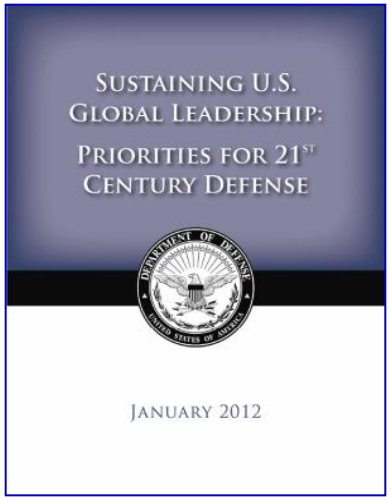
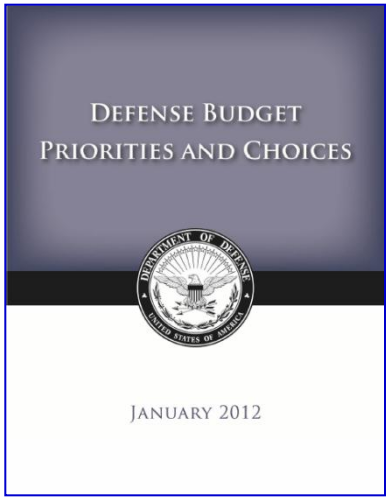
NDIA Science & Engineering Conference

24 April 2013

Al Shaffer
Acting Assistant Secretary of Defense for Research and Engineering

Defense Strategic Guidance
January 2012



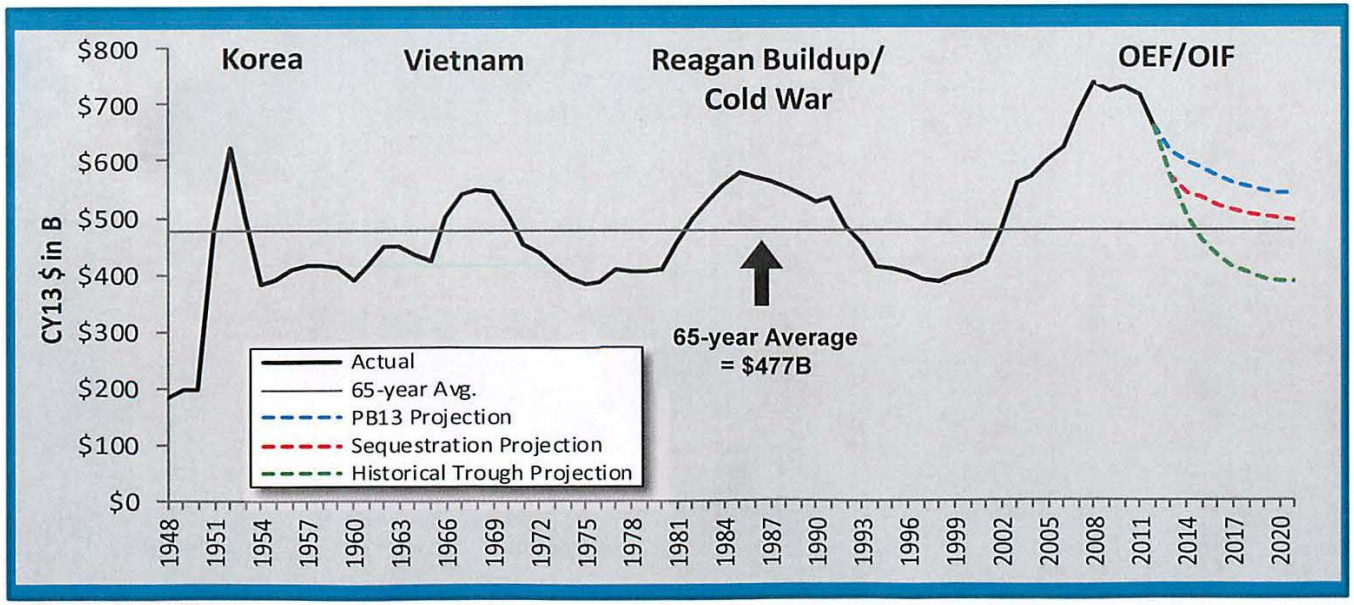


- **The military will be smaller and leaner, but it will be agile, flexible, ready and technologically advanced.**
- **Rebalance our global posture and presence to emphasize Asia-Pacific and the Middle East.**
- **Build innovative partnerships and strengthen key alliances and partnerships elsewhere in 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."

