief of Staff of the Air Force
Air Force Print News Today, 12 October 2011

In the upcoming year, the Air Force will face a budget environment unlike anything we have encountered in decades. As elected officials consider what to do about the federal debt, pressure mounts to reduce defense spending. The Air Force will play a role in the solution; systems engineering will affect the solution not by retrenching or continuing business as usual on a reduced scale, but by advocating and instilling systems engineering tools and practices in a thoughtfully disciplined manner and ensuring a properly sized and trained workforce.

We anticipate significant consolidation and shaping to include organizational changes at the Major Commands, the largest employer of systems engineers. This will impact the systems engineering community. In the upcoming year, we will focus on shaping the systems engineering workforce within the established budgetary guidelines.

The *Air Force Systems Engineering Strategic Plan,* issued in August 2011, is our first-ever effort to provide a vision that focuses our limited resources on key systems engineering goals and initiatives. It provides the framework for the way the Air Force will conduct systems engineering capabilities—our people, processes, and practices. We must now turn to a long-term view keenly focused on systems engineering to ensure that all our efforts are directed towards sustaining acquisition excellence.



JANET C. WOLFENBARGER, Lt Gen, USAF
Military Deputy, Office of the Assistant Secretary
of the Air Force (Acquisition)

1.0 Progress and Plans for Improved Service Systems Engineering Capability

1.1 Pre-Milestone A and Pre-Milestone B Rigorous Systems Analysis and Systems Engineering Process (Pub. L 111-23, title I, Sec. 102(b)(1)(B)(i))

As stated in our 2010 report, *"Development Planning products identify technical/technology feasibility, operational, and programmatic issues associated with concepts for prospective material solutions. In so doing, they enable integrated risk assessments to technically inform pre-acquisition and S&T investment decisions."* Concepts (prospective materiel solutions) increase in technical maturity as they advance through the early systems engineering process to implementation analysis. Following the Materiel Development Decision, the sponsor and the acquisition community continue operational, technical, and programmatic analyses during the Materiel Solution Analysis phase. The Analysis of Alternatives Study Team, generally led by the sponsor, is charged to address critical areas including operational and employment concepts; threats and scenarios; technologies and alternatives; effectiveness; life cycle cost; and risk. The Analysis of Alternatives report provides an integrated assessment of the concepts along with relative "ranking" in each of the analytical areas; it serves as the basis for the sponsor's selection of a preferred system concept to be brought forward to the Milestone A decision.

The Air Force has begun deliberate efforts to better align planning for: Science and Technology (S&T); technology transition; and development. This results in the most effective S&T investments that will buy down the most critical technology risks—thereby initiating acquisition programs with mature technologies and credible cost estimates. Linkages between these planning activities are being incorporated in revised Air Force S&T management guidance.

The Air Force S&T planning process is driven by S&T needs identification and S&T solutions formulation. An input to this process is documented capability needs provided by the Major Commands (MAJCOMs). The Air Force has established MAJCOM, Center, and Air Force Research Laboratory (AFRL) collaborations to conduct systems engineering decompositions to determine if S&T is required to address Center technology needs in support of the capability needs. These efforts yield a set of vetted MAJCOM-prioritized S&T needs based upon critical technologies required for ongoing or prospective materiel solutions. Following S&T needs identification, the collaborations will identify and vet potential S&T solutions mapped to MAJCOM capability needs by mission area. Recommended S&T solutions may become internally managed AFRL S&T projects, or may be proposed as candidate Advanced Technology Demonstrations, Flagship Capability Concepts, or Joint Capability Technology Demonstrations requiring approval by their respective governing bodies. For approved Advanced Technology Demonstrations or Flagship Capability Concepts, the Center will lead a transition planning Integrated Product Team that is responsible for developing and coordinating the Technology Transition Plan.

Air Force S&T activities support, and are informed by, Development Planning efforts in the following manner: 1) S&T communities identify technology maturity, as well as opportunities (e.g., the "art of the possible") to inform the formulation and consideration of candidate concepts; 2) Development Planning communities identify technology needs and technical risk areas of candidate concepts to inform S&T planning; and 3) the Air Force will conduct the necessary Development Planning activities to transition Advanced Technology Demonstrations,

Flagship Capability Concepts, and Air Force-led Joint Capability Technology Demonstrations into acquisition programs.

Additionally, AFRL is conducting early systems engineering activities in all major technology demonstration efforts, and documenting aspects of these activities in baseline documents (e.g., precision air drop capability). To lead these activities, AFRL established a Chief Engineer position both at its Headquarters and in each of the Technical Directorates.

The Air Force maintained their commitment to Development Planning by funding these activities in a stand-alone Program Element (PE 0604337F, Requirements Analysis and Maturation). The resources in this program are focused on long-range capability analyses efforts to identify potential materiel shortfalls and opportunities; concept development activities, including early systems engineering; and pre-systems acquisition planning activities that address requirements, schedule, cost, technology, and acquisition strategy. The Air Force recognizes the value of a dedicated source of funding to ensure future acquisition programs are initiated using rigorous processes in a consistent manner. The four points emphasized in DTM 10-017 "*Development Planning to Inform Materiel Development Decision (MDD) Reviews*" have been incorporated into Air Force directive guidance.

