DoD Systems Engineering Update

Kristen Baldwin

Principal Deputy, Office of the Deputy Assistant Secretary of Defense for Systems Engineering (ODASD(SE))

NDIA Systems Engineering Division Meeting
March 16, 2015

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DASD, Systems Engineering Mission

Systems Engineering focuses on engineering excellence – the creative application of scientific principles:

- **To design, develop, construct and operate complex systems**
- **To forecast their behavior under specific operating conditions**
- **To deliver their intended function while addressing economic efficiency, environmental stewardship and safety of life and property**

DASD(SE) Mission: Develop and grow the Systems Engineering capability of the Department of Defense – through engineering policy, continuous engagement with component Systems Engineering organizations and through substantive technical engagement throughout the acquisition life cycle with major and selected acquisition programs.

A Robust Systems Engineering Capability Across the Department Requires Attention to Policy, People and Practice

- ***US Department of Defense is the World's Largest Engineering Organization***
- ***Over 108,000 Uniformed and Civilian Engineers***
- ***Over 39,000 in the Engineering (ENG) Acquisition Workforce***

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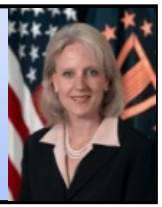
DASD, Systems Engineering

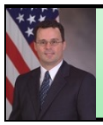
DASD, Systems Engineering
Stephen Welby
Principal Deputy Kristen Baldwin



Major Program Support
James Thompson

Supporting USD(AT&L) Decisions with Independent Engineering Expertise

- **Engineering Assessment / Mentoring of Major Defense Programs**
- **Program Support Assessments**
- **Overarching Integrated Product Team and Defense Acquisition Board Support**
- **Systems Engineering Plans**
- **Systemic Root Cause Analysis**
- **Development Planning/Early SE**
- **Program Protection**



Engineering Enterprise
Robert Gold

Leading Systems Engineering Practice in DoD and Industry

- **Systems Engineering Policy and Guidance**
- **Technical Workforce Development**
- **Specialty Engineering (System Safety, Reliability and Maintainability, Quality, Manufacturing, Producibility, Human Systems Integration)**
- **Security, Anti-Tamper, Counterfeit Prevention**
- **Standardization**
- **Engineering Tools and Environments**

Providing technical support and systems engineering leadership and oversight to USD(AT&L) in support of planned and ongoing acquisition programs

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DASD(SE) Key Responsibilities

- **Program Engagement**
  - Serve as principal engineering advisor to the SECDEF and USD(AT&L) in support of critical acquisition decisions
  - Provide continuous engineering oversight and mentoring of Major DoD Programs to identify, assess, and mitigate engineering risk; focus on helping ensure program success
  - Serve as approval authority for Systems Engineering Plans for all Major DoD Programs
  - Certify completeness of Preliminary Design Reviews and Critical Design Reviews for all Major DoD Programs
- **Policy and Guidance**
  - Develop engineering, manufacturing, reliability, program protection, and modeling and simulation policy and guidance for the DoD
  - Serve as Defense Standardization Executive – approve military standards and coordinate DoD engagement on non-military standards
- **Technical Workforce Development**
  - Provide functional leadership for the Non-Construction (Engineering) and the Acquisition (ENG and PQM) workforce
- **Engineering Research and Development**
  - Sponsor the DoD Systems Engineering Research Center (SERC) University Affiliated Research Center (UARC)
  - Sponsor the MITRE National Security Engineering Center (NSEC) Federally Funded Research and Development Center (FFRDC)

Reference: DoDI 5134.16, Deputy Assistant Secretary of Defense for Systems Engineering

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FY 2014 DASD(SE) Accomplishments

