



# **NDIA Science & Engineering Conference**

**24 April 2013**

**Al Shaffer**

**Acting Assistant Secretary of Defense  
for Research and Engineering**

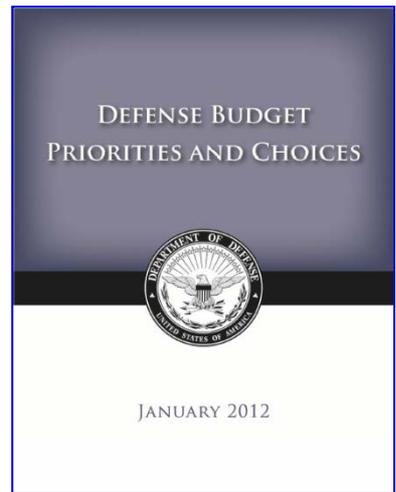
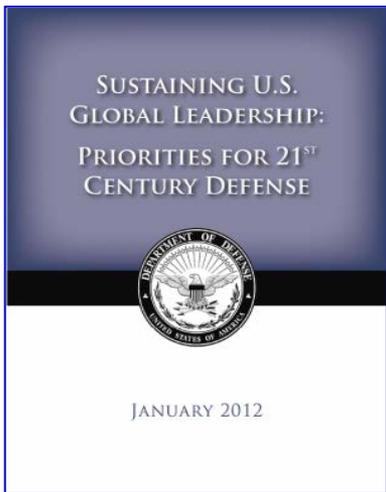


# Defense Strategic Guidance

## January 2012



- The military will be smaller and leaner, but it will be agile, flexible, ready and technologically advanced.
- Rebalance our global posture and presence to emphasize Asia-Pacific and the Middle East.
- Build innovative partnerships and strengthen key alliances and partnerships elsewhere in the world.
- Ensure that we can quickly confront and defeat aggression from any adversary – anytime, anywhere.
- Protect and prioritize key investments in technology and new capabilities, as well as our capacity to grow, adapt and mobilize as needed.

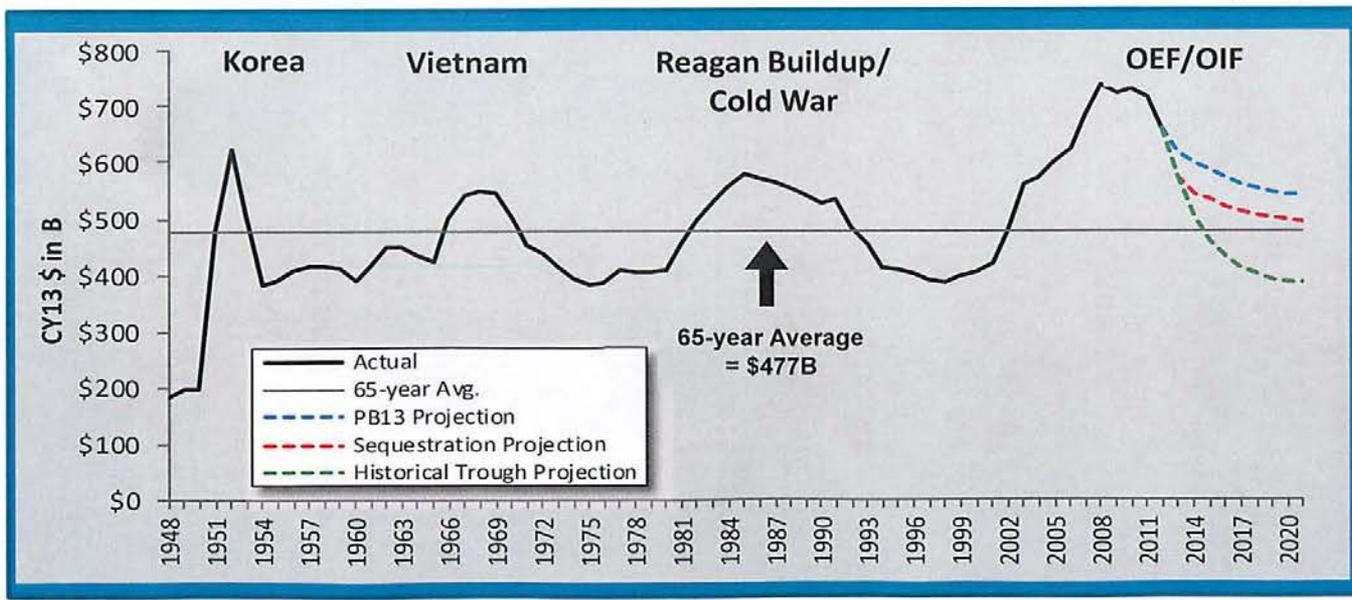




# The Reality....

*“Our current security challenges are more formidable and complex than those we faced in downturns following Korea, Vietnam, and the Cold War. There is no foreseeable “peace dividend” on our horizon.”*