During FY11 the Air Force established an Integrated Product Team (IPT) to support ongoing DASD(SE) efforts to position Modeling, Simulation, and Analysis (MS&A) as a consistent and trusted tool within the SE domain to support acquisition. A new Air Force governance structure established Life Cycle Management as one of three pillars of Modeling & Simulation, along with Analytics and Operations/Test/Training.

The Air Force has established the Air Force Program Support Review (PSR) to support the Milestone Decision Authority prior to Milestone Reviews. It synchronizes existing reviews, including the Office of the Secretary of Defense (OSD) PSR. This meets statutory and Department of Defense (DoD) policy guidance and minimizes additional workload on program offices. It assesses the status of technical planning and management processes; identifies cost, schedule, and performance risks; and proposes recommendations to mitigate risks—ensuring effective requirements implementation. It augments OSD's process in several key areas (e.g., Environment, Safety, and Occupational Health; Risk; Technology Readiness Assessment (TRA); Manufacturing Readiness Assessment; and Intelligence). A fully coordinated Air Force PSR Handbook, version 1.0, was issued in Fiscal Year (FY) 2011.

In FY 2010, the Air Force successfully completed the Air Force PSR process for the Small Diameter Bomb Increment II, Acquisition Category (ACAT) ID program. In FY 2011, the process was used again on three more programs: MQ-9 Reaper (ACAT ID); B-2 Extremely High Frequency Increment I (ACAT IC); and B61 (ACAT ID).

A major factor in the Air Force pursuit of an integrated PSR process with OSD is the TRA process for Major Defense Acquisition Programs (MDAPs). The TRA process was modified in 2011 by *DoD TRA Guidance,* from the Assistant Secretary of Defense for Research and Engineering (DASD(R&E)), as well as the May 2011 memorandum, *Improving Technology Readiness Assessment Effectiveness* from the Undersecretary of Defense for Acquisition,

Technology, and Logistics (USD(AT&L)). The Air Force is currently interpreting OSD guidance for Product Center and program implementation. On June 16, 2011, the Air Force Service Acquisition Executive (SAF/AQ) signed a policy memorandum that stated, "Air Force Program Managers working through their respective Program Executive Officer, shall engage with the Deputy Assistant Secretary for Science, Technology and Engineering (SAF/AQR) early but not later than one year prior to Milestone B so TRA execution can be integrated with the Air Force PSR."

TRAs are not required for Major Automated Information System (MAIS) programs and non-MDAPs. We are collaborating with Electronic Systems Center Chief Engineer to execute MAIS Engineering Reviews (MERs) for MAIS ACAT IAM/IAC programs. MER is a tailored Defense Acquisition Program Support methodology for MAIS programs, with augmentation for MAIS-specific issues such as information assurance, software reuse, and enterprise. It assesses the MAIS program's systems engineering risks, and provides recommendations for risk management and mitigation. The first program planned for a MER is Expeditionary Combat Support System in FY 2012. Determination of the Milestone C date will drive the start of the MER.

Our 2010 report described planned efforts to extend the OSD PSR methodology to Air Force space programs. Per Directive-Type Memorandum (DTM) 09-025, *Space Systems Acquisition Policy,* space programs use an Independent Program Assessment (IPA) process. The PSR and IPA reviews have similar objectives and scope, but are performed differently. Throughout FY 2011, the Office of the Deputy Assistant Secretary of Defense for Systems Engineering (ODASD(SE)), Office of the Deputy Assistant Secretary of Defense for Space and Intelligence (ODASD(SIO)), and SAF/AQR continued the effort to benefit from the two approaches without burdening programs. As an interim step, the Joint Space Operations Center Mission System program and Global Positioning System enterprise went through combined IPA/PSR reviews in February and August of 2011, respectively. These reviews focused on evaluating the programs against a combined set of IPA and PSR criteria. In FY 2012, the Air Force will continue to lead the assessment review streamlining effort for space programs with the goal of achieving a common approach that captures best practices and meets the needs of all stakeholders.

Systems engineering across the life cycle documented in Systems Engineering Plans (SEPs) and Life Cycle Sustainment Plans (LCSPs) has afforded programs opportunities to ensure compliance with current guidance. On 20 Apr 2011, DASD/SE issued an updated SEP template to improve product which incorporated new guidance to include USD/AT&L DTM 11-003 issued 21 March 2011 on Reliability Analysis, Planning, Tracking and Reporting. Since the new template was issued, the Air Force has reviewed 8 SEPs. Additionally, the Air Force reviewed 14 LCSPs and ensured life cycle sustainability issues were identified within each program.

1.2 Reliability, availability, maintainability, and sustainability as an integral part of design and development (Pub. L. 111-23, title I, Sec. 102(b)(1)(B)(ii))

The Air Force identified a collaborative team to develop and implement reliability and maintainability (R&M) policy, processes, and human capital training across the Air Force led by senior R&M engineers. The team members were identified at each of the Air Force Materiel

Command Product Centers and Air Logistics Centers, as well as Air Force Space Command's Space and Missile Systems Center (SMC) to participate in these efforts.

In November 2010, SAF/AQR hired a General Engineer to serve as service lead to coordinate life cycle systems engineering integration in the area of R&M. As service lead, this individual directly interfaces with the ODASD(SE)) R&M engineering focal point and represents the Air Force at ODASD(SE) Service Lead Meetings.