- **Performed systems engineering oversight of 182 programs with acquisition costs of $1.8T, including focused priority efforts:**
  - F-35 software and manufacturing reviews
  - Deep dive analysis of Indirect Fire Protection Capability
- **Approved 17 SEPs, conducted 15 Focused Reviews, performed 18 PPP reviews, and supported 211 program technical reviews and assessments**
- **Assessed 755 technical performance metrics (TPMs) across 21 MDAP & MAIS programs for systemic improvement of SEP TPMs**
- **Implemented significant SE policy improvements through an update to DoDI 5000.02**
- **Initiated reliability growth reporting in DAES for major defense acquisition programs**
- **Released DFARS for Safeguarding Technical Information, published two technical standards (IEEE 15288.1 and 15288.2), updated DoDM 4120.24 Defense Standardization Program procedures, and DoD 5000.69-M Joint Services Weapon Safety Review Process**
- **Updated and launched the M&S Catalog enabling community access through DTIC**
- **Developed Anti-Tamper guidance for exportability, and roadmap for Anti-Tamper Technology**
- **Supported Better Buying Power 2.0 and planning for BBP 3.0**

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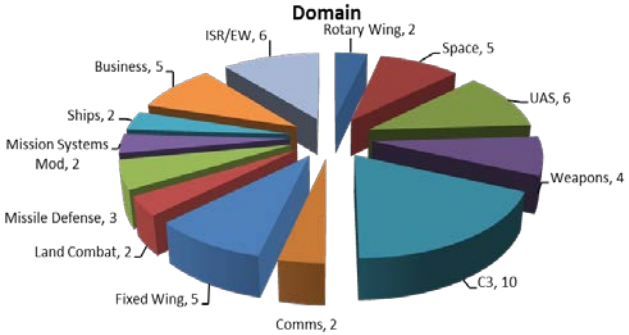
FY 2014 Major Program Support Activity

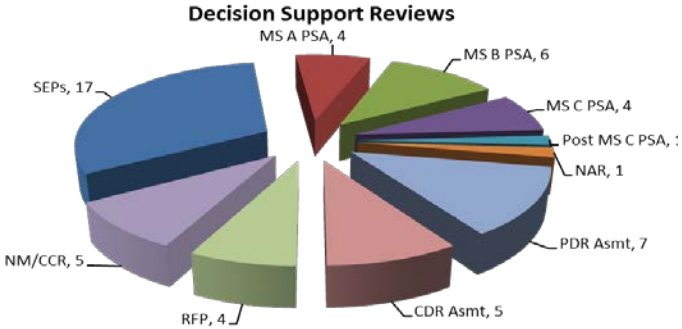
FY 2014 SEP Review and Approval Activity

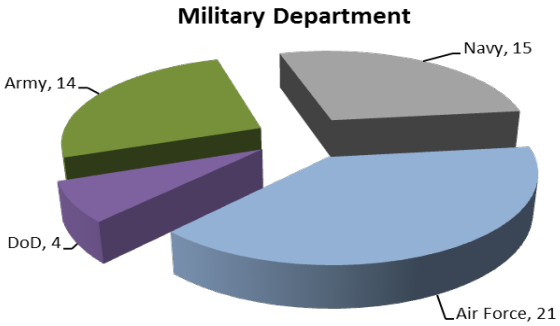
Major Programs	Program SEPs Reviewed			Program SEPs Approved		
	MDAP	MAIS	Total	MDAP	MAIS	Total
Supporting MS A	1	0	1	1	0	1
Supporting MS B	2	5	7	3	2	5
Supporting MS C	6	2	8	4	1	5
Other (FDD, FRP, ADM Action, etc.)	10	4	14	3	3	6
Total	19	11	30	11	6	17

FY 2014 DASD(SE) Systems Engineering Assessment Summary

Major Program	PSAs/ Focused Reviews	NM/ CCR	Non-Advocate Reviews	PDR Assessment	CDR Assessment	DPAP RFP Peer Reviews	TOTAL
MDAP/Pre-MDAP	13	2		6	1	4	26
MAIS/MDA	2	3	1	1	4	0	11
Total	15	5	1	7	5	4	37