GEN DEMPSEY, CJCS  
Testimony to SASC, 12 Feb 2013

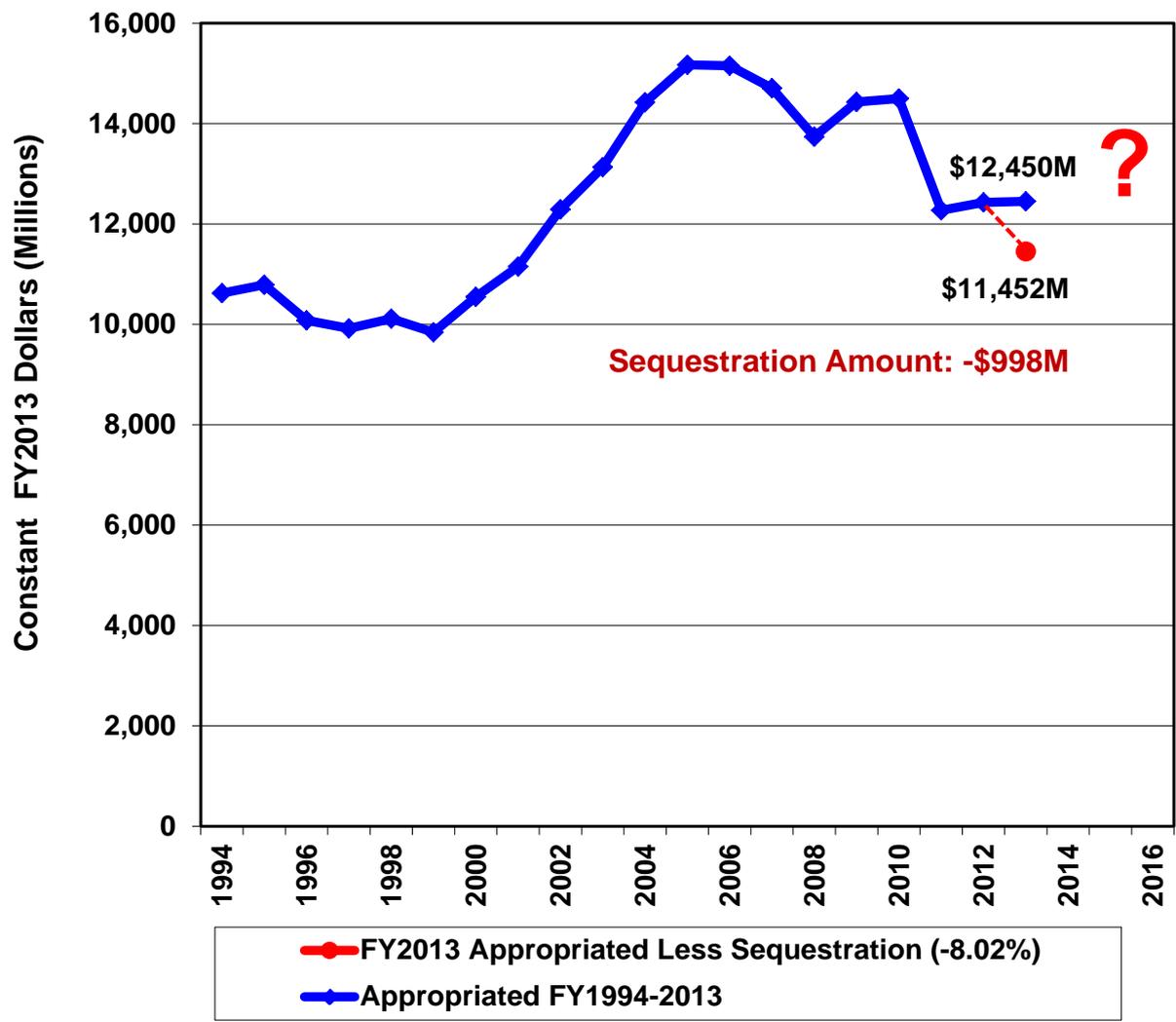


UNCLASSIFIED



# DoD S&T FUNDING: FY1994-2013

(FY1994-2013 Appropriated and FY2013 Appropriated Less 8.02% Sequestration)



## Sequestration Impact

- Slow Programs
- Fewer Awards
- Reduce Grants ~\$200M
- Reduce FFRDC STEs
- Reduce overall Contract Support



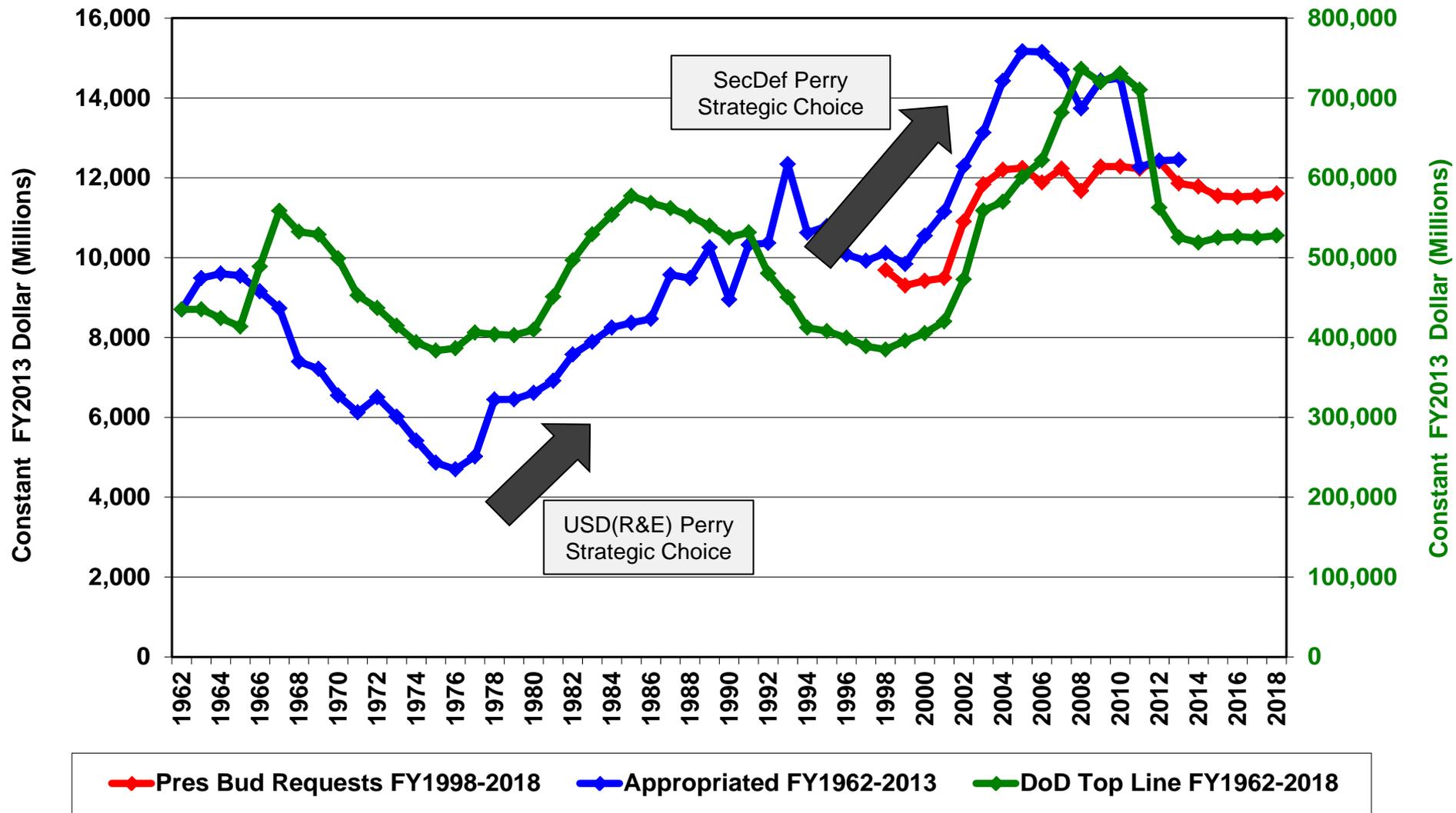
*“Gentleman, we are out of money.  
Now we must think!”*