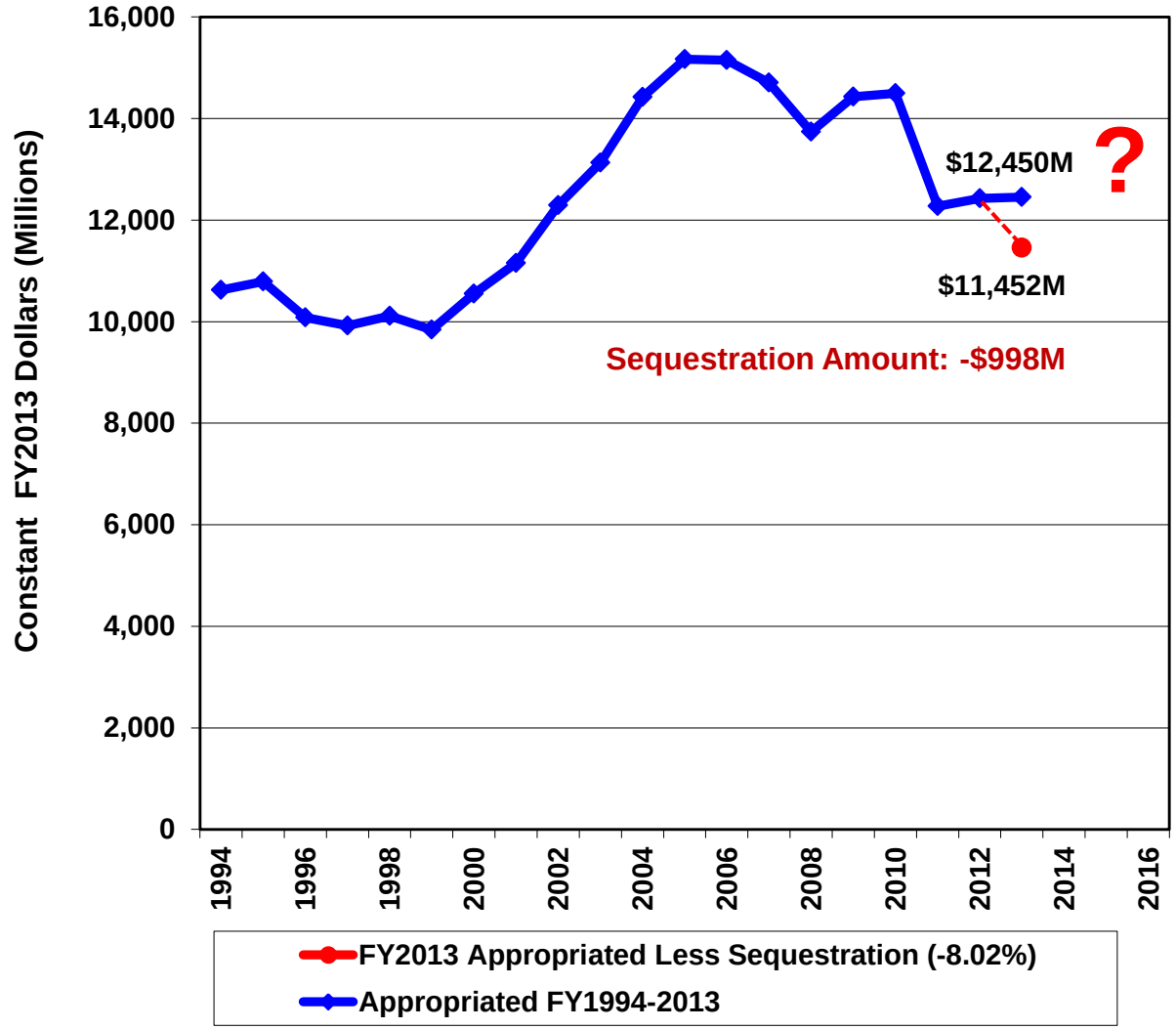
GEN DEMPSEY, CJCS
Testimony to SASC, 12 Feb 2013