In response to the release of DTM 11-003, *Reliability Analysis, Planning, Tracking, and Reporting*, in March 2011, work began on an R&M attachment to Air Force Instruction (AFI) 62-101, *Systems Engineering*—the replacement for AFI 63-1201, *Life Cycle Systems Engineering.* A collaborative team of R&M engineers reviewed and commented on the attachment. Comments were coordinated to the satisfaction of all R&M engineers. AFI 62-101 remains in development while the Air Staff considers and finalizes a new structure for headquarters governance documents.

R&M was a technical session topic at the second Air Force Systems Engineering Conference in August 2011. Senior R&M engineers, the ODASD(SE) R&M engineering focal point, and nearly 75 government and industry representatives attended the session. Implementation of DTM 11-003 was discussed, as was an Air Force R&M strategy built on policy, consistent processes, and adequate staffing. Additionally, an R&M practitioner meeting was conducted building rapport with Air Staff and OSD—DTM 11-003 implementation and Air Force R&M strategy was discussed.

The *Air Force Systems Engineering Strategic Plan* states as a tenet that: "We must ensure we have our own organic systems engineering capabilities to perform inherently government functions across the entire life cycle." Acquisition reform contributed to fewer personnel in reliability, quality, and manufacturing disciplines. In 1989, Wright-Patterson AFB employed fifty-two dedicated R&M engineers. By 2001, six remained. The Centers recognize this expertise need and in light of current hiring restrictions have adopted a plan to leverage Center level R&M experts and/or work-share a program office R&M engineer across a portfolio of programs. R&M engineers have received high priority when balanced against the larger AF engineering needs as indicated by KC-46 receiving approval for hiring of a dedicated R&M engineer.

A focus of FY 2012 is R&M training for practitioners and other program office staff. Discussions have begun between the Air Staff, the Center for Systems Engineering, and the Air Force Institute of Technology (AFIT) Graduate School to develop such training.

1.3 Systems Engineering Requirements During the JCIDS Process and in Contract Requirements for each MDAP (Pub. L. 111-23, title I, Sec. 102(b)(1)(B)(iii))

The Air Force has codified the Development Planning and early systems engineering processes and key artifacts using Guidance Memoranda and Interim Changes to both AFI 63-101 and AFI 63-1201, *Life Cycle Systems Engineering*. During FY 2011, five Development Planning efforts produced Concept Characterization and Technical Descriptions for review in preparation for

Materiel Development Decisions. These five programs are: Long Range Stand-Off; B61; Ground Based Strategic Deterrent; Air Force Knowledge Operations; and Air Force Network Increment 2.

AFI 10-601, *Operational Capability Requirements,* directs the Commander of Air Force Materiel Command (AFMC/CC) and the Service Acquisition Executive to certify to the Secretary of the Air Force that space and non-space system requirements: 1) can be translated for evaluation in a source selection in a clear and unambiguous way; 2) are prioritized (if appropriate); and 3) are organized into feasible increments of capability. These requirements appear in Capability Development Documents (CDDs) for ACAT I and non-delegated ACAT II programs. For delegated ACAT II and ACAT III programs and Capability Production Documents (CPDs) as feasible, AFMC/CC attests to the requirements as described in the CDD. The certification or attestation occurs concurrent with presentation of the CDD or CPD to the Air Force Requirements Oversight Council. These actions represent further translation of operational and technical requirements into contract requirements. The Air Force Systems Engineering Strategic Plan states in Objective 7.2: "Ensure that all technical risks are identified and assessed within the trade space before each Milestone decision as part of the Air Force Program Support Review process."

In response to the OUSD(AT&L) November 2010 memorandum, *Better Buying Power*, the Air Force is incorporating direction to conduct and review "*systems engineering tradeoff analysis showing how cost varies as major design parameters and time-to-complete are varied"* into directive guidance a complete revision to AFI 63-101. As a result, each Center commander has appointed a Center Level Technical Authority (CLTA) which assesses the adherence of program offices to Center-level SE policies, practices, guidance, tools, education and training. The CLTA also assists the PEOs in the appointment of Chief Systems Engineers specifically assigned to each program. The PM will ensure that overall responsibility for SE implementation is assigned to their Chief Systems Engineer and is responsible for directing implementation of rigorous SE practices across all program areas.

Materiel Development Decision is the initial investment decision that addresses whether the Air Force intends to put resources against a materiel solution to an identified capability need; therefore, both the sponsor and the acquisition community must maintain a portfolio perspective when prioritizing capabilities. The sponsor must demonstrate fiscal commitment to their proposed course(s) of action in terms of these same considerations at Milestone A, which is when the first translations of operational requirements into contract requirements appear.

Trade space characterization encompasses the first steps in the early systems engineering process that underpins the technical aspects of Development Planning. These efforts identify the sponsor's most critical value elements (e.g., ground rules, assumptions, constraints, etc.) in terms of how to address the identified capability gap(s), associated dependencies, and desired operational attributes.

As the early systems engineering process moves into candidate solution sets characterization, it engages a broader cross-section of material stakeholders to participate in trade space refinement. Identification of dependencies and enablers (such as interfacing systems in a portfolio or system-

of-systems environment) shapes the evolution of operational criteria into characteristics from which specific requirements can be derived and put on contract. Examples of operational criteria are Measures of Effectiveness and Key Performance Parameters—examples of characteristics are Measures of Performance and Key System Attributes. Continued collaboration between the sponsor and the acquisition community ensures that the prospective materiel solutions are well vetted in terms of the desired capability, the realm of the possible, and awareness of affordability.

