DoD Systems Engineering

Mr. Stephen Welby
Director, Systems Engineering
Office of the Director, Defense Research and Engineering

12th Annual NDIA Systems Engineering Conference
October 27, 2009

Support from the Top for Change

Weapon Systems Acquisition Reform Act of 2009

- Establishes Director, Systems Engineering (D, SE) and Director, Developmental Test and Evaluation (D, DT&E) as principal advisors to the SECDEF and the USD(AT&L)
- Mandates documented assessment of technological maturity and integration risk of critical technologies for MDAPs during the Technology Development (TD) phase
- Establishes D, DT&E and D, SE joint tracking and Congressional reporting on MDAP achievement of measurable performance criteria
- Mandates competitive prototyping and MDA completion of a formal Post-Preliminary Design Review Assessment for all MDAPs before MS B; additional MDA certification to both at MS B
- Strengthens technical analysis of cost and schedule breaches during the Technology Development (pre-MS B) and the Engineering and Manufacturing Development (post-MS B) phases

President Barack Obama hands a pen to U.S. Rep. Robert Andrews (D-NJ) as he signs the Weapons Systems Acquisition Reform Act in the Rose Garden at the White House Friday, May 22, 2009. Standing from left are: Andrews, Rep. John McHugh (R-NY), Sen. Carl Levin (D-MI), Rep. Ike Skelton (D-MO) and Rep. Mike Conaway (R-TX). Official White House Photo by Samantha Appleton

MDAP- Major Defense Acquisition Program (USC 2430)
MDA – Milestone Decision Authority

Director, Systems Engineering

Director, Systems Engineering
Steve Welby

Terry Jaggers, Principal Deputy

Systems Analysis
Kristen Baldwin

- System Complexity Analysis
- Red Teaming
- Modeling & Simulation Coordination Office
- Development Planning
- SE for Systems of Systems
- Program Protection/Acquisition Cyber Security
- SE Research Center

Major Program Support
James Thompson

- Program Support Reviews
- Systems Engineering Plans
- Program Technical Auditing
- OIPT/DAB/DSAB Support
- DAES Database Analysis and Support
- Performance Measurement
- Systemic Root Cause Analysis

Mission Assurance
Nicholas Torelli

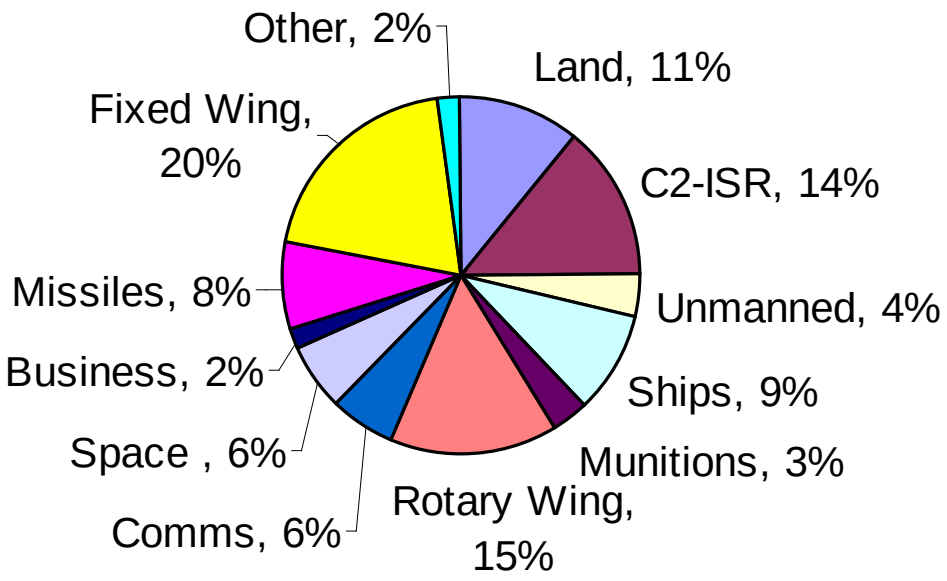
- Systems and Software Engineering Policy, Guidance, Standards
- System Safety
- Reliability, Availability, Maintainability
- Quality, Manufacturing, Producibility
- Human Systems Integration (HSI)
- Technical Workforce Development
- Organizational Capability Assessment (WSARA)