Winston Churchill to  
Parliament during World War II



# During Previous Budget Pressures, DoD Protects the Future through R&E

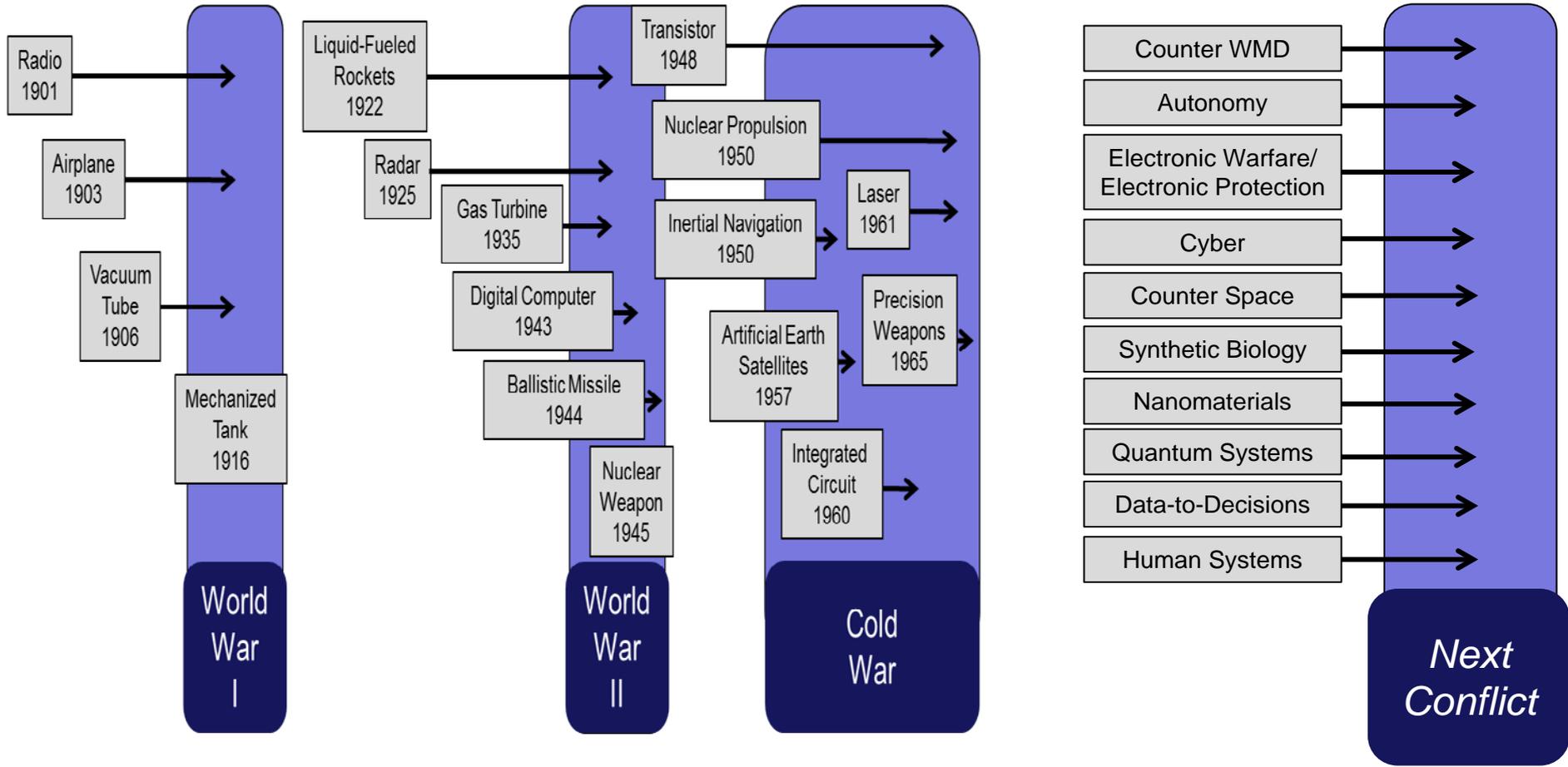




# Lab Demo to Forcing Function: Technology Investment Stocks Cupboard



1900    1910    1920    1930    1940    1950    1960    1970    2013    Future





# Defense S&T Investment



*“Protect and prioritize key investments in technology and new capabilities, as well as our capacity to grow, adapt and mobilize as needed.”*

-SECDEF, January 2012 Strategic Guidance

## 1. **Mitigate** new and emerging capabilities

- Electronic Warfare
- Counter Space
- Cyber
- Counter-WMD

## 2. **Affordably** enable new or extended capabilities in existing military systems

- Systems Engineering
- Engineered Resilient Systems
- Data Reuse
- Developmental Test & Evaluation

## 3. Develop technology **surprise** through science and engineering

- Autonomy
- Data-to-Decisions
- Basic Research
- Human Systems

## Technology Needs

The composite image includes three main components:
 

- Top Right:** A network diagram showing various nodes and connections, with labels for 'C/ISR/Int. Frame.' and 'C/Logistics Frame.'.
- Middle Left:** A photograph of a North Korean missile launch from a mobile launcher vehicle, with a flag visible in the background.
- Bottom Right:** A map titled 'DF-21C ANTI-SHIP BALLISTIC MISSILE' showing the range of the missile. The map includes labels for 'Beijing', 'East China Sea', 'South China Sea', 'PHILIPPINE ISLANDS', 'TAIWAN', 'JAPAN', 'INDONESIA', 'AUSTRALIA', 'PACIFIC OCEAN', and 'INDIAN OCEAN'. A legend indicates 'DF-21C - Estimated current range: 1,700 km' and 'DF-21D - Maximum claimed range: 3,400 km'.