1.4 Area for Improvement Identified in FY 2010: Reliability; Availability; and Maintainability

Status: The revised AFI 63-101 will provide detailed guidance on the implementation of systems engineering, to include additional requirements for R&M and reference to a standard practice for implementing reliability in contracts. It will also incorporate additional guidance on reliability contained in the March 2011 OSD DTM 11-003. The Air Force participated in the development and release of DTM 11-003, which is designed to improve reliability analysis, planning, tracking, and reporting in acquisition. A network of senior R&M engineers from across the Air Force worked with the Air Staff to develop R&M language for the AFI, which is expected for release in FY 2012.

The Air Force partnered with ODASD(SE) at SMC to accomplish a pathfinder event on program protection for the Global Positioning System. The goal was to refine the Department's process for protecting program information, technology, and components from malicious intent through engineering and security analyses, including the criticality analysis. The experience allowed ODASD(SE) to refine its approach when providing assistance with program protection. SMC shared lessons learned from the pathfinder event to systems engineers at the August 2011 Air Force Systems Engineering Conference.

1.5 Area for Improvement Identified in FY 2010: Training of acquisition workforce

Status: The Air Force Systems, Programming, Research, Development, and Engineering-Systems Engineering (SPRDE-SE) community continues to benefit from additional resources for training made available through the Defense Acquisition Workforce Development Fund (DAWDF).

In FY 2010, the Air Force developed several courses to train new and existing personnel in key focus areas where gaps in training were identified. To date, Systems (SYS) 209, *Introduction to Technology Readiness Assessments,* has graduated 148 personnel, SYS 213, *Manufacturing Readiness Assessments,* has graduated 344 personnel, and SYS 105, *Introduction to Development Planning*, has graduated 134 personnel.

OUSD(AT&L)'s Workforce Management Group charter, signed in July 2011, promises to address the need for a cross-functional review process to ensure scarce Defense Acquisition University resources are equitably allocated to the highest priority functional needs.

1.6 Area for Improvement Identified in FY 2010: Identification of Systems Engineering and Development Planning resources across the Air Force

As described in Section 1.1, the Air Force has greatly improved the S&T planning process, connecting the dots among the S&T community, development planners, systems engineers, and user commands. Over the past year, the Air Force published an S&T strategy and a corresponding S&T plan that provides vision and guidance for continued collaboration among these communities. Systems engineering and to some extent Development Planning personnel (a mix of both organic government and non-organic workforce), functions, and activities are widely distributed across the Air Force. Much of the funding and many resources for the conduct of systems engineering and Development Planning support to existing programs are buried in the programs themselves through engineering and program management personnel, tools, and processes. The recently established Center-Level Technical Authority positions will improve visibility and management of these assets.

1.7 Other Area of Improvement: Air Force Update on GAO SECTION 804-Software Acquisition Improvement Program

The FY 2003 National Defense Authorization Act (NDAA), *Improvement of Software Acquisition Processes,* Section 804, requires DoD, the Services and Agencies to implement software acquisition improvement programs and provide specific requirements for these programs. In FY 2009, the Government Accountability Office (GAO) recommended DoD report periodically to Congress on Section 804 implementation. DoD's response to the report, agreed to by the GAO, was to address this recommendation as part of the annual Weapon Systems Acquisition Reform Act (WSARA) report—it follows:

FY 2011 Progress

The Air Force Institute of Technology (AFIT) completed the second year offering of its revamped Software Professional Development Program (SPDP), a series of web-based distance learning courses. This long-standing program now offers a track focused on the management of software development projects. Since its redesign, a total of 180 Air Force members and 10 members from the other Services, have completed one or more of the SPDP modules. AFIT issued SPDP certificates to 20 individuals that have completed the entire program.

The Air Force reconstituted the Air Force Software Intensive System Strategic Improvement Program Working Group (WG), with representatives from all Air Force acquisition and sustainment organizations. The WG focused its activities on identifying areas were guidance can improve software sustainment and early life cycle sustainment planning.

The Air Force modified the Air Force Product Data Acquisition (PDAQ) tool to emphasize software; includes software guidance, lessons learned, template language for solicitation, and recommended Data Item Descriptions for software documentation and software deliverables. PDAQ is a web-based tool that provides guidance for planning and acquiring product data to improve competition and reduce total life cycle cost.

SMC started the development of a Software Acquisition Guidebook. The guidebook is a web-based document to assist SMC software engineers to plan and execute the development, integration,

and management of software. The guidebook incorporates Air Force software engineering policy and addresses the specific challenges for SMC systems.

FY 2012 Plans

Increase SPDP awareness throughout the Air Force acquisition and sustainment community and develop incentives to increase participation.

Update the Air Force Weapon Systems Software Management Guidebook to incorporate guidance for software sustainment and address DoD acquisition policy changes and initiatives from the last two years. The updated guidebook may be issued as an official Air Force Pamphlet Manual or Manual.

The Air Force will update AF publications, including AFI 63-101 to implement OSD guidance on IT acquisition. It will also provide additional tailoring guidance specifically for IT programs in AFPAM 63-128.