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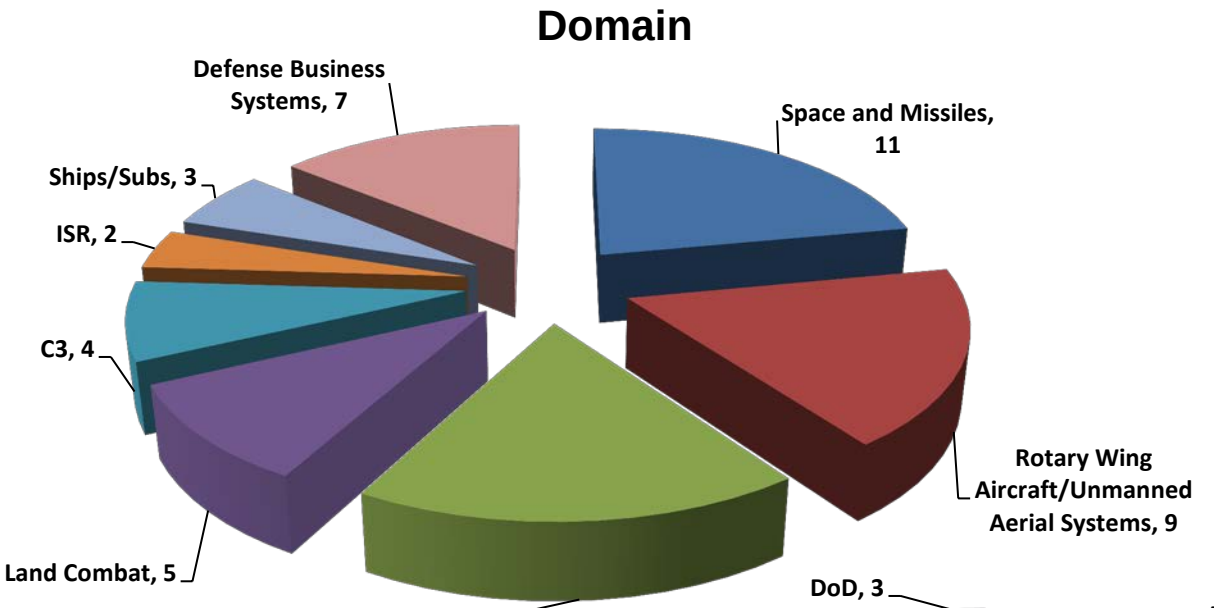
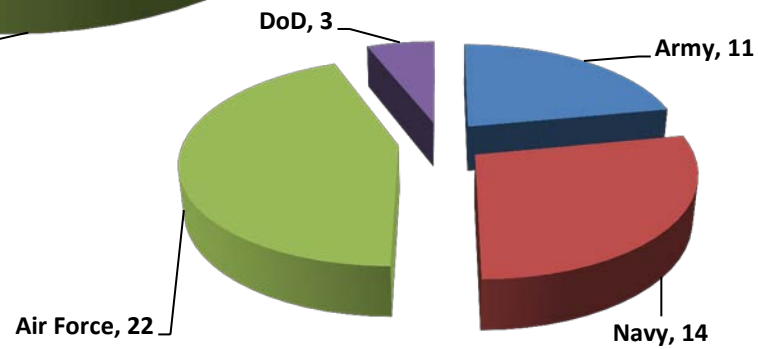
FY 2014 Program Protection Engagement and Support Summary

50 Programs Supported



18 PPPs Approved

- 3DELRR, MS B
- AOC-WS, MS B
- B61-12 TKA, MS B
- CANES, MS C
- DAI Inc 2, MS B
- DEAMS, MS B
- EPS CAPS, MS B
- Global Hawk, MS C
- GPS Enterprise, MS B
- IFPC-2, MS A
- IPPS-A Inc 1, MS C
- ISPAN INC 4, MS B
- LMP Inc 2, MS B
- P-8A Inc 1, FRP
- PKI, FDD
- SDB II, MS C
- TMIP-J, FRP
- VXX, MS B



Military Department

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Continued Focus on Engineering Policy and Guidance

- **Revised DoD Instruction (DoDI) 5000.02 Operation of the Defense Acquisition System, January 7, 2015**
  http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf
  - Instantiated engineering activities through the DoD acquisition lifecycle
  - Articulates strong role for DASD(SE) and the engineering functions
  - Strengthen key engineering and technical considerations such as reliability and maintainability, development planning, systems engineering trade-off analyses, and systems security engineering
  - Defense Acquisition University training materials being revised to reflect guide.
- **DoD Risk Management Guide for Defense Acquisition Programs, December 2014**
  http://www.acq.osd.mil/se/docs/DoD-Risk-Mgt-Guide-v7-interim-Dec2014.pdf
  - Major focus area and key initiative under BBP 3.0
  - Developing an updated risk management guide
  - Risk management best practices captures and updated to reflect Department-wide focus on risk mitigation vice monitoring