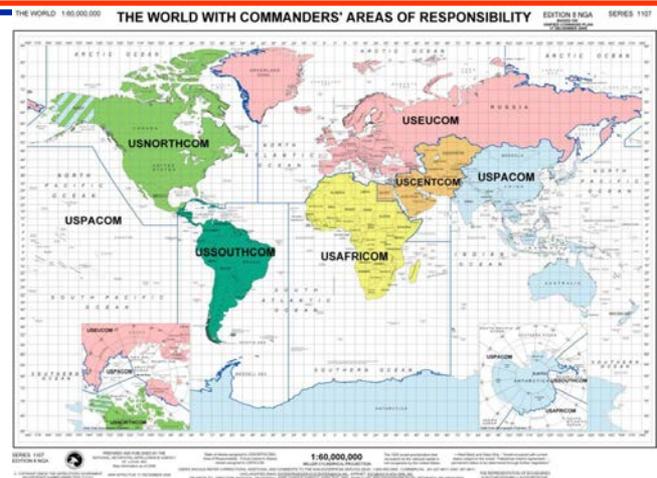
- Middle East Instability
- North Korean Nuclear Ambitions
- Anti-Access/Area Denial
- Cyber Attacks
- Electronic Warfare



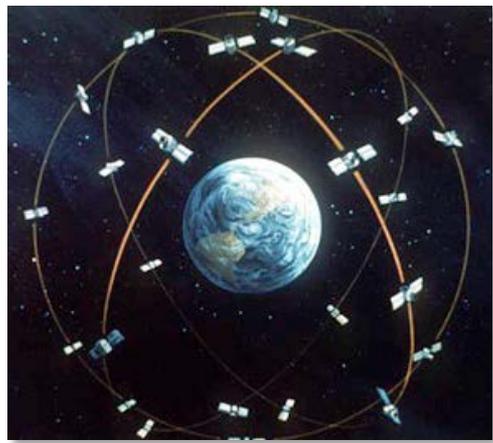
# Mitigate: Rise of the Commons



**Electronic Warfare**



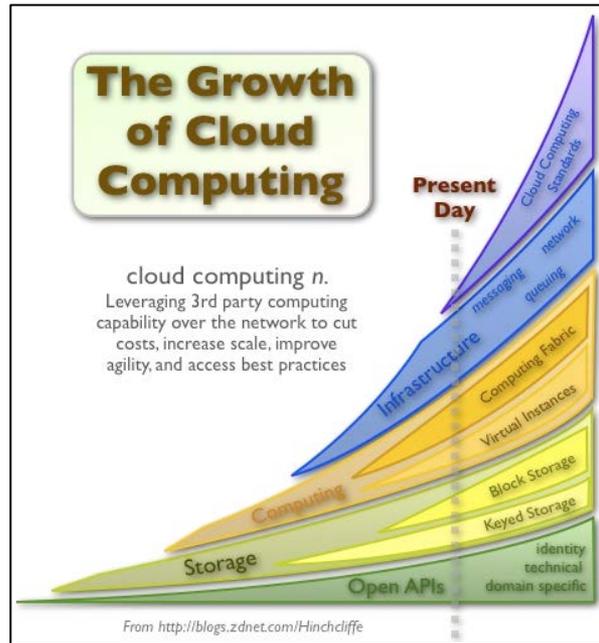
**Oceans**



**Space**



**Cyber**



**Ubiquitous Data**

**Military Operations Increasingly Depend on Being Able to Operate in Places “No One Owns” – *The Enablers***

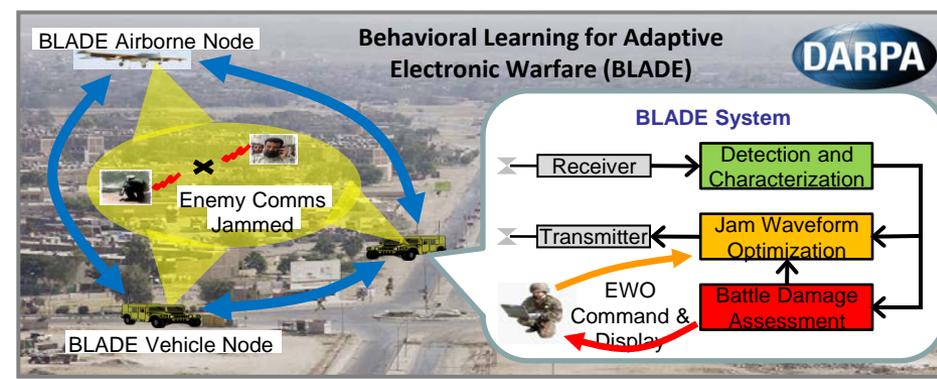
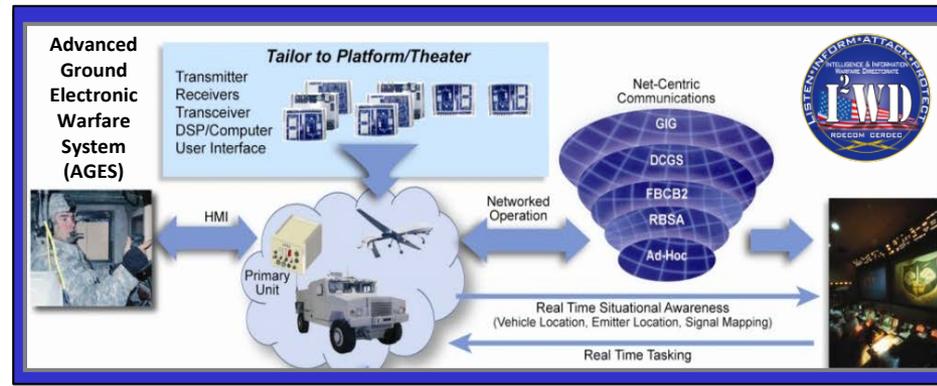