1.8 Air Force Center for Systems Engineering (CSE) – Enabler for Systems Engineering

Air Force CSE is tasked to lead the re-vitalization of systems engineering. It was established at the direction of the Secretary of the Air Force. CSE's effectiveness resulted in a January 2011 Charter Addendum executed by Air Education and Training Command and SAF/AQ—it further codified CSE's role and moved operational control directly to SAF/AQ. The Addendum amended the original Memorandum of Agreement establishing CSE. Highlights for 2011 include: 1) assisting Joint Strike Fighter program (ACAT ID) successfully addressing a Nunn-McCurdy breach as co-lead of the Air Force TRA team; 2) co-leading the KC-X TRA; 3) leading a four-month reliability assessment at the request of Program Executive Officer for Intelligence, Surveillance, and Reconnaissance and Special Operations Forces; 4) providing systems engineering expertise to support numerous AFRL critical programs (e.g., Precision Drop and Airborne Warning and Control System Bi-Static); 5) forming and leading a joint-Service team of experts, at the request of ODASD(SE), to investigate the infrastructure/collaborative environment technology needed to implement the *Workplace of Tomorrow,* successfully delivering the Department's first Concept of Operations; 6) leading a Joint-Service team with the goal of revitalizing Reliability of Weapon Systems across the Department—directly contributing to the issuance of DTM 11-003; 7) conducting a 40-hour systems engineering course for future Chief Engineers and; 8) publishing two systems engineering case studies.

1.9 FY 2012 Plan: Priority Areas to Improve Systems Engineering and Development Planning

Since our last WSARA report submitted November 5, 2010, we have continued to work to improve the systems engineering craft and support the Air Force's initiative to recapture acquisition excellence. The recently released *Air Force Systems Engineering Strategic Plan* identifies and prioritizes key activities to meet the systems engineering needs of program offices, recognizing a resource constrained environment. The Strategic Plan, which focuses on people, processes, and practices, will form the foundation for FY 2012 activities to improve systems engineering and Development Planning.

2.0 Systems Engineering Workforce

2.1 Workforce Development Initiatives

The Air Force achieved a significant increase in the size of its systems engineering workforce since FY 2008, primarily at its Product Centers. In FY 2011, the Air Force began to curtail the remaining planned growth under its Acquisition Excellence initiative, to include some SPRDE-SE requirements at its Air Logistics Centers, due to OSD-directed reductions in planned civilian growth programmed during the FY 2012 President's Budget (PB). However, the Air Force is projecting to complete the Secretary of Defense (SECDEF) directed growth initiative announced in May 2009, which has been exempted from hiring controls announced in May 2011.

The Air Force continues to use FY 2008 NDAA Sec 852 DAWDF funding to hire career ladder / developmental and journeymen overhires in advance of programmed growth supporting our replenishment and knowledge transfer strategy. DAWDF funds for recruiting and hiring are allocated to acquisition commands, which determine the highest priority needs for these funds by Center and functional area. In the current austere budget environment, DAWDF is integral to our workforce development strategies as it provides: resources needed to address training gaps; employment incentives to attract the highest quality candidates; and hiring for replenishment needs.

Recognizing a resource-constrained environment, we will leverage the existing workforce. Therefore, in FY 2012, we will identify subject matter experts in the areas of reliability, maintainability, manufacturing, and program protection from the Air Force Reserve engineering pool. Many of these individuals have proficiency in these areas in their civilian capacity.

In March 2011, we published *Bright Horizons - Air Force Science, Technology, Engineering, and Mathematics (STEM) Workforce Strategic Roadmap.* It concurred with a National Research Council study recommendation creating the STEM Advisory Council to actively manage the STEM-degreed and STEM-cognizant workforce. The STEM Advisory Council is chaired by SAF/AQ and meets quarterly to review progress on the six goals and thirty-one (31) initiatives in *Bright Horizons.* Goal champions of *Bright Horizons* are identifying current and future STEM workforce requirements, developing strategies to address any gaps between, and establishing methods to measure success. We are developing measures through the Council and *Bright Horizons* to improve our ability to attract, retain, shape, and manage our mission critical STEM workforce. *Bright Horizons* discusses the national challenge of producing STEM-degreed talent, and how the Air Force must maintain a competitive edge by recruiting and retaining STEM-qualified personnel. The Air Force presently has RAND Corporation investigating current and future STEM requirements for officers and civilians. They work with Air Force functionals revalidating hard degree and soft STEM requirements for our career fields. A "hard degree" is one awarded by an institutional program. A "soft STEM requirement" is an individual obtaining necessary education, training, or experience to be considered qualified or competent and able to make technical decisions. One *Bright Horizons* initiative creates a Headquarters-level office to coordinate Air Force STEM outreach activities. This office has been allocated three individuals and is fully operational. It coordinates and leverages over 150 STEM engagements each year. These range from volunteer scientists and engineers judging science fairs to the National

Defense Science and Engineering Graduate Program providing scholarships to STEM students. Engagements encourage and leverage local, state, and federal STEM activities, affecting hundreds of thousands of students and teachers. Our outreach activities are designed to grow and attract future STEM-degreed individuals, thereby, replenishing the workforce.

The Air Force has developed a Career Path Tool to inform workforce members of career opportunities and to provide information that assists career field managers in shaping and managing career field resources. STEM career fields were among the first to adopt this new capability. The Air Force Scientist and Engineer Advisory Council has four strategic panels focused on developing information that can be incorporated into the Career Path Tool. These panels are: Continuing Education & Training; Career Development Programs and Placement; Qualifications & Certifications; and Workforce Capability Requirements.