UNCLASSIFIED

DoD S&T FUNDING: FY1994-2013

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



Sequestration Impact

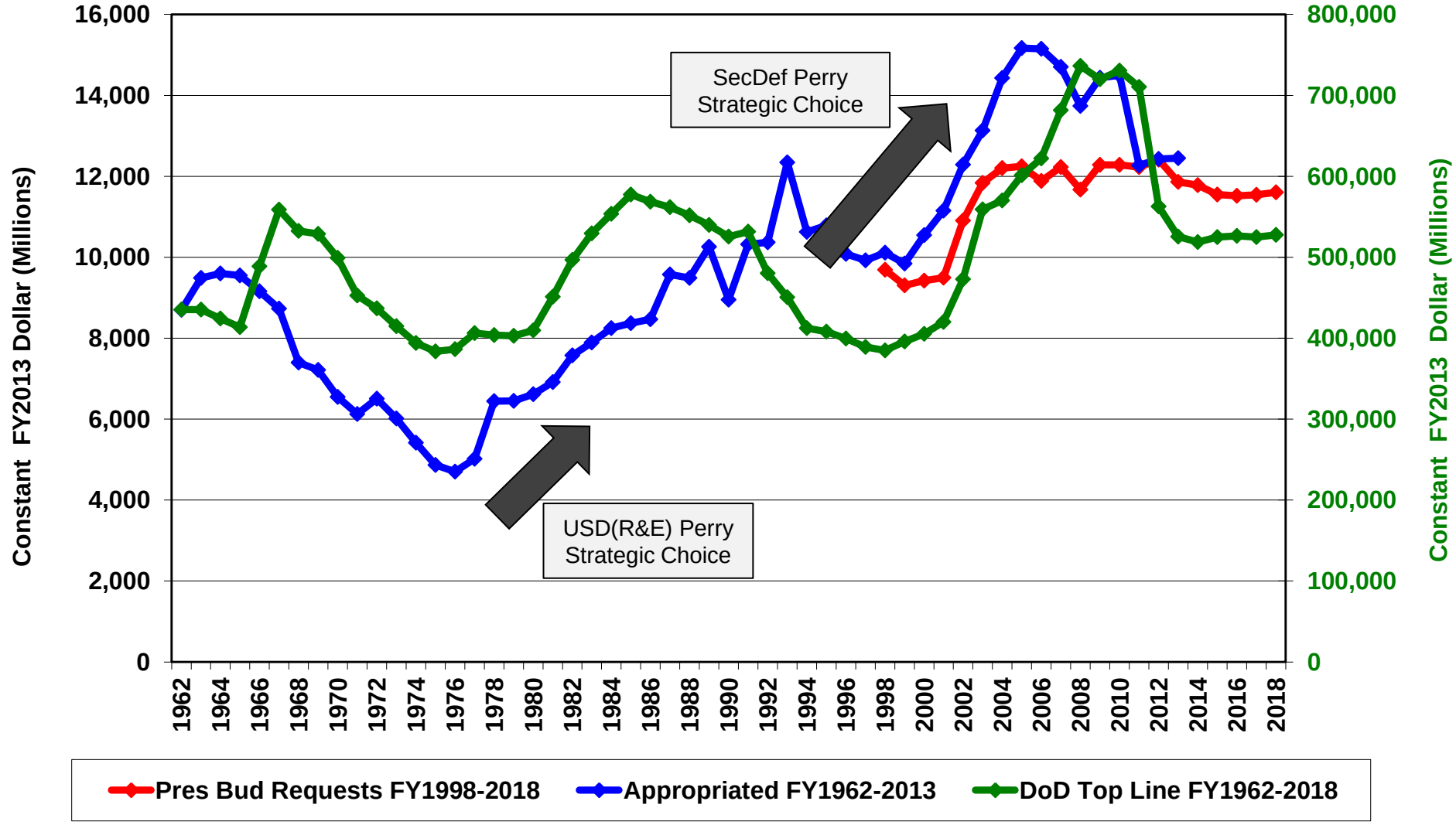
- Slow Programs
- Fewer Awards
- Reduce Grants ~$200M
- Reduce FFRDC STEs
- Reduce overall Contract Support

"Gentleman, we are out of money.