Highlights the need for continuous process improvement in acquisition policy

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Program Protection Planning Methodology

Criticality Analysis

- Determine system critical components based on critical mission threads
- Analyze component vulnerability to malicious exploit
- Identify potential component suppliers

CPI Analysis

- Identify capability elements providing a US technological advantage
- Assess the risk associated with each CPI (exposure, consequence of compromise)
- Conduct horizontal analysis

Threats and Vulnerabilities Assessment

- Identify supply chain threats and vulnerabilities
- Identify foreign collection threats and vulnerabilities
- Identify personnel, physical, operational threats and vulnerabilities

Program Protection Plan

- Determine candidate protection measures to address vulnerabilities: anti-tamper, cybersecurity, hardware/software assurance, physical security, operations security, supply chain, system security, and trusted suppliers
- Determine foreign involvement expectations and impacts on protection measures
- Conduct engineering risk/cost trade-off analysis to select protection measures
- Identify acquisition mitigations (e.g., blind buy, trusted source)
- Determine system security requirements

Contractor

- Respond to acquisition and security requirements
- Continually assess security risks during design reviews and system implementation
- Conduct early defense exportability features planning and design

Test and Evaluation

- Assess hardware and software vulnerabilities
- Evaluate anti-tamper protections
- Verify security requirements (Contractor, Developmental Test, Operational Test)

Program Protection – an Integral Part of Systems Engineering

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Joint Federated Assurance Center (JFAC)

Congress directed DoD through the 2014 National Defense Authorization Act Section 937 to:

"…provide for the establishment of a joint federation of capabilities to support the trusted defense system needs…to ensure security in the software and hardware developed, acquired, maintained, and used by the Department."

Approach:

- **Establish a Federation of HwA and SwA capabilities to support programs in program protection planning and execution**
- **Support program offices across the life cycle by identifying and facilitating access to Department SwA and HwA expertise and capabilities, policies, guidance, requirements, best practices, contracting language, training, and testing support**
- **Coordinate with DoD R&D for SwA & HwA**
- **Procure, manage, and distribute enterprise licenses for SW and HW assurance tools**

Status:

- **Charter signed out by DepSecDef**
- **937 Congressional Report in final stages**
- **Working concept of operations, capability map, and capability gap analysis**
- **Initial capability on track for 2015**

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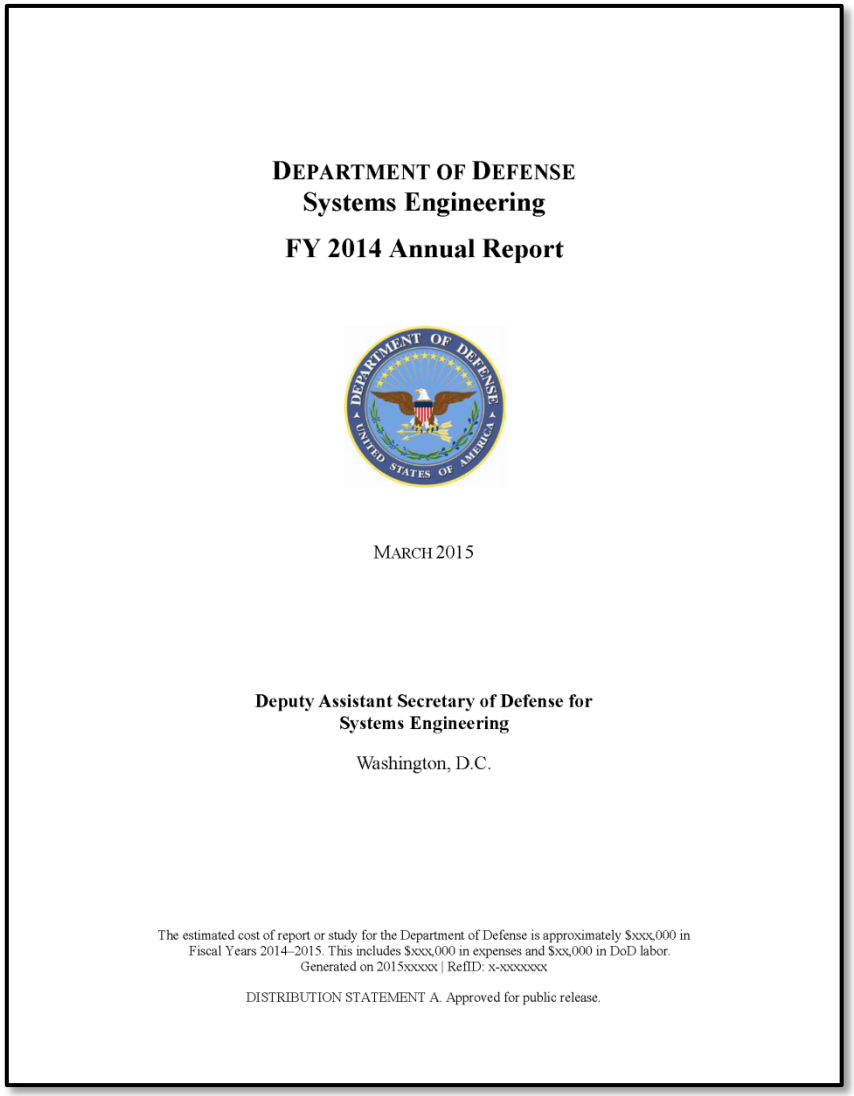
SE Annual Report to Congress