Responsible to provide technical support, systems engineering oversight, program development and mission assurance certification to USD(AT&L) in support of planned and ongoing acquisition programs

Scope of DDR&E Acquisition Program Oversight Efforts*

Program Category	Increasing cost/risk	# of Progs
ACAT ID**	$$$ MDA = AT&L	93
ACAT IC**	$$$ MDA = CAE	52
Special Interest**	Any $s Risk	19
MAIS, ACAT IA	$-$$$, AIS	30
Pre-MDAP	$$$ pre-MS B	53
Pre-MAIS	$-$$$, AIS pre-MS B	10
ACAT II	$$ < ACAT I	8
ACAT III	$ < ACAT II	9
Total		274

% Distribution of MDAPs by Domain



*Based on 2009 T&E Oversight List (Jan 5, 2009)
**Major Defense Acquisition Program (MDAP)
+Major Automated Information System (MAIS)

MDA – Milestone Decision Authority
TMA – Technology Maturity Assessment
CAE – Component Acquisition Executive

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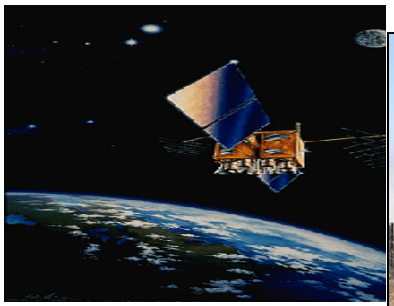
Systems Engineering Contributions to Acquisition

- Systems-level technical leadership
- Risk identification and management
- Interface management
- Life cycle focus
- Robust exploration of the need
- Achievable system design
- Integration of technical disciplines