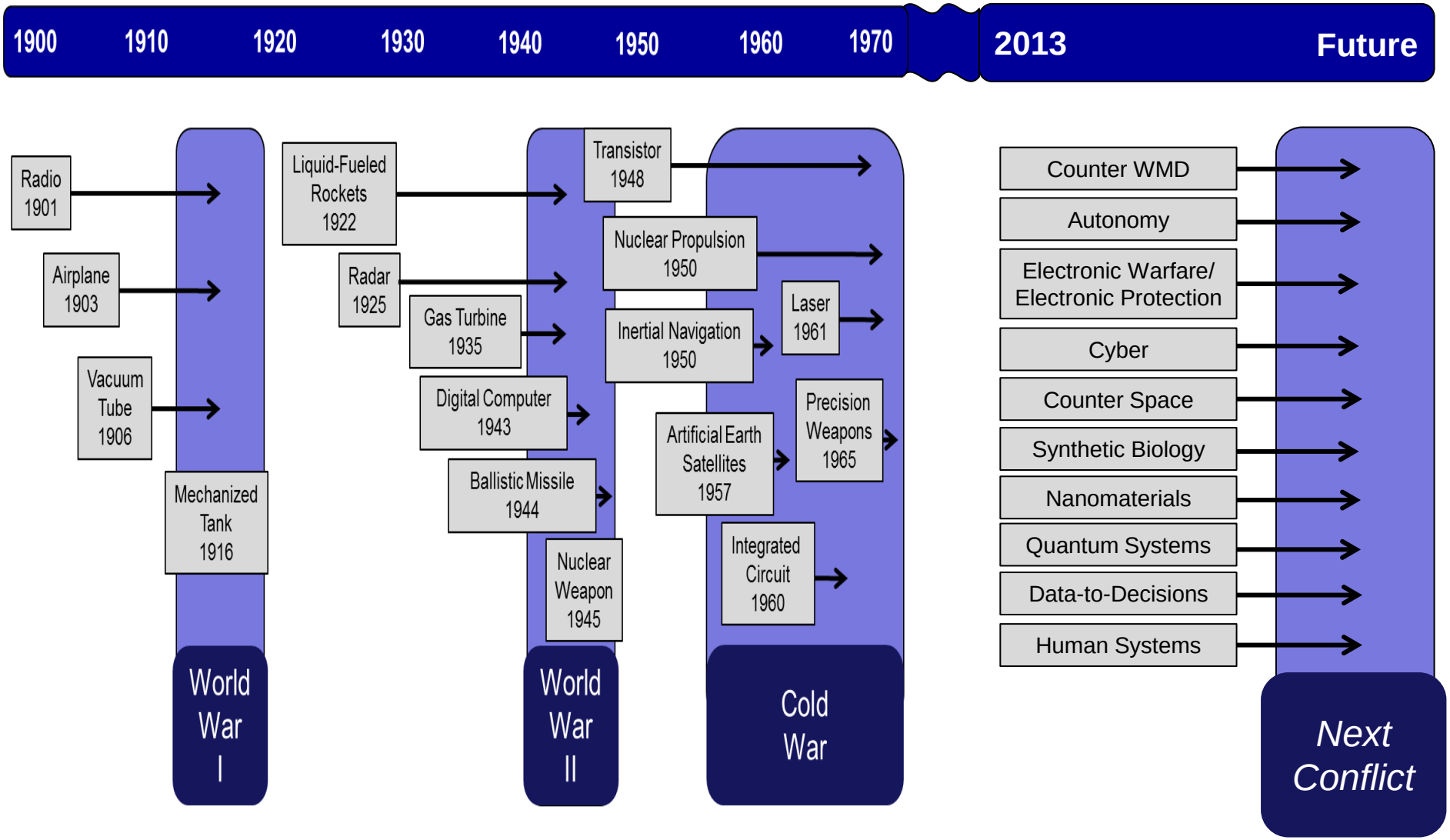
Now we must think!"

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



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
- Cyber
- Counter Space
- Counter-WMD

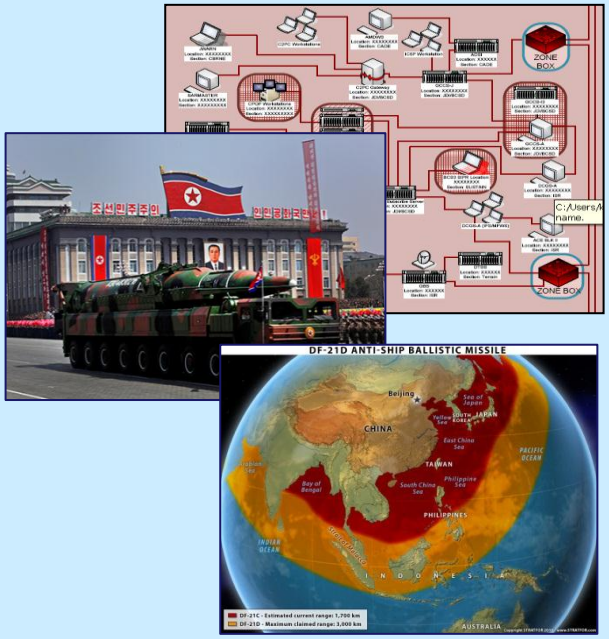
2. Affordably enable new or extended capabilities in existing military systems