2.2 Additional Authorities or Resources Needed

As previously noted, sustained DAWDF funding is needed to fully execute acquisition workforce improvement initiatives for recruiting, hiring, and training. The Air Force Director, Acquisition Career Management, has advocated that OUSD(AT&L) adopt a workforce replenishment strategy using DAWDF to enable a steady, predictable influx of recent graduates and anticipatory hiring at the journey-level for the orderly transfer of institutional knowledge.

DAWDF funded overhires can be a key tool for managing retirements and forecasted attrition. In addition to having knowledge transfer overlap, advance hires can complete required certification training without impacting operations. DAWDF funding for interns should continue at required levels to provide steady renewal of the workforce with recent college graduates. This is essential to prevent "bathtubs" in the force structure caused by temporary pauses in entry level hiring. Further, DAWDF funding for overhires can ensure highly qualified candidates can be hired upon graduation even when no immediate vacancy exists. DAWDF overhires would transition to funded vacancies just like they do today under the SECDEF growth plan, so costs would be comparable to current DAWDF hiring costs.

2.3 Impact of FY 2012 Budget on Systems Engineering Workforce

Changing budget impacts on planned and programmed growth are not yet known pending Corporate Air Force decisions that implement DoD Efficiencies and Air Force Manpower Summit recommendations. Civilian reductions are contingent on the Air Force's implementation of the civilian end strength ceiling imposed in the FY 2012 Presidential Budget (PB). This will impact both the existing and recently in-sourced workforce. The SE contract support workforce will be impacted by the upcoming drastic reduction in our staff augmentation contractors. Specific impacts to the SE workforce will not be known until MAJCOMs identify these reductions in their Unit Manpower Documents (estimated completion date, August 2012).

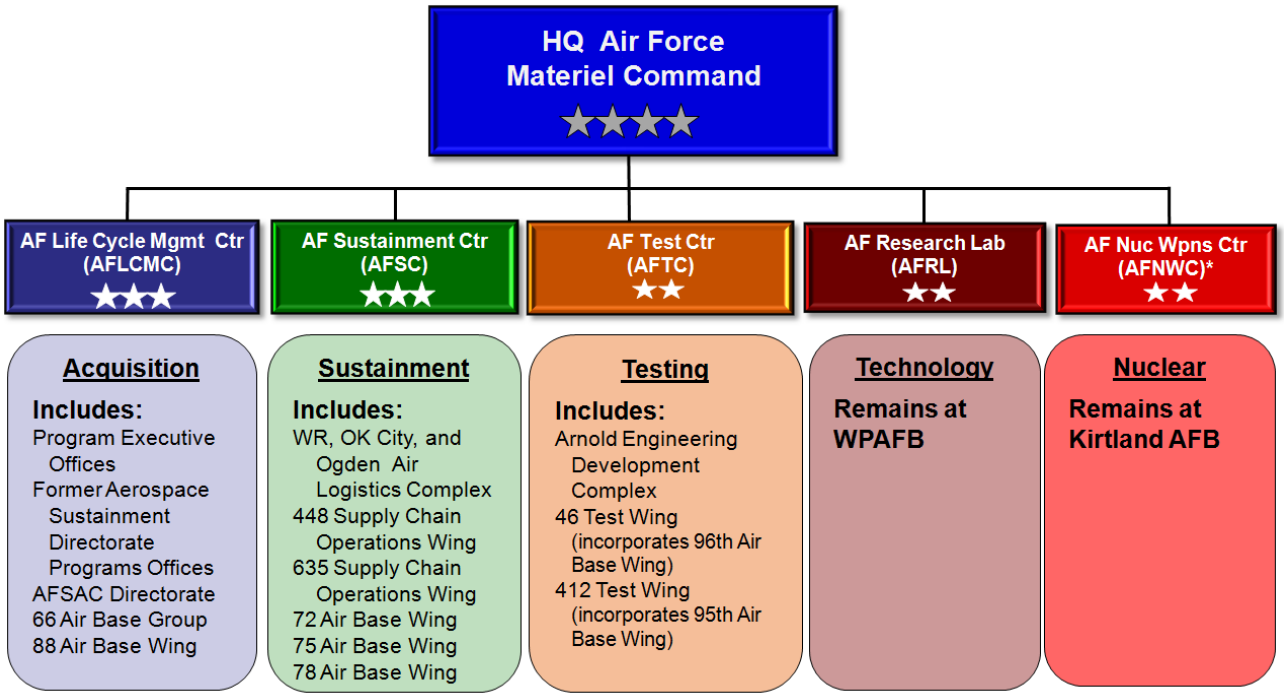
The results of military and civilian force reduction programs add to the unknowns we face in terms of loss of experience and critical skills. The programmatic reductions in acquisition

support contractors, coupled with the organic hiring freeze, will mean significant loss of experienced personnel in our program offices, PEO staffs, and in SAF/AQ.

A prolonged hiring freeze will potentially create new "bathtubs" (experience gaps) in our force structure, similar to the gaps caused by the post-Cold War drawdown. To prevent loss of critical acquisition expertise and capability, we need to continue timely and targeted replenishment hiring while staying within the force ceilings we're given.