DEPARTMENT OF DEFENSE
Systems Engineering

FY 2014 Annual Report

MARCH 2015

Deputy Assistant Secretary of Defense for
Systems Engineering

Washington, D.C.

The estimated cost of report or study for the Department of Defense is approximately $xxx,000 in Fiscal Years 2014–2015. This includes $xxx,000 in expenses and $xx,000 in DoD labor.
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DISTRIBUTION STATEMENT A. Approved for public release.

- **FY 2014 SE Annual Report to Congress currently on track to deliver 31 March**
- **Detailed review of DASD(SE) Accomplishments in FY 2014**
- **Review of Service progress and plans implementing key pieces of WSARA to improve SE capabilities**
- **Current ENG workforce numbers by Service and best available estimates of SE contracting workforce**
- **Detailed program by program assessments for 46 MDAPs**

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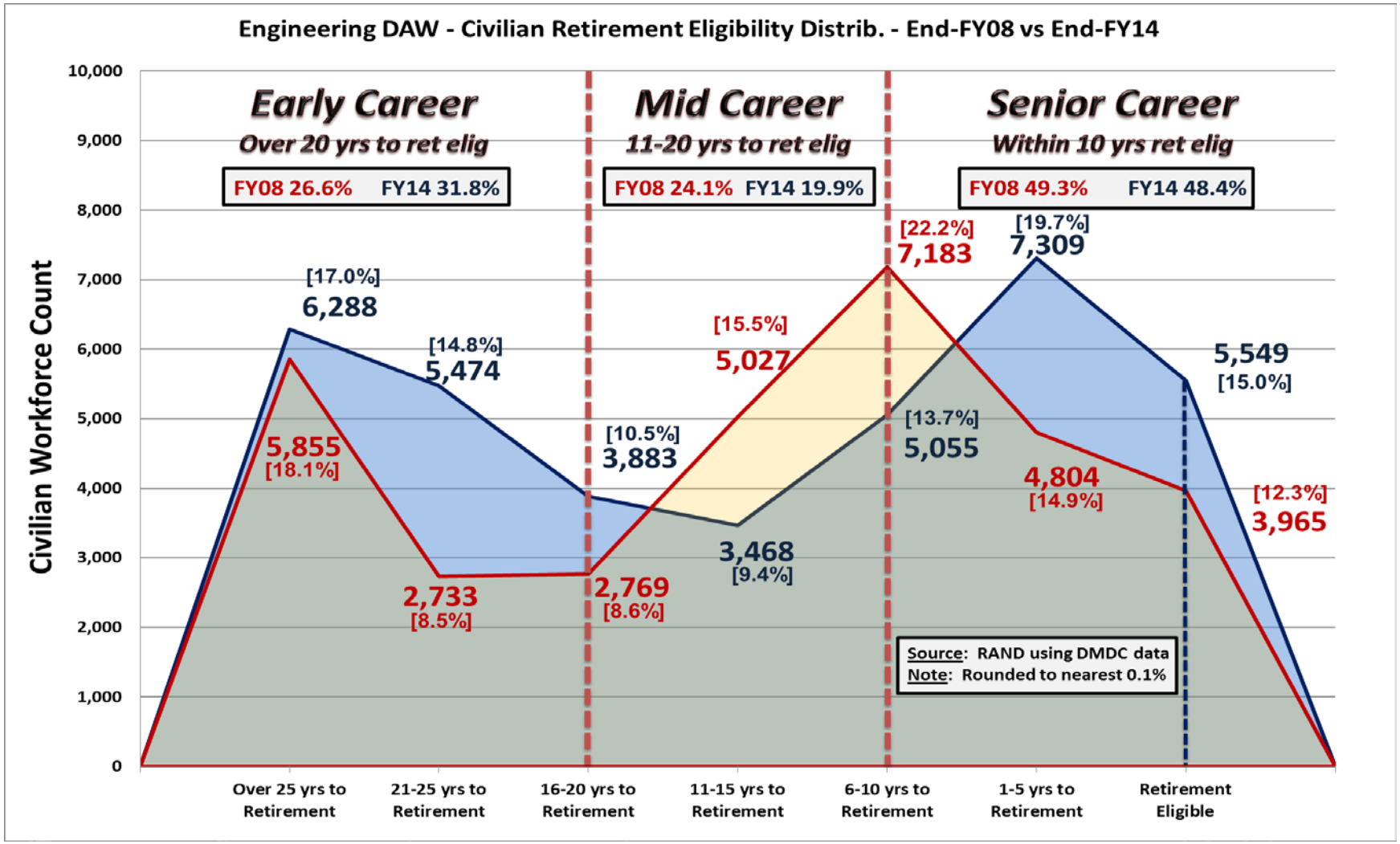
Engineering Civilian Retirement Eligibility Distribution – FY 2008/FY 2014



Data Source: RAND NDRI Forces and Resources Policy Center

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Systems Engineering Research Center

1. Stevens Institute of Technology
2. University of Southern California