# Mitigate: Electronic Warfare/Electronic Protection

## S&T Needs

- RF/Mixed signal component technologies
- EO/IR component technologies
- Photonics
- Network enabled EW
- Distributed, heterogeneous EW system-of-systems architecture
- Adaptive EW

The goal of electronic warfare is to advantage U.S. and coalition force operations by “shaping” the electromagnetic spectrum (EMS)





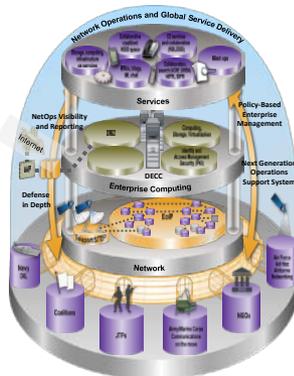
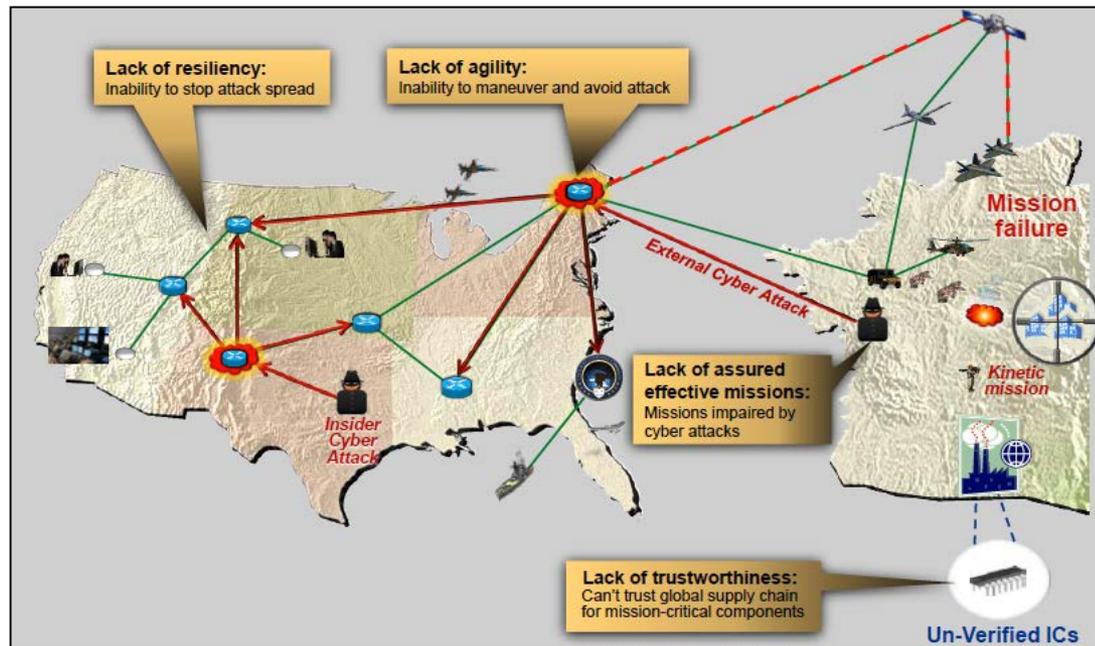


# Mitigate: Cyber



## S&T Needs

- Resilient infrastructure
- Agile operations
- Assuring effective missions
- Trust
- Cyber experimentation and measurement
- Cyber modeling and simulation





# Mitigate: Counter—WMD



## S&T Needs

- Sensors
- Network analytics
- Data integration
- Predictive tools



“Department of Defense will continue to enhance its capabilities, acting with an array of domestic and foreign partners, to conduct effective operations to counter the proliferation of WMD.”  
*- January 2012 Strategic Guidance*



# Affordability: Technology Development Pace

“Moore’s Law” → Computing doubles every 18 months

“Fiber Law” → Communication capacity doubles every 9 months

“Storage Law” → Storage doubles every 12 months

## “Traditional” Defense Acquisition Pace

<b>F-22</b>	<b>Milestone I:</b>	<b>Oct 86</b>	<b>IOC:</b>	<b>Dec 05*</b>
<b>Comanche</b>	<b>Milestone I:</b>	<b>Jun 89</b>	<b>IOC:</b>	<b>Sep 09</b>

\* Computers at IOC are 512 X faster, hold 65,000 X bits of information than they did at MS I