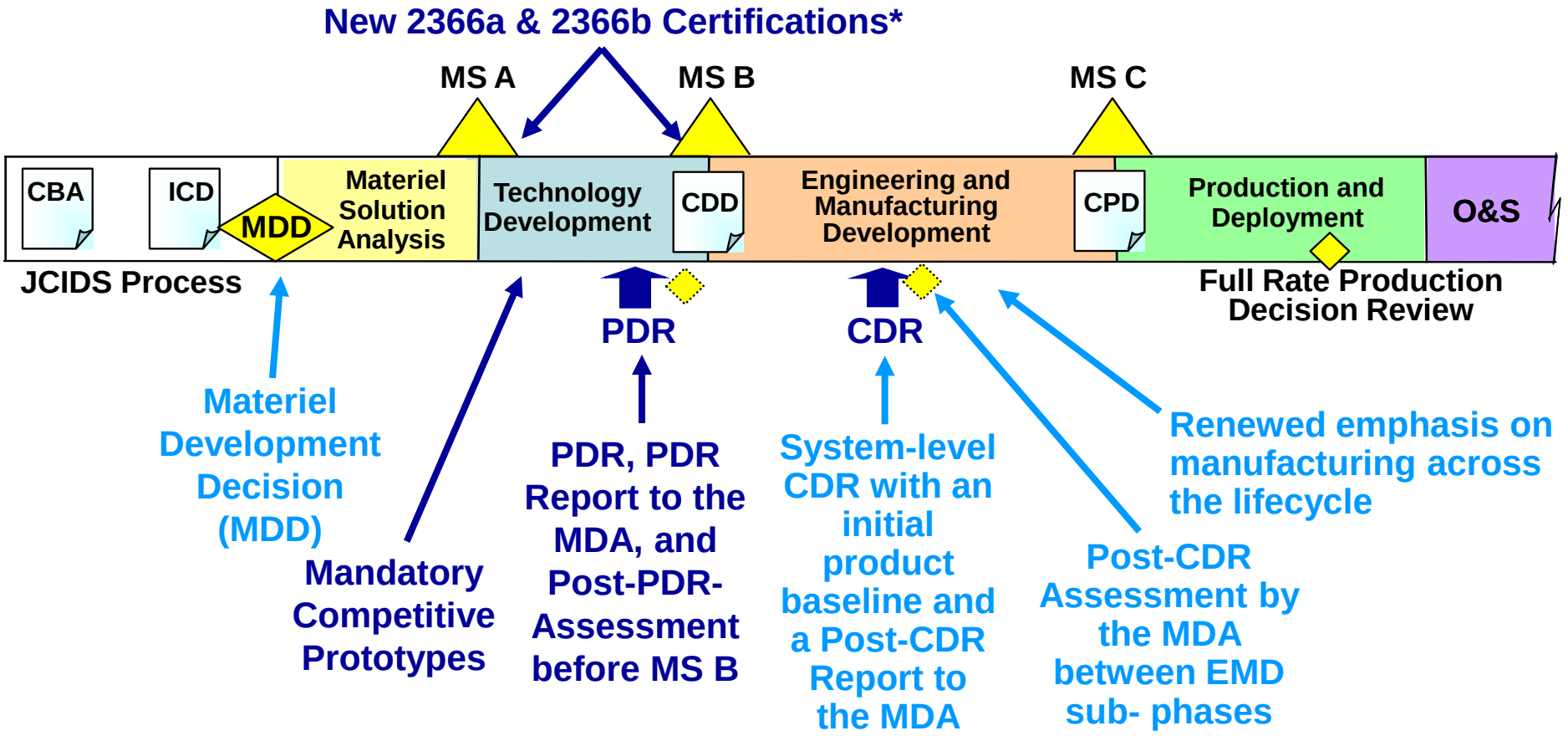



Systems Engineering Mission

Execute substantive technical engagement throughout the acquisition life cycle with major and selected acquisition efforts across DoD to apply best Systems Engineering practices to:

- Help program managers identify and mitigate risks
- Shape technical planning and management
- Provide insight to OSD stakeholders
- Identify systemic issues for resolution above the program level

DoD 5000.02 and PL 111-23 – the Changed Acquisition Landscape



"Knowledge-based" Decision Making . . .making acquisition decisions when you have solid evidence and acceptable risk