3. Air Force Institute of Technology
4. Auburn University
5. Carnegie Mellon University
6. Georgetown University
7. Georgia Institute of Technology
8. Massachusetts Institute of Technology
9. Missouri University of Science and Technology
10. Naval Postgraduate School
11. North Carolina Agricultural & Technical State University
12. Pennsylvania State University
13. Purdue University
14. Southern Methodist University
15. Texas A&M University
16. Texas Tech University
17. University of Alabama in Huntsville
18. University of California - San Diego
19. University of Maryland
20. University of Massachusetts Amherst
21. University of Virginia
22. Wayne State University

Research Focus Areas:

- Enterprise Systems and Systems of Systems
- Trusted Systems
- Systems Engineering and Systems Management Transformation
- Human Capital Development

140 journal and conference papers
88 technical reports
NOTABLE PROJECTS:

- Tradespace and Affordability Methods, Tools, and Processes
- System Security Engineering
- Quantitative Risk

SERC leverages expertise of over 400 researchers across the Nation

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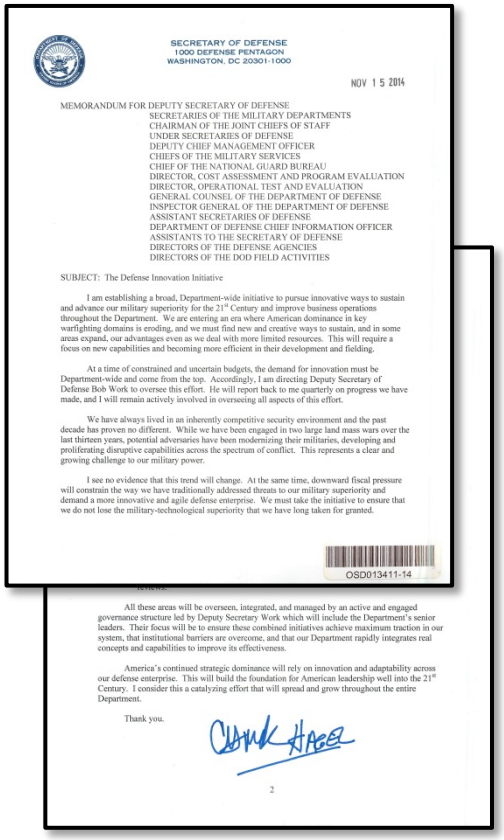
Defense Innovation Initiative (DII)



SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

NOV 15 2014

MEMORANDUM FOR DEPUTY SECRETARY OF DEFENSE
SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
DEPUTY CHIEF MANAGEMENT OFFICER
CHIEFS OF THE MILITARY SERVICES
CHIEF OF THE NATIONAL GUARD BUREAU
DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION
DIRECTOR, OPERATIONAL TEST AND EVALUATION
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
DEPARTMENT OF DEFENSE CHIEF INFORMATION OFFICER
ASSISTANTS TO THE SECRETARY OF DEFENSE
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: The Defense Innovation Initiative

I am establishing a broad, Department-wide initiative to pursue innovative ways to sustain and advance our military superiority for the 21st Century and improve business operations throughout the Department. We are entering an era where American dominance in key warfighting domains is eroding, and we must find new and creative ways to sustain, and in some areas expand, our advantages even as we deal with more limited resources. This will require a focus on new capabilities and becoming more efficient in their development and fielding.

At a time of constrained and uncertain budgets, the demand for innovation must be Department-wide and come from the top. Accordingly, I am directing Deputy Secretary of Defense Bob Work to oversee this effort. He will report back to me quarterly on progress we have made, and I will remain actively involved in overseeing all aspects of this effort.

We have always lived in an inherently competitive security environment and the past decade has proven no different. While we have been engaged in two large land mass wars over the last thirteen years, potential adversaries have been modernizing their militaries, developing and proliferating disruptive capabilities across the spectrum of conflict. This represents a clear and growing challenge to our military power.

I see no evidence that this trend will change. At the same time, downward fiscal pressure will constrain the way we have traditionally addressed threats to our military superiority and demand a more innovative and agile defense enterprise. We must take the initiative to ensure that we do not lose the military-technological superiority that we have long taken for granted.

OSD013411-14

All these areas will be overseen, integrated, and managed by an active and engaged governance structure led by Deputy Secretary Work which will include the Department's senior leaders. Their focus will be to ensure these combined initiatives achieve maximum traction in our system, that institutional barriers are overcome, and that our Department rapidly integrates real concepts and capabilities to improve its effectiveness.

America's continued strategic dominance will rely on innovation and adaptability across our defense enterprise. This will build the foundation for American leadership well into the 21st Century. I consider this a catalyzing effort that will spread and grow throughout the entire Department.

Thank you.

Chuck Hagel

2

"We must accelerate innovation throughout the Department in several linked areas:

- **The 21st Century requires us to integrate <u>leadership development practices</u> with emerging opportunities to re-think how we develop managers and leaders.**
- **A <u>new long-range research and development planning program</u> will identify, develop, and field breakthrough technologies and systems that sustain and advance the capability of U.S. military power.**
- **A <u>reinvigorated wargaming effort</u> will develop and test alternative ways of achieving our strategic objectives and help us think more clearly about the future security environment.**
- **<u>New operational concepts</u> will explore how to employ resources to greater strategic effect and deal with emerging threats in more innovative ways.**
- **Finally, we need to continue to further <u>examine our business practices</u> and find ways to be more efficient and effective through external benchmarking and focused internal reviews."**

Secretary of Defense Chuck Hagel's November 15, 2014 memo, "The Defense Innovation Initiative"
http://www.defenseinnovationmarketplace.mil/resources/DefenseInnovationInitiative.pdf

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Long-Range R&D Program Plan (LRRDPP) Approach

Identify <u>high-payoff enabling technology investments</u> that could:

- **Provide an opportunity to shape key future US materiel investments**
- **Offer opportunities to shape the trajectory of future competition for technical superiority,**
- **Engage communities inside and outside the Defense community, and**
- **Will focus on technology that can be moved into development programs within the next five years.**