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

3. Develop technology surprise through science and engineering

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

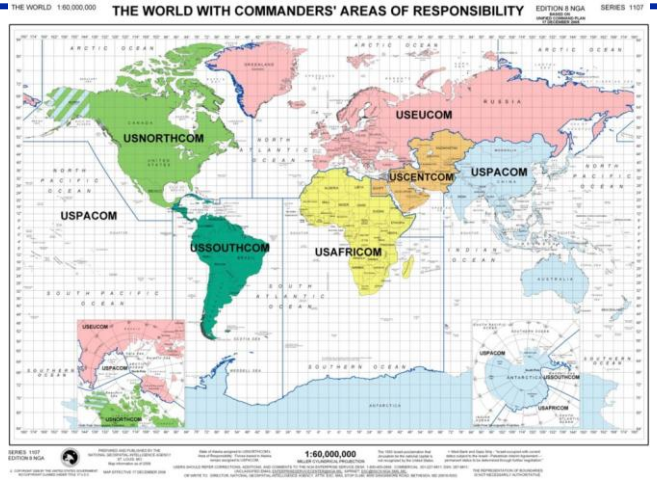
Technology Needs



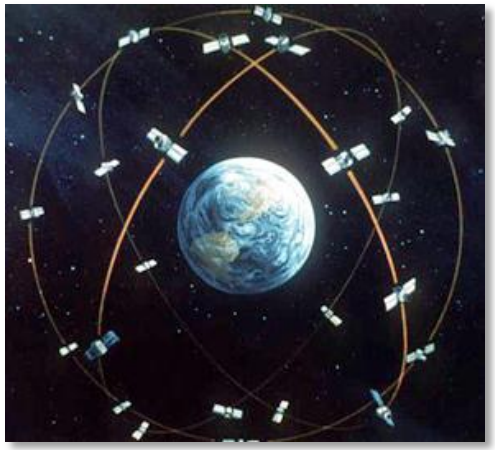
- Middle East Instability
- North Korean Nuclear Ambitions
- Anti-Access/Area Denial
- Cyber Attacks
- Electronic Warfare