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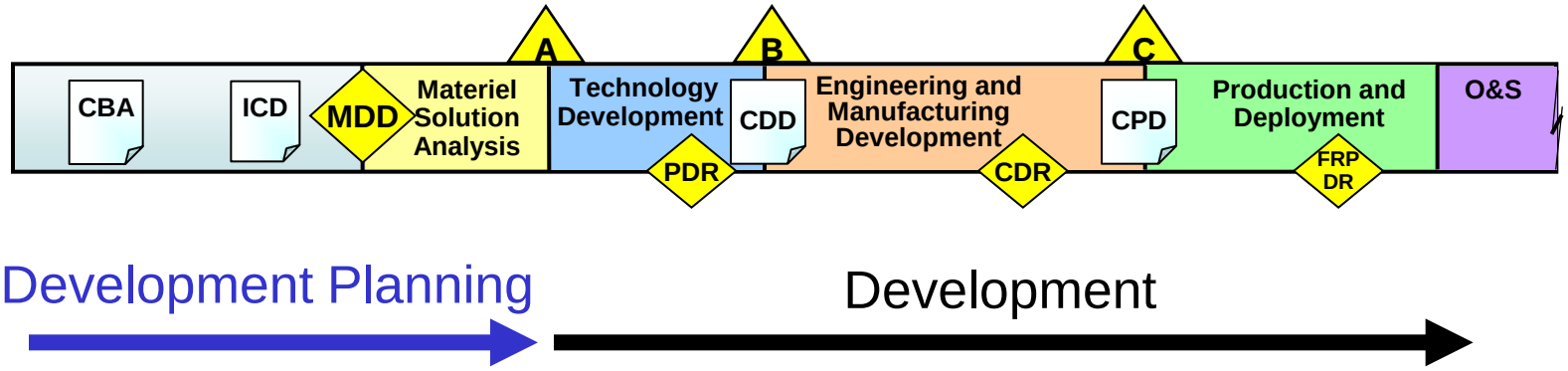
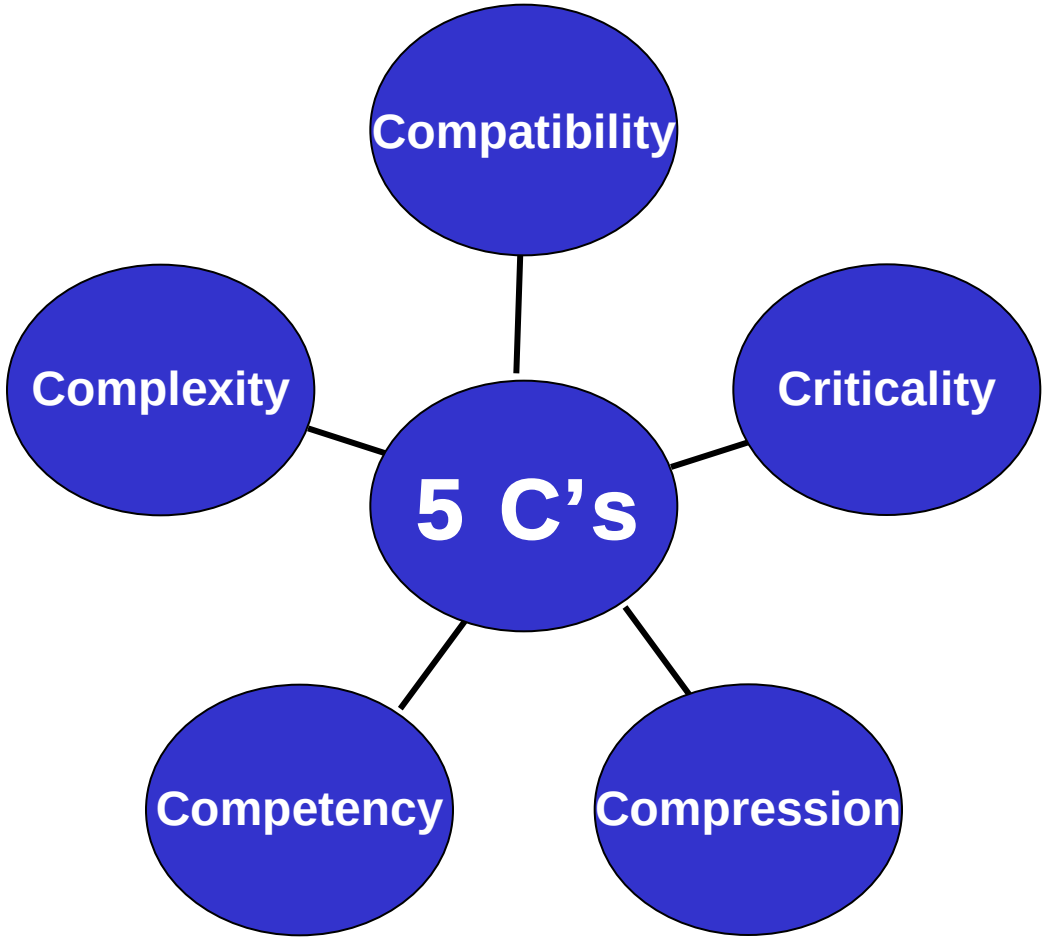
* Director, SE supports MDA certifications including PDR Report assessment at MS B

New Emphasis on Development Planning and Early Systems Engineering



CBA: Capabilities Based Assessment
CDD: Capability Development Document
CDR: Critical Design Review
CPD: Capability Production Document
DP: Development Planning
FRP DR: Full-Rate Production Decision Review
ICD: Initial Capabilities Document
MDD: Materiel Development Decision
O&S: Operations and Support
PDR: Preliminary Design Review

The Current Systems Engineering Environment



Systems Engineers confront a spectrum of issues that challenge "traditional" systems engineering

DDR&E Imperatives

1. Accelerate delivery of technical capabilities to win the current fight
2. Prepare for an uncertain future
3. Reduce the cost, acquisition time and risk of our major defense acquisition programs
4. Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation

(Draft) FY2010 Systems Engineering Initiatives

DDR&E 1 Accelerate delivery of technical capabilities to win the current fight

SE 1.1 Leverage "lighter-weight" tailored Systems Engineering process for urgent needs, rapid fielding and technology insertion

Director, Systems Engineering Focus:
Support the current fight, manage risk with discipline