Space technology

Undersea technology

Air dominance and strike technology

Air and missile defense technology

Other technology-driven concepts

http://www.defenseinnovationmarketplace.mil/LRRDPP.html

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Better Buying Power 3.0 (Draft)

Achieving Dominant Capabilities Through Technical Excellence and Innovation

Achieve Affordable Programs

- Continue to set and enforce affordability caps

Achieve Dominant Capabilities While Controlling Lifecycle Costs

- Strengthen and expand "should cost" based cost management
- Build stronger partnerships between the acquisition, requirements, and intelligence communities
- Anticipate and plan for responsive and emerging threats
- Institutionalize stronger DoD level Long Range R&D Planning
- Protect unclassified technical information

Incentivize Productivity in Industry and Government

- Align profitability more tightly with Department goals
- Employ appropriate contract types, but increase the use of incentive type contracts
- Expand the superior supplier incentive program across DoD
- Increase effective use of Performance-Based Logistics
- Remove barriers to commercial technology utilization
- Improve the return on investment in DoD laboratories
- Increase the productivity of IR&D and CR&D

Incentivize Innovation in Industry and Government

- Increase the use of prototyping and experimentation
- Emphasize technology insertion and refresh in program planning
- Use Modular Open Systems Architecture to stimulate innovation
- Increase the return on Small Business Innovation Research (SBIR)
- Provide draft technical requirements to industry early and engage industry in funded concept definition to support requirements definition
- Provide clear "best value" definitions so industry can propose and DoD can choose wisely

Eliminate Unproductive Processes and Bureaucracy

- Emphasize Acquisition Executive, Program Executive Office and Program Manager responsibility, authority, and accountability
- Reduce cycle times while ensuring sound investments
- Streamline documentation requirements and staff reviews

Promote Effective Competition

- Create and maintain competitive environments
- Improve technology search and outreach in global markets

Improve Tradecraft in Acquisition of Services

- Increase small business participation, including more effective use of market research
- Strengthen contract management outside the normal acquisition chain
- Improve requirements definition
- Improve the effectiveness and productivity of contracted engineering and technical services

Improve the Professionalism of the Total Acquisition Workforce

- Establish higher standards for key leadership positions
- Establish stronger professional qualification requirements for all acquisition specialties
- Strengthen organic engineering capabilities
- Ensure the DoD leadership for development programs is technically qualified to manage R&D activities
- Improve our leaders' ability to understand and mitigate technical risk
- Increase DoD support for Science, Technology, Engineering and Mathematics (STEM) education

Continue Strengthening Our Culture of Cost Consciousness, Professionalism, and Technical Excellence

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FY 2015 DASD(SE) Goals

- Continue excellence in Engineering support to programs and acquisition decisions to include improving focus on technical risk management
- Provide consistent Program Protection engagement with programs resulting in successful vulnerability mitigation strategies, improve system security engineering engagement and support to programs, standup the Joint Federated Assurance Center, and implement data protection activities
- Advocate for and ensure adequate DoD Engineering Workforce capacity and capability, and enhance STEM engineering activities
- Launch and/or support BBP 3.0 implementation plans for organic workforce capability, managing technical risk, increasing technology insertion opportunities, and modular open systems architectures; and protection of unclassified technical data
- Support R&E on critical engineering research and prototyping investments
- Refine and implement processes to oversee Acquisition of Engineering and Technical Services
- Support Defense Innovation Initiative, lead Department-wide Long Range Research and Development Program Plan, support ASD(R&E) initiatives and support several Defense Science Board study efforts

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Summary

- **Criticality of our Systems Engineering mission work has grown**
  - Our work will be even more essential in facing budget challenges
- **We are making an impact**
  - Strong support for System Engineering mission across the Department
- **Dedicated, professional and committed SE staff**
- **Focused on working smarter, as a more tightly integrated team across OSD and the Services**
- **Continue to make a difference for the warfighter and the taxpayer**

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Systems Engineering: Critical to Defense Acquisition

Defense Innovation Marketplace
http://www.defenseinnovationmarketplace.mil

DASD, Systems Engineering
http://www.acq.osd.mil/se

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