Mitigate:
Rise of the Commons

Electronic Warfare

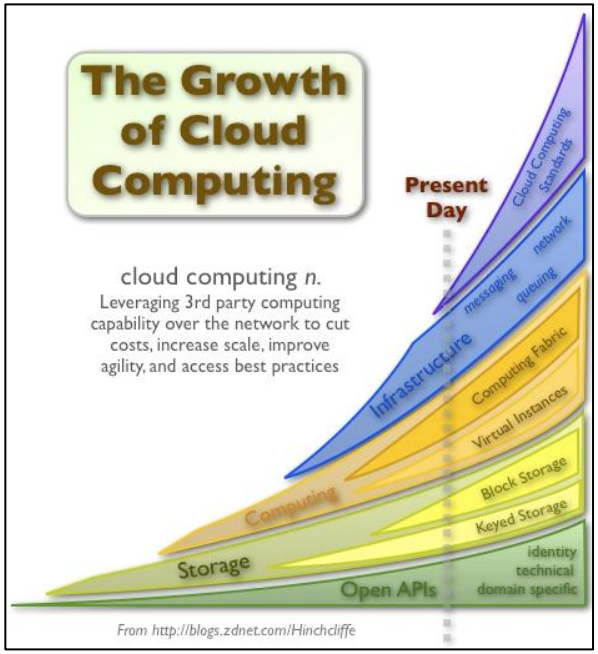


Oceans



Space

Cyber



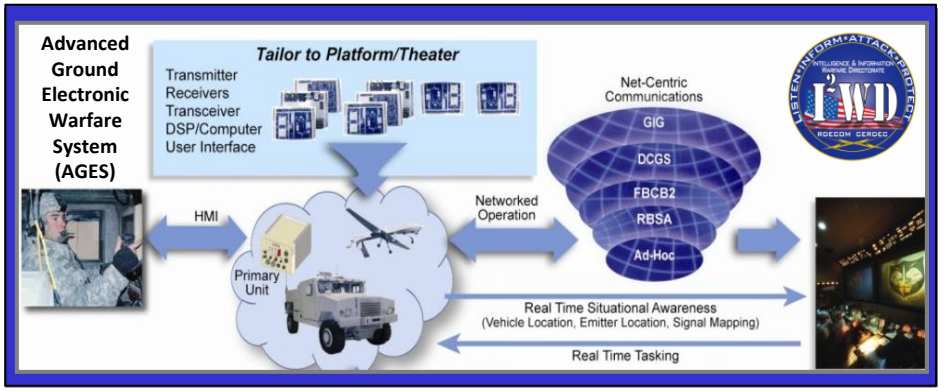
Ubiquitous Data

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

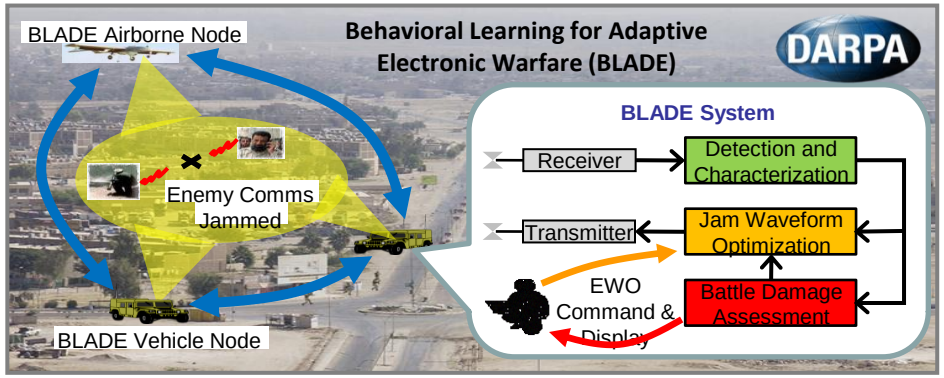
Mitigate:
Electronic Warfare/Electronic Protection

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



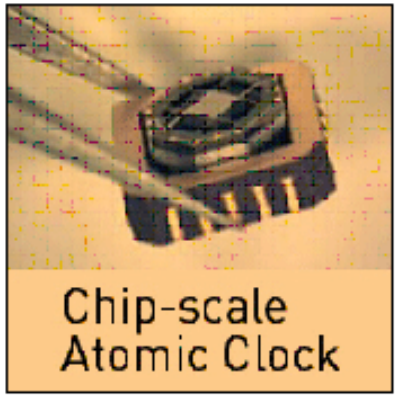
The goal of electronic warfare is to advantage U.S. and coalition force operations by "shaping" the electromagnetic spectrum (EMS)



Mitigate:
Counter Space

S&T Needs

- Space and cyberspace are becoming vulnerable
- Solution: need space capabilities with or without space layer
  - Non-GPS Precision Navigation and Timing
  - Robust communication without space layer
  - Enhanced ISR without space Layer
- Enhance precision navigation and timing
- Enhance military communications
- Enhance space launch responsiveness



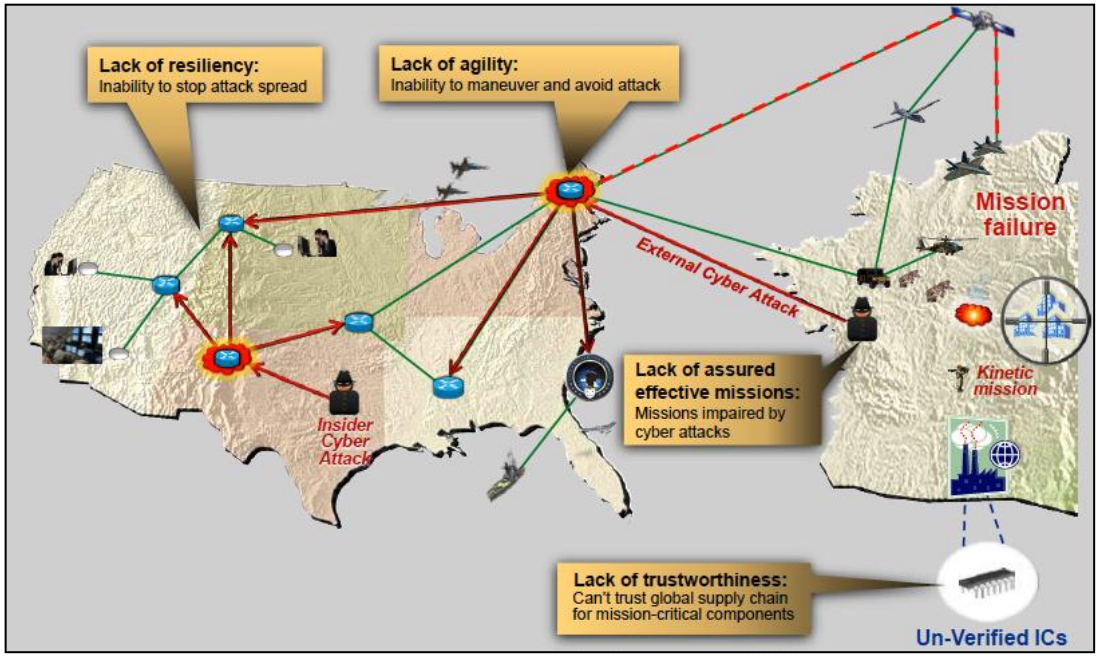
"The current and future strategic environment is driven by three trends –space is becoming increasingly *congested*, *contested*, and *competitive*."