DDR&E 2 Prepare for an uncertain future

SE 2.1 Develop Systems Engineering techniques to formally specify and measure adaptability/flexibility/adjustability of defense systems to operate in new and unknown environments/missions

SE 2.2 Develop new approaches to address emerging Systems Engineering competencies in complex systems, large scale software, and trusted and secured systems

SE 2.3 Conduct Systems of Systems analysis in support of system and architecture level assessment of emerging capabilities

Director, Systems Engineering Focus:
Grow engineering capabilities to address emerging challenges

(Draft) FY2010 Systems Engineering Initiatives

DDR&E 3 Reduce the cost, acquisition time and risk of our Major Defense Acquisition Programs

- **SE 3.1 Engage continuously with Service acquisition efforts – provide mentorship and support to program offices**
- **SE 3.2 Support early development planning for emerging acquisition efforts per WSARA**
- **SE 3.3 Review and approve Systems Engineering Plans for all MDAP and MAIS efforts and report to Congress**
- **SE 3.4 Eliminate serial oversight – Integrate Systems Engineering Program Support Reviews with specialty reviews across DDR&E and A&T**
- **SE 3.5 Leverage the Systems Engineering process for major systems acquisition to identify and mitigate technical and programmatic risks early**
- **SE 3.6 Manage risk escapes through the use of formal DDR&E red teams to provide comprehensive technical assessment of critical programs**
- **SE 3.7 Manage system vulnerability and mitigate security risk through program threat protection policy and assessment**

Director, Systems Engineering Focus:
Champion Systems Engineering as a tool to improve acquisition quality

(Draft) FY2010 Systems Engineering Initiatives

DDR&E 4 Develop World Class Science, Technology, Engineering and Mathematics capabilities for the DoD and the Nation

- **SE 4.1 Create opportunities to attract, foster and grow future DoD engineering leaders**
- **SE 4.2 Engage with industry to develop and share Systems Engineering "Best Practices"**
- **SE 4.3 Support workforce development, competency modeling and assessment and certification standards**
- **SE 4.4 Assess Service Systems Engineering capabilities and report to Congress per WSARA**
- **SE 4.5 Develop, support and coordinate next generation Modeling, Simulation and Analysis capabilities**
- **SE 4.6 Provide consistent Systems Engineering guidance and policy to the Services, Agencies and industry**

Director, Systems Engineering Focus:
Develop future technical leaders across the acquisition enterprise

Systems Engineering Research Center (SERC)
DoD University Affiliated Research Center