The future of the Defense Acquisition Workforce Development Fund (DAWDF) after the SECDEF acquisition growth initiative is completed remains uncertain. The loss of DAWDF funds would force cuts to training and halt future training improvements. In addition, the loss of DAWDF, especially in this austere budget environment, would derail our strategy for advance hiring in anticipation of vacancies, which gives the overhire person the opportunity to complete DAWIA training coupled with the opportunity for knowledge transfer before stepping into a permanent position. Our ability to conduct stable acquisition workforce replenishment at the entry/development and journeymen level, with the incentives needed to attract the highest quality candidates, is heavily reliant on continued DAWDF at robust funding levels.

The Air Force plans to reduce the number of AFMC centers from 12 to 5 as depicted in the figure below. We are currently working to address the FY 12 NDAA, Section 326, requirement for an independent review of the proposed reorganization of AFMC prior to implementation. At this time, it is not known the impact this reorganization will have to the SE community.



2.4 Systems Engineering Workforce Positions in the USAF

Total Number of Civilian and Military Acquisition-Coded SPRDE-SE/PSE Personnel			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
FY05	September 30, 2005	5,561	
FY06	September 30, 2006	5,536	
FY07	September 30, 2007	6,162	
FY08	September 30, 2008	6,430	
FY09	September 30, 2009	7,201	
FY10	September 30, 2010	7,625	
FY11	September 30, 2011	(Civ 7027, Mil 1489) 8,516	
Planned Growth in Civilian and Military Acquisition-Coded SPRDE-SE/PSE*			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
As Reported in:		FY10	FY11
FY12	September 30, 2012	150	(Civ -677, Mil 134) -543**
FY13	September 30, 2013	86	(Civ -86, Mil 0) -86
FY14	September 30, 2014	170	(Civ 160, Mil 0) 160
FY15	September 30, 2015	-4	(Civ -6, Mil 0) -6
FY16	September 30, 2016		(Civ -9, Mil 0) -9
Total Number of Contractor Positions In-sourced to SPRDE-SE/PSE Positions***			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
FY11	September 30, 2011	205	
FY12	September 30, 2012	90	
FY13	September 30, 2013	25	
FY14	September 30, 2014	0	
FY15	September 30, 2015	0	
FY16	September 30, 2016	0	
Total Number of DoD Personnel Recoded to SPRDE-SE/PSE Positions			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
FY11	September 30, 2011	732	
FY12	September 30, 2012	0	
FY13	September 30, 2013	0	
FY14	September 30, 2014	0	
FY15	September 30, 2015	0	
FY16	September 30, 2016	0	
Total Number of SPRDE-SE/PSE Civilian New Hires*			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
FY11	September 30, 2011	552 (actual off the street hires)	
FY12	September 30, 2012	106 (actual as of EOM Jan 12)	
FY13	September 30, 2013	0	
FY14	September 30, 2014	160	
FY15	September 30, 2015	0	
FY16	September 30, 2016	0	
Planned End-State Total Number of Civilian and Military Acquisition-Coded SPRDE-SE/PSE*			
Fiscal Year	**Year Ending**	**U.S. Air Force**	
FY16	September 30, 2016	(Civ 6406, Mil 1626) 8,032	

* Data based on FY 13 PB 23 as of 11 Jan 2012

** Overhires play a significant role in the delta between FY11 personnel and FY12 positions. In FY 11, there were 379 SPRD&E-SE/PSE overhires funded by DAWDF alone

*** Data based on Manpower Programming and Execution System as of 30 Sept 2011

Abbreviations and Acronyms

ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
AFI	Air Force Instruction
AFIT	Air Force Institute of Technology
AFMC	Air Force Materiel Command
AoA	Analysis of Alternatives
AOTR	Assessment of Operational Test Readiness
APB	Acquisition Program Baseline
AS	Acquisition Strategy
ASA(ALT)	Assistant Secretary of the Army for Acquisition, Logistics, and Technology
ASD(L&MR)	Assistant Secretary of Defense for Logistics and Materiel Readiness
ASD(R&E)	Assistant Secretary of Defense for Research and Engineering
ASN(RDA)	Assistant Secretary of the Navy for Research, Development, and Acquisition
AT&L	Acquisition, Technology, and Logistics
ATEC	Army Test and Evaluation Command
BKCASE	Body of Knowledge and Curriculum to Advance Systems Engineering
BRAC	base realignment and closure
BTA	Business Transformation Agency
C4	command, control, communications, and computers
CAE	Component Acquisition Executive
CAPE	Cost Assessment and Program Evaluation
CDD	Capability Development Document
CDR	Critical Design Review
CLTA	Center Level Technical Authority (Air Force)
COE	common operating environment
COTS	commercial off-the-shelf
CPD	Capability Production Document
CTE	critical technology element