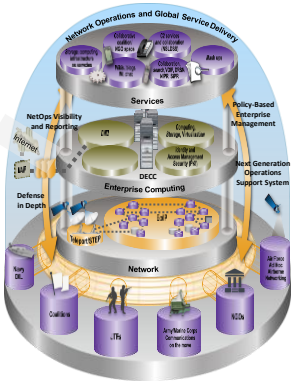
- 2011 National Security Space Strategy

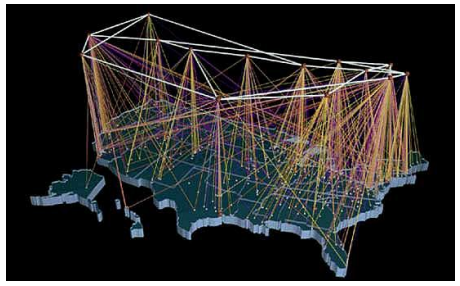
Mitigate:
Cyber

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

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

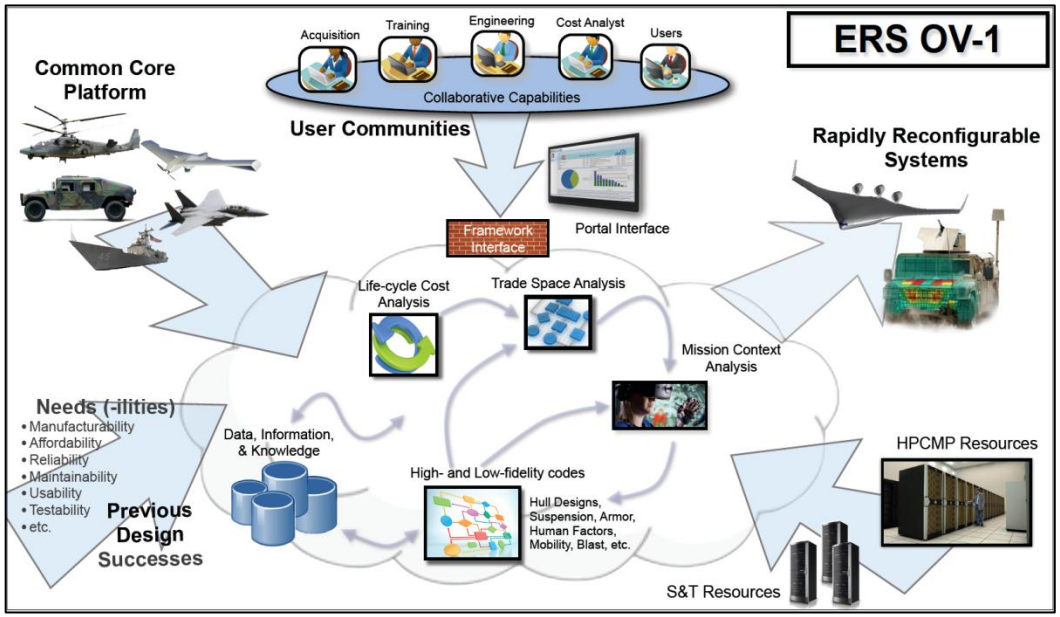
* Computers at IOC are 512 X faster, hold 65,000 X bits of information than they did at MS I

