Affording Defense Capability: An SE-Centric Take on Science and Technology Priorities

Kristen Baldwin
Principal Deputy, Office of the Deputy Assistant Secretary of Defense for Systems Engineering
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**Supplementary Notes**

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Integrated S&T Enterprise

Missions
• National Defense Strategy
• Quadrennial Defense Review
• Space Posture Review
• Nuclear Posture Review

Operational Challenge
JUONs, UONs, COCOM IPL

Objective Architectures

Critical Capabilities

Enabling Technologies

Laboratory Program
Basic Research Program
STEM Program
Industry IR&D

FFRDCs
UARCs
Assistant Secretary of Defense
Research and Engineering 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.

Fast Track Studies
- Electronic Warfare
- Computer Science
- Cyber Operations
- Energy & Water
- Rapid Capability Tool Kit

Task Forces
- Helo Survivability
- Base Protection
- Tag, Track, Locate
- C-IED SIG Support
- QDR Missions Architectures

Threat sensors mounted to fuselage exterior
Helicopter Alert & Threat Termination-Acoustic (HALTT-A)
MRAP-ATV
Stiletto
PGSS
Quadrennial Defense Review Mission Set

1. Defend the United States and Support Civil Authorities at Home

2. Succeed in Counterinsurgency, Stability, and Counterterrorist Operations

3. Build the Security Capacity of Partner States

4. Deter and Defeat Aggression in Anti-Access Environments

5. Prevent Proliferation and Counter Weapons of Mass Destruction

6. Operate Effectively in Cyberspace.

http://www.defense.gov/DefenseReviews/
Architecture – Technology Trade Space

Architectures Drive Technologies
Technologies Inform Architectures
DoD S&T Focus Areas

SECDEF Guidance

Complex Threats
- Electronic Warfare / Electronic Protection
- Cyber Science and Technology
- Counter Weapons of Mass Destruction

Force Multipliers
- Data-to-Decisions
- Human Systems
- Autonomy
- Engineered Resilient Systems

19 April 2011
Electronic Warfare / Electronic Protection

New capabilities to dominate the electromagnetic spectrum

Affordable Laser IRCM Survivability System (ALISS)

Behavioral Learning for Adaptive Electronic Warfare (BLADE)
Cyber: Architecture for S&T Investments

Enhance United States National Security & Economic Prosperity

- Cyberspace is the new domain of warfare
- Need for active defenses
- Ensure the safety of critical infrastructure
- Collective defense
- Keep the technological advantage

Foundational DoD S&T Thrusts

Resiliency
Agility
Assuring Effective Missions
Foundations of Trust

Cyberspace is the new domain of warfare
Need for active defenses
Ensure the safety of critical infrastructure
Collective defense
Keep the technological advantage

Foundational DoD S&T Thrusts
Countering Weapons of Mass Destruction

- Advanced sensors
- Rapid response capabilities
- Advanced defeat mechanisms
Data-to-Decisions

- Investments span all aspects of this challenge with emphasis shifting from imagery to motion and text analytics
- Unstructured data analytics is the most challenging and critical component
Human Systems

**Personnel & Training**
- Realistic, immersive training
- Adaptive, tailored instruction
- Train partner state forces

**Strategic Decision Support**
- Battle management
- Autonomous system control
Autonomy

- Mobility
- Scalability
- Manipulation
- Perception
- Human Interaction
- Learning & Intelligence
Engineered Resilient Systems
Complex Systems Design

**Technical Thrusts**

- **Trustworthy Systems Design**
  - Trustability: design patterns, analytic tools
  - Tying design, physical and computational testing
  - Virtual worlds projecting alternative futures

- **Conceptual Engineering**
  - Platform-based analysis and architecting

- **Model Based Engineering**
  - Model-based tools: Analysis and simulation
  - Tradespace exploration

- **Platform Based Engineering**

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Some Final Thoughts

• How will we get there?

• Systems Engineering Research can contribute to many of the cross cutting DoD S&T priorities
  – We are placing priority for the SERC on Engineered Resilient Systems
  – Today’s panel will kick this off!
And, while you’re at it…

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Source: National Science Board, S&E Indicators, 2010; SDO Analysis