STEVENS Institute of Technology

USC UNIVERSITY OF SOUTHERN CALIFORNIA

AUBURN UNIVERSITY

UMASS

UCSD

UNIVERSITY OF MARYLAND

AFIT The Air Force Institute of Technology

Fraunhofer

NPS PRAESTANTIA PER SCIENTIAM

PENN STATE Great Valley

SYSTEMS ENGINEERING Research Center

MISSOURI S&T

A&M

UAHuntsville THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

TEXAS TECH UNIVERSITY

Massachusetts Institute of Technology

Carnegie Mellon University PITTSBURGH PENNSYLVANIA

SMU

UNIVERSITY of VIRGINIA

Wayne State University

Multi-Level Engagement

SE

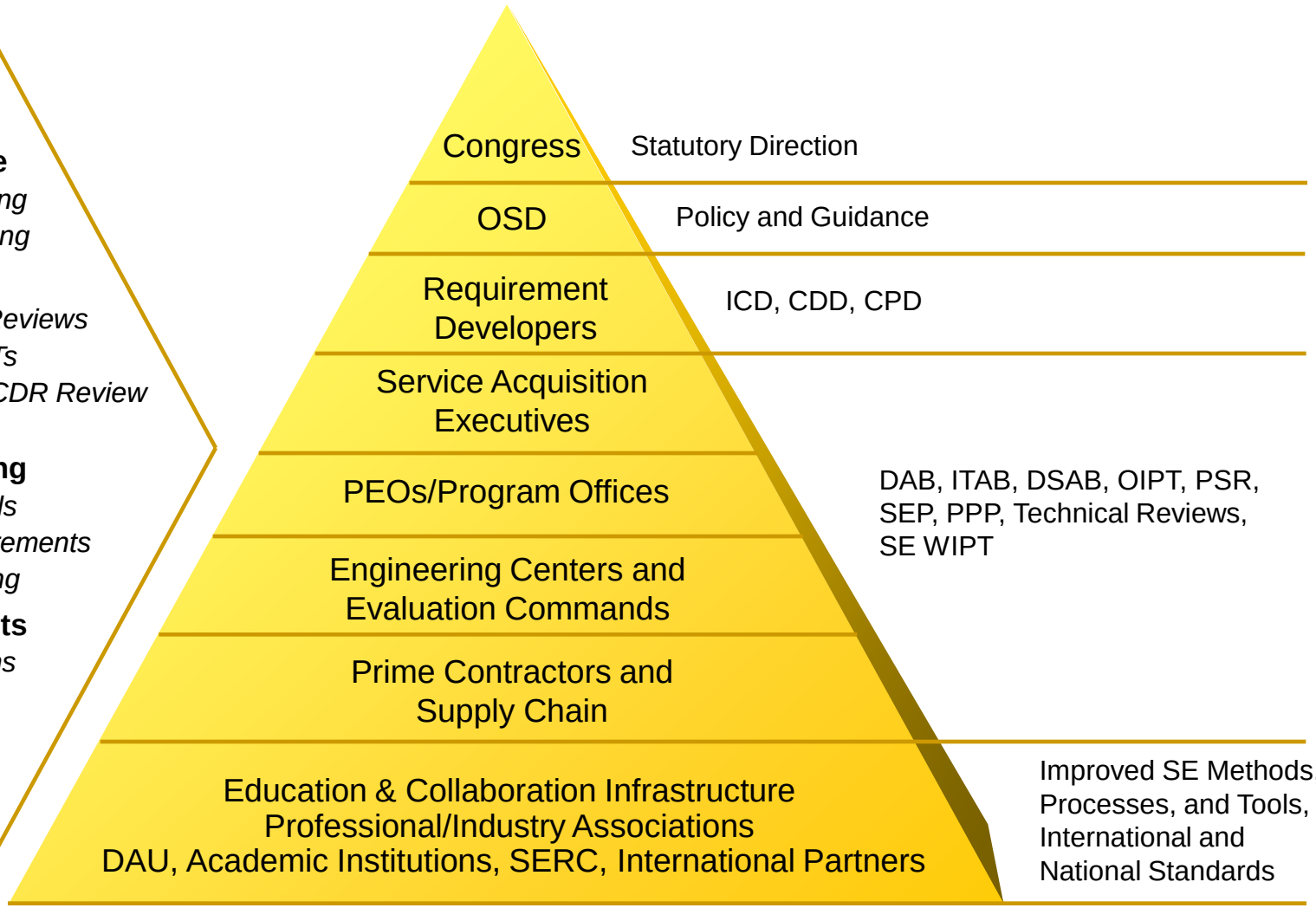
Policy & Guidance
- *Systems Engineering*
- *Software Engineering*

Program Support
- *Program Support Reviews*
- *OIPT and SE WIPTs*
- *AOTR, Post-PDR/CDR Review & Assessment*

Workforce Planning
- *Competency Models*
- *Certification Requirements*
- *Education & Training*