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

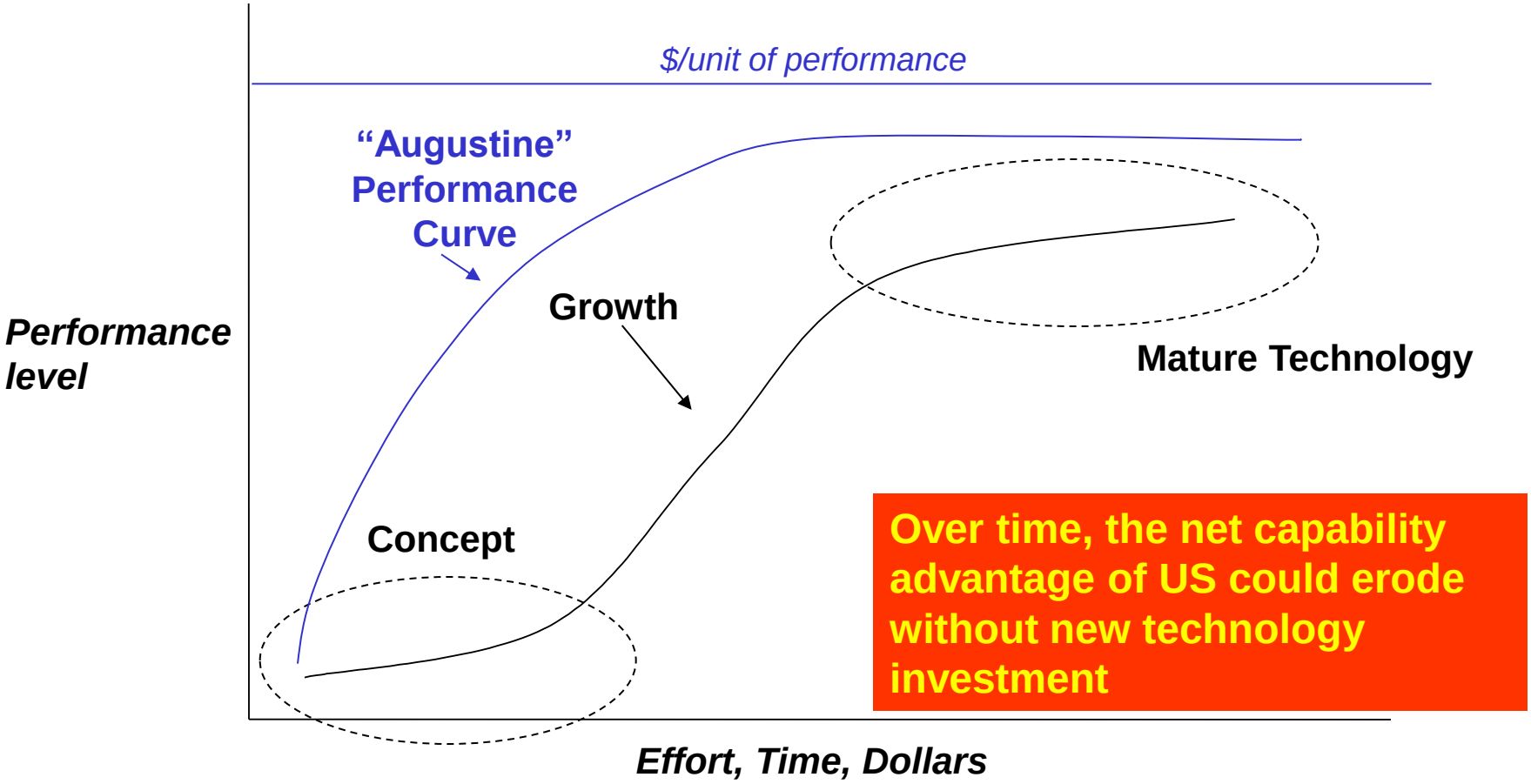
Defense Technical Information Center (DTIC)

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

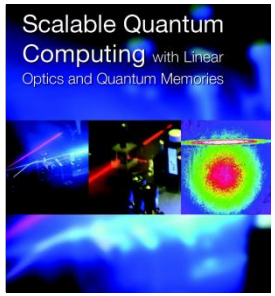


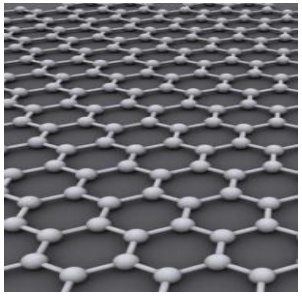
Over time, the net capability advantage of US could erode without new technology investment

Surprise:
Basic Research

S&T Needs

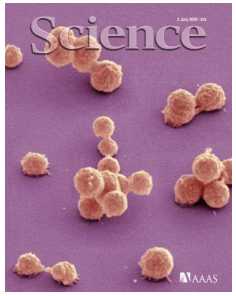
- Metamaterials and Plasmonics
- Quantum Information Science
- Cognitive Neuroscience
- Nanoscience and Nanoengineering
- Synthetic Biology
- Understanding Human and Social Behavior





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, Uncertainly, Complexity…Military Power* in the 21st 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

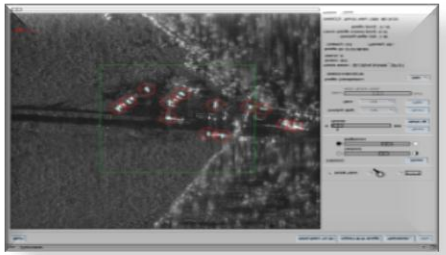
S&T Needs

- **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**

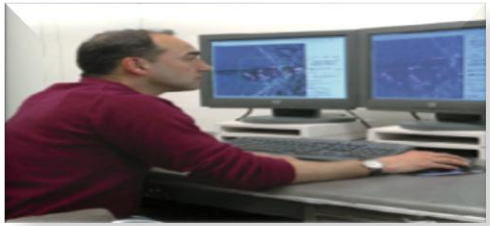
Current assessment is that unstructured data analytics is the most challenging and critical component of D2D

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

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

Summary

- DoD S&T aligned to meet priorities for a 21st 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