**Technology growth is non-linear...  
Acquisition path has been linear**

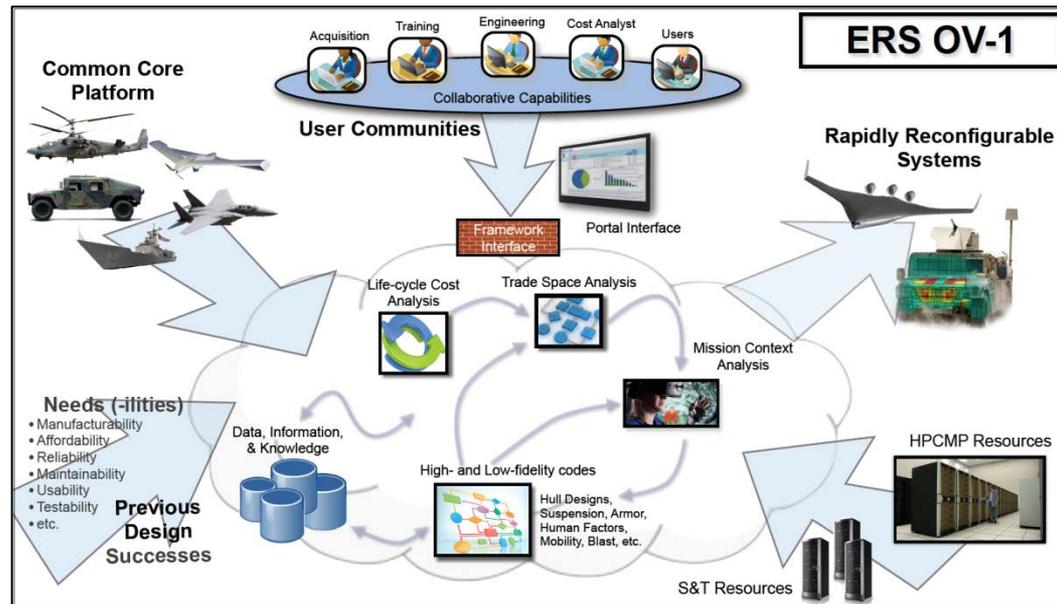


# Affordability: Engineered Resilient Systems (ERS)



## S&T Needs

- Decrease time and cost of system development
- Improve effectiveness of fielded systems
- Integrate physics-based models with acquisition
- Quantify the effects of architecture change on system cost and performance
- Automate trade-space analyses
- Computational algorithms
- Design tools





# Affordability: Data Reuse



## Links to Relevant DoD Information

- S&T planning documents
- Key briefs from department leaders
- Doing business with DoD, e.g.
  - Broad agency announcements
  - Industry day announcements
  - Rapid innovation fund information
  - Links to Army, AF, Navy Labs

[www.defenseinnovationmarketplace.mil](http://www.defenseinnovationmarketplace.mil)

DEFENSE INNOVATION MARKETPLACE

HOME RESOURCES FAQs NEWS & EVENTS ABOUT CONTACT US

**CONNECTING INDUSTRY & GOVERNMENT**

The Defense Innovation Marketplace is a centralized resource to reinvigorate innovation.

**For Industry**, the Marketplace is a resource for information about Department of Defense investment priorities and capability needs. Additionally, industry uses this site to submit proprietary IR&D summary reports which are separately stored, accessed and used solely for compliance with the Defense Federal Acquisition Supplement at 48 CFR 231.205-10(c)(4)(C).

**For Government**, the Marketplace provides access to search tools to assess and then leverage industry IR&D projects for current and future programs.

**NEW IN THE MARKETPLACE**

S&T Strategic Documents	Doing Business with DoD	News & Events
<ul style="list-style-type: none"> <li>• ASDRE FY14 S&amp;T Testimony "NEW"</li> <li>• Army FY14 S&amp;T Testimony "NEW"</li> <li>• Navy FY14 S&amp;T Testimony "NEW"</li> <li>• AF FY14 S&amp;T Testimony "NEW"</li> <li>• DARPA FY14 S&amp;T Testimony "NEW"</li> <li>• SOCOM 2013 Strategic Plan</li> <li>• USAF Posture Statement 2013</li> <li>• USAF Space Budget 2014</li> <li>• Equipping the Modern Soldier</li> <li>• Equipping the Modern Marine</li> </ul>	<ul style="list-style-type: none"> <li>• (TERN) Tactically Exploited Reconnaissance Node</li> <li>• TERN Industry Day Material</li> <li>• R&amp;D for Cargo Pocket ISR</li> <li>• System Enabling Technologies</li> <li>• Submarine and Surface Combat System Signal Processing BAA</li> <li>• Aviation Alternative Engine</li> <li>• Conceptual Design and Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Sea Power Expo Online Overview</li> <li>• Navy Sea Air Space Exposition Starts Today</li> <li>• Submarine and Surface Combat System Signal Processing Industry Day</li> <li>• AMPV Industry Day</li> <li>• OASD&amp;E IR&amp;D Update to Industry</li> </ul>

Updated: 4/17/13

SPECIAL INITIATIVES

- Resources for Industry: DoD Info for Business & Program Planning
- Submit IR&D Data: Share projects with DoD Customers
- Resources for DoD: Government employees search access tools
- Human Systems
- Space Systems

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**Defense Technical Information Center (DTIC)**

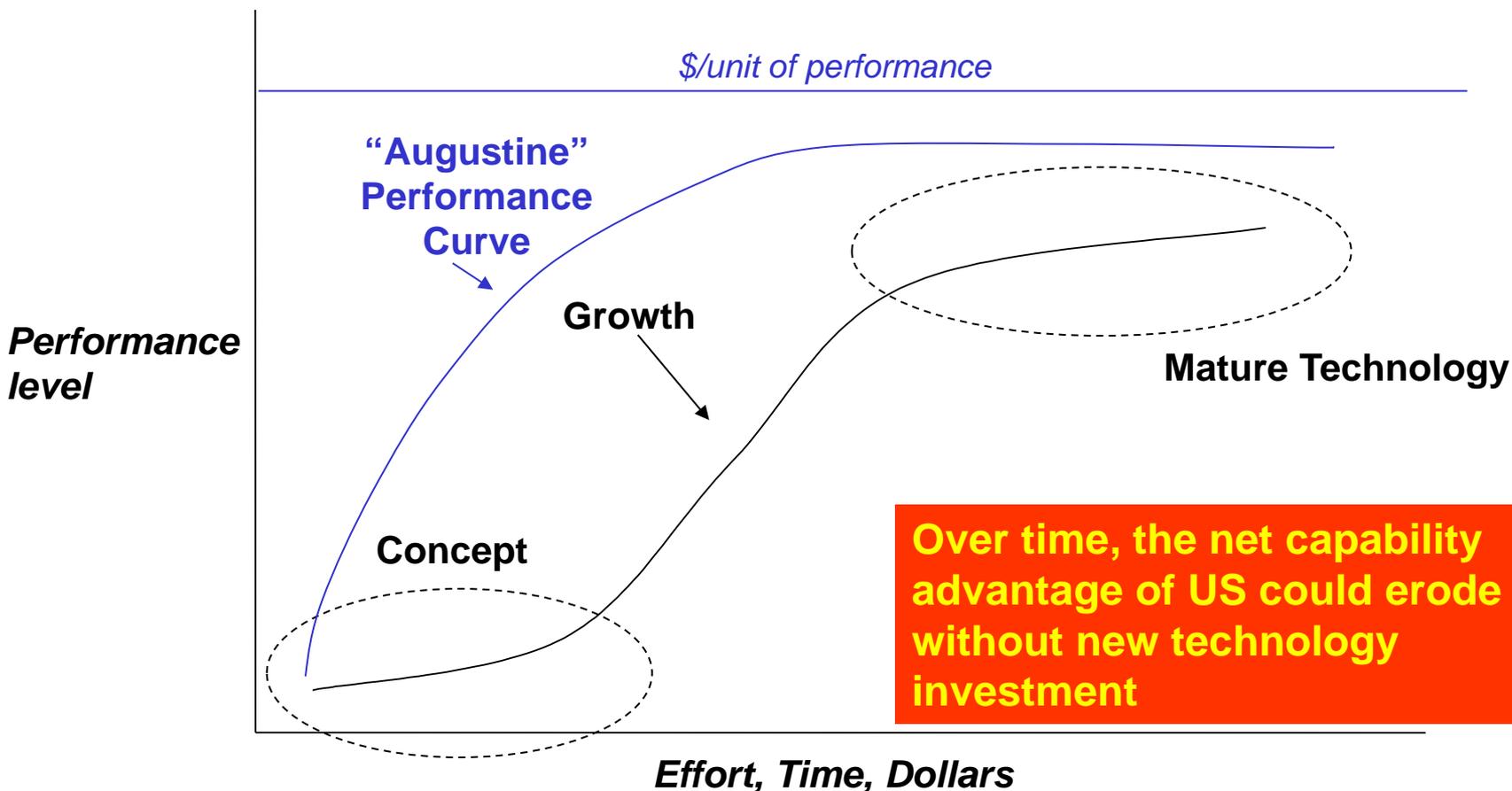
Website devoted to making it easier for you to find out about DoD's S&T and Program Investments