CTP	critical technical parameter
DAB	Defense Acquisition Board
DAES	Defense Acquisition Executive Summary
DAG	Defense Acquisition Guidebook
DAPS	Defense Acquisition Program Support
DASD(DT&E)	Deputy Assistant Secretary of Defense for Developmental Test and Evaluation
DASD(SE)	Deputy Assistant Secretary of Defense for Systems Engineering
DASM	Deputy for Acquisition and Systems Management
DASN(RDT&E)	Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation
DAU	Defense Acquisition University
DAWDF	Defense Acquisition Workforce Development Fund
DAWIA	Defense Acquisition Workforce Improvement Act
DISA	Defense Information Systems Agency
DoD	Department of Defense
DoDI	Department of Defense Instruction
DON	Department of the Navy
DOT&E	Director of Operational Test and Evaluation
DP	development planning
DPAP	Defense Procurement and Acquisition Policy
DPWG	Development Planning Working Group
DT	developmental test
DT&E	developmental test and evaluation
DTM	Directive-Type Memorandum
DVH	double-V hull
EMD	Engineering and Manufacturing Development (phase)
EOA	Early Operational Assessment
ESB	Executive Steering Board
FFRDC	Federally Funded Research and Development Center
FIPT	Functional Integrated Product Team

FoS	family of systems
FoV	family of vehicles
FRP	Full-Rate Production
FY	fiscal year
GCV	Ground Combat Vehicle
GFE	Government-furnished equipment
HCI	Human Capital Initiatives
HSI	human systems integration
IA	information assurance
IBD	Integrated Base Defense
ICD	Initial Capabilities Document
IIPT	Initial Integrated Product Team
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
IPR	In-Progress Review
IPT	Integrated Product Team
ISR	intelligence, surveillance, and reconnaissance
IT	information technology
ITAB	Information Technology Advisory Board
ITR	Independent Technical Review (Air Force)
ITT	Integrated Test Team
JCIDS	Joint Capabilities Integration and Development System
JROC	Joint Requirements Oversight Council
KDP	Key Decision Point
KLP	Key Leadership Position
KPP	Key Performance Parameter
KSA	Key System Attribute
LCSP	Life Cycle Sustainment Plan
LRIP	Low-Rate Initial Production

LUT	Limited User Test
M&S	modeling and simulation
MAIS	Major Automated Information System
MAJCOM	Major Command
MDA	Missile Defense Agency
MDAP	Major Defense Acquisition Program
MDD	Materiel Development Decision
MRL	Manufacturing Readiness Level
MRR	Manufacturing Readiness Review
MS	Milestone
MSA	Materiel Solution Analysis (phase)
NAVAIR	Naval Air Systems Command
NDAA	National Defense Authorization Act
NDIA	National Defense Industrial Association
N-M	Nunn-McCurdy
NPS	Naval Postgraduate School
O&S	Operations and Support (phase)
OCSE	Office of the Chief Systems Engineer (Army)
OIPT	Overarching Integrated Product Team
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OT&E	operational test and evaluation
OTRR	Operational Test Readiness Review
PARCA	Performance Assessment and Root Cause Analysis
PD	Production and Deployment (phase)
PDR	Preliminary Design Review
PEO	Program Executive Office
PL	Public Law
PM	program manager

PMO	Program Management Office
PMR	Program Management Review
POC	point of contact
POM	Program Objective Memorandum
PPBE	Planning, Programming, Budgeting, and Execution
PPP	Program Protection Plan
PQM	Production, Quality, and Manufacturing
PRR	Production Readiness Review
PSE	Program Systems Engineer
PSR	Program Support Review
QOT&E	Qualification Operational Test and Evaluation
R&M	reliability and maintainability
RAM	reliability, availability, and maintainability
RAM-C	reliability, availability, maintainability, and cost
RDECOM	Research, Development and Engineering Command (Army)
RDT&E	research, development, test, and evaluation
RFP	Request for Proposal
RGC	reliability growth curve
RT	Research Topic
RTO	Responsible Test Organization
S&E	science and engineering
S&T	science and technology
SADB	Systemic Analysis Database
SAF/AQ	Secretary of the Air Force for Acquisition
SDD	System Development and Demonstration
SE	systems engineering
SE WIPT	Systems Engineering Working Integrated Product Team
SEAC	Scientist and Engineer Advisory Council
SECNAV	Secretary of the Navy

SEP	Systems Engineering Plan
SERC	Systems Engineering Research Center
SESG	Systems Engineering Stakeholders Group
SETR	Systems Engineering Technical Review
SFR	System Functional Review
SLOC	source lines of code
SoS	system of systems
SoSE	system-of-systems engineering
SPAWAR	Space and Naval Warfare Systems Command
SPRDE	Systems Planning, Research, Development, and Engineering
SPRDE-SE	Systems Planning, Research, Development, and Engineering–Systems Engineer
SRCA	systemic root cause analysis
SRR	System Requirements Review
STEM	science, technology, engineering, and mathematics
SWaP-C	space, weight, power, and cooling
SwE	software engineering
SYSCOM	Systems Command
T&E	test and evaluation
TD	Technology Development (phase)
TDS	Technology Development Strategy
TEMP	Test and Evaluation Master Plan
TES	Test and Evaluation Strategy
TIM	Technical Information Meeting
TPM	Technical Performance Measure
TPP	Technical Performance Parameter
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
TRR	Test Readiness Review
UARC	University Affiliated Research Center

UAS	unmanned aircraft system
USAF	United States Air Force
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
USD(C/CFO)	Under Secretary of Defense (Comptroller)/Chief Financial Officer
USMC	United States Marine Corps
USN	United States Navy
WIPT	Working Integrated Product Team
WSARA	Weapon Systems Acquisition Reform Act

Department of Defense Developmental Test and Evaluation and Systems Engineering
FY 2011 Annual Report

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