Emerging Concepts
- *Systems of Systems*
- *SE Research*

Outreach
- *SE Forum*
- *Engagement Strategy*



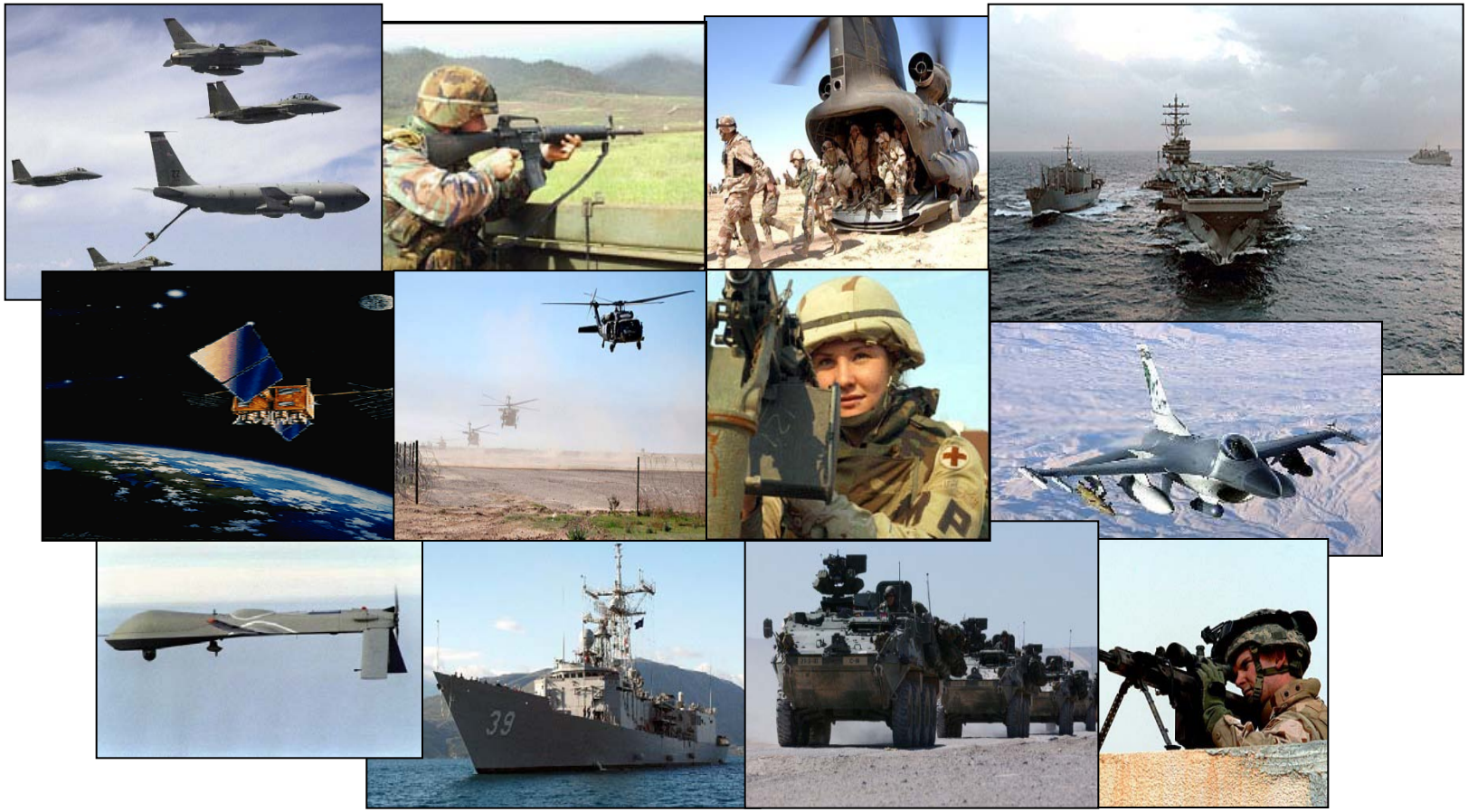
Systems Engineering's Partnership with Industry

- **Systems Engineering's industry stakeholders include:**
  - Prime and sub contractors
  - Supply chain vendors
  - Practicing systems engineers
  - Systems engineering tool vendors
- **Systems Engineering leverages industry and professional associations to:**
  - Disseminate policy and guidance
  - Obtain feedback from industry
  - Promote sound systems engineering best practices

Opportunities

- **Acquisition reform efforts have recognized criticality of strong Systems Engineering focus for program success**
  - ***Systems Engineering toolkit focused on identifying and managing risk – development risk, production risk and life-cycle***
- **Growing focus on addressing "early-acquisition" phases - requirements definition, development planning, and early acquisition**
  - ***Leading to more informed decisions at MS B***
- **Our development processes need to evolve to provide faster product cycles, more adaptable products and address emerging challenges**
- **Future US Defense capabilities depend on a capable US engineering workforce in and out of government**
  - ***Need to create opportunities to grow future Engineering Heroes***

Systems Engineering: Critical to Program Success



Innovation, Speed and Agility