# Surprise: Technology S-Curve

Most Technology Maturation Follows S-curve:

Initial Discovery, “Productization”, then Incremental Improvement



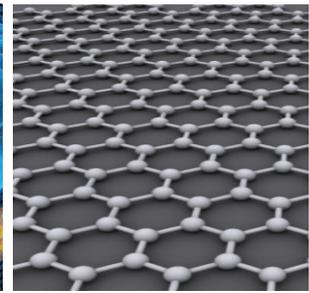
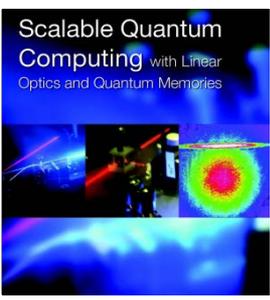


# Surprise: Basic Research



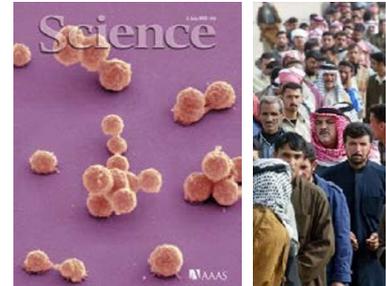
## S&T Needs

- **Metamaterials and Plasmonics**
- **Quantum Information Science**
- **Cognitive Neuroscience**
- **Nanoscience and Nanoengineering**
- **Synthetic Biology**
- **Understanding Human and Social Behavior**



**Trends in basic research are identified and judged through a variety of interactions, including:**

- **Publications, university site visits, conference attendance**
- **Future Directions Workshops (identifying emerging areas for investment and International Centers of Excellence for collaborative opportunities)**
- **Engage expert panels (JASONs, National Academy of Sciences, etc...)**



## **Understanding and Creating the Cutting Edge**



# Surprise: Autonomy



***Decentralization, Uncertainty, Complexity...Military Power in the 21<sup>st</sup> Century will be defined by our ability to adapt – this is THE hallmark of autonomy***

## S&T Needs

- Sense and React
- Movement Algorithms
- Cross Domain Interactions
- Strategic Decisions Support
- Battle Management
- Autonomous Systems Control



**Autonomy is not about making widgets...  
It is making existing/future systems more self-governing**



# Surprise: Data-to-Decisions

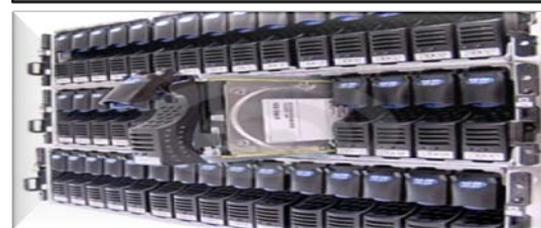


## S&T Needs

- **Tracking**
  - Automated tools that support 100x improvement in the number of tracks that an analyst manages
- **Image analysis**
  - Automated tools that support 100x improvement in the number of objects, activities, and events that an analyst can manage
- **Text Analysis**
  - Automated tools that improve the extraction rate of information from documents in any language with high probability of correct extraction

Current assessment is that unstructured data analytics is the most challenging and critical component of D2D

Data Management Layer



Analytics Layer



User Interface Layer





# Surprise: Human Systems



## S&T Needs

- Realistic, immersive training
- Adaptive, tailored instructions
- Train partner state forces
- Social networking analysis
- Cultural situation awareness
- Cultural & language expertise
- Extreme environment protection
- Medical and physical aiding
- Extended combat rations

### Personnel & Training



### Social & Cultural Modeling



### Protection & Sustainment





# Defense Innovation Marketplace



DEFENSE INNOVATION MARKETPLACE

HOME INDUSTRY RESOURCES FAQs NEWS ABOUT IR&D CONTACT US

## Connecting Industry with Government Customers

The Defense Innovation Marketplace is a centralized online resource to better connect industry with government customers to invigorate innovation.

**For Industry**, the Marketplace is the place to learn about Department of Defense investment priorities and capability needs, and comply with the new Defense Federal Acquisition Supplement (DFARS) rule.

**For Government**, the Marketplace will provide new search tools to assess and then leverage industry technology projects for current and future programs.

### NEW IN THE MARKETPLACE

S&T Strategic Documents	Doing Business with DoD	News & Events
<ul style="list-style-type: none"> <li>Sailing the Great Green Fleet</li> <li>21st Century Naval Amphibious Capability</li> <li>Administration Priorities for Science, Technology &amp; Innovation</li> <li>2012 Army Strategic Planning Guidance</li> </ul>	<ul style="list-style-type: none"> <li>Navy Information</li> <li>Army Information</li> <li>Armored Multi-Purpose Vehicle</li> <li>S&amp;T Emphasis Area Solicitations</li> <li>DoD Placing a Big Bet on Big Data</li> </ul>	<ul style="list-style-type: none"> <li>2012 SWE S&amp;T Industry Day</li> <li>Expansion of Voluntary Cybersecurity Information Sharing Activities</li> <li>ASD(R&amp;E) S&amp;T Weekly Bulletin</li> </ul>

Updated June 6

**Industry Resources**  
DoD Information for Useful Business Development [here](#)

**Industry Users**  
Market Your Innovation to DoD Customers [here](#)

**Government Users**  
Find Details about Industry Innovation Projects [here](#)

Click Here to sign up for RSS feeds

[defenseinnovationmarketplace.mil](http://defenseinnovationmarketplace.mil)

Website devoted to making it easier for you to find out about DoD's S&T and Program Investments

## Links to Relevant DoD Information

- S&T Planning Documents
- Key Briefs from Department Leaders
- Doing Business with DoD, e.g.
  - Broad Agency Announcements
  - Industry Day Announcements
  - Rapid Innovation Fund Information
  - Links to Army, AF, Navy Labs

DEFENSE INNOVATION MARKETPLACE

HOME INDUSTRY RESOURCES FAQs NEWS ABOUT IR&D CONTACT US

The Defense Innovation Marketplace is your one-stop source for Department of Defense (DoD) science and technology (S&T) planning, acquisition resources, funding and financial information.

### Strategic S&T Overview

**S&T FY13 Testimony**

- ASD(R&E)
- Army
- Navy
- Air Force
- DARPA

**Service S&T Priorities**

- DoD Defense Budget Priorities
- Army S&T Strategic Direction
- Naval S&T Strategic Plan
- USAF S&T Strategic Plan
- Missile Defense Program Strategic Plan
- US Special Operations Command S&T Strategic Plan
- Unmanned Systems Integrated Roadmap
- Strategic Direction to the Joint Forces

**S&T Emphasis Area Roadmaps**

- Autonomy
- Cyber
- Countering Weapons of Mass Destruction
- Data-to-Decisions
- Engineered Resilient Systems (ERS)
- Electronic Warfare / Electronic Protection (EW/EP)
- Human Systems

**General Service Strategy Documents**

- Army Equipping Strategy
- USAF Force Structure Changes
- IEDOC Strategic Plan
- IEDOC Future R&D Capabilities Gaps
- TRADOC Capability Manager (TCM)

**DoD Financial Documents**

### Doing Business with DoD

**Small Business Innovation Research Awards**

- SBR (Small Business Innovation Research) Awards
- Army SBR Website
- Navy SBR Awards

**Open Solicitations**

**Army BAAs**

- Army Corps of Engineers Engineer Research and Development Center Contracting Office
- Army Research Laboratory/Army Research Office

**Navy BAAs**

- Naval Research Laboratory Contracting Division
- Office of Naval Research

**Air Force BAAs**

- Air Force Office of Scientific Research
- Air Force Research Laboratory

**DoD Agency BAAs**

- Defense Threat Reduction Agency
- Defense Advanced Research Projects Agency
- Missile Defense Agency
- Joint Program Executive Office for Chemical and Biological Defense

**Other Government Funding Sources**

- FedBiosOps

**Request For Information (RFIs)**

- Medium Range Precision Strike System (MORPSS)
- Step 4 Acquisition Subject (AS4)

### Industry Day Presentations

Industry Days are held to inform industry about opportunities to work with the Department of Defense.

**Navy**

- Maritime Tactical Command and Control (11/20/2011)
- Air Vehicle Modification and Instrumentation (11/20/2011)
- Shipboard Automated Landing Technology Innovation Program (11/20/2011)
- Demonstration System Development for Advanced Shipboard Desalination PNC (10/1/2011)
- ONR Electronic Warfare S&T (10/20/2011)

**USMC**

- Marine Personnel Carrier (MPC) SCOW
- MPC Technology Readiness Levels

**Defense Advanced Research Projects Agency**

- System F6 Technology Package (11/20/2011)
- FAB Foundry/FANG (11/16/2011)
- Warrior Web (10/22/2011)
- Visual Media Reasoning (10/12/2011)
- Automated Program Analysis for Cyber Security (10/20/2011)
- Content-Based Mobile Edge Networking (10/23/2011)
- Broad Operational Language Translation (10/20/2011)



# Summary

- DoD S&T aligned to meet priorities for a 21<sup>st</sup> Century security environment
- DoD Strategic Framework..... lays the foundation for S&T commitments
- Federal Deficit Reduction will impact; S&T remains steady priority
- Asia-Pacific rebalance is the foundation of our R&E strategy
- DoD R&E committed to a healthy Defense Industrial Base

**DoD S&T Budget Focus**

The diagram illustrates the DoD S&T Budget Focus, structured into three main categories:

- Enablers/Commons:** Includes Undersea Offensive, Space, C2, and PSC/COI.
- OSD/Joint Focus:** Includes Space Programs (PNT, Comms, ISR) and Cyber.
- Service Focus:** Includes Air Force, Navy, and Army / Marine Corps.

Below the diagram is a screenshot of the **Defense Innovation Marketplace** website ([www.defenseinnovationmarketplace.mil](http://www.defenseinnovationmarketplace.mil)). The website features a navigation menu with links for HOME, RESOURCES, FAQs, NEWS, ABOUT I&R&D, and CONTACT US. The main content area is titled "Connecting Industry with Government Customers" and includes sections for "Resources", "Industry", and "Government". A "NEW IN THE MARKETPLACE" section lists various S&T Strategic Documents, Doing Business with DoD opportunities, and News & Events.