Keeping Technology Programs Alive and Running

Al Shaffer
Acting Assistant Secretary of Defense for Research and Engineering
March 2014

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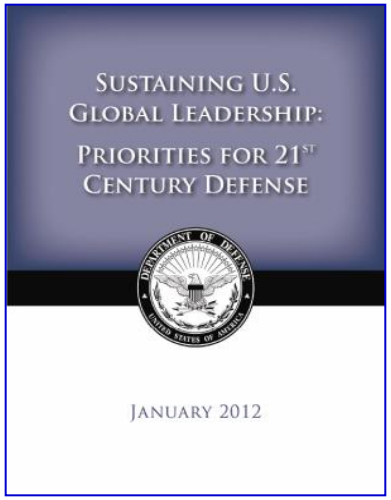
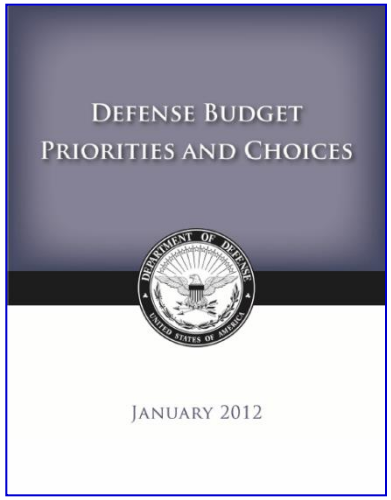
Key Elements of Defense Strategic Guidance





- 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 regions.
- 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.

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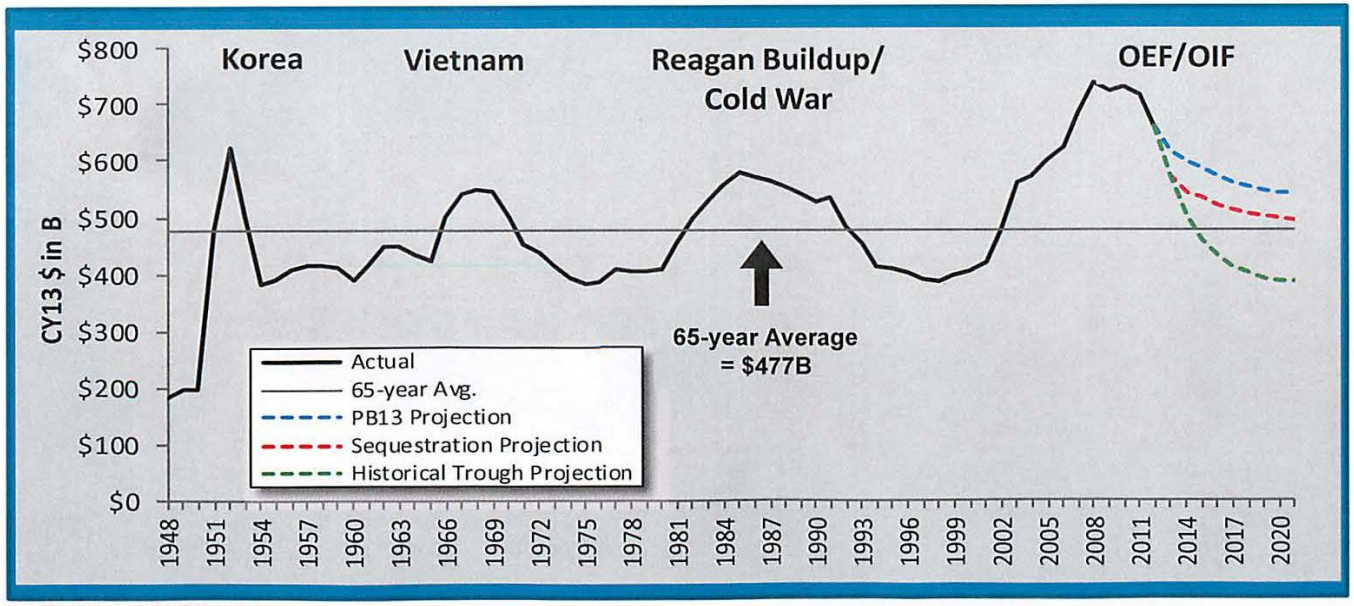
The Reality….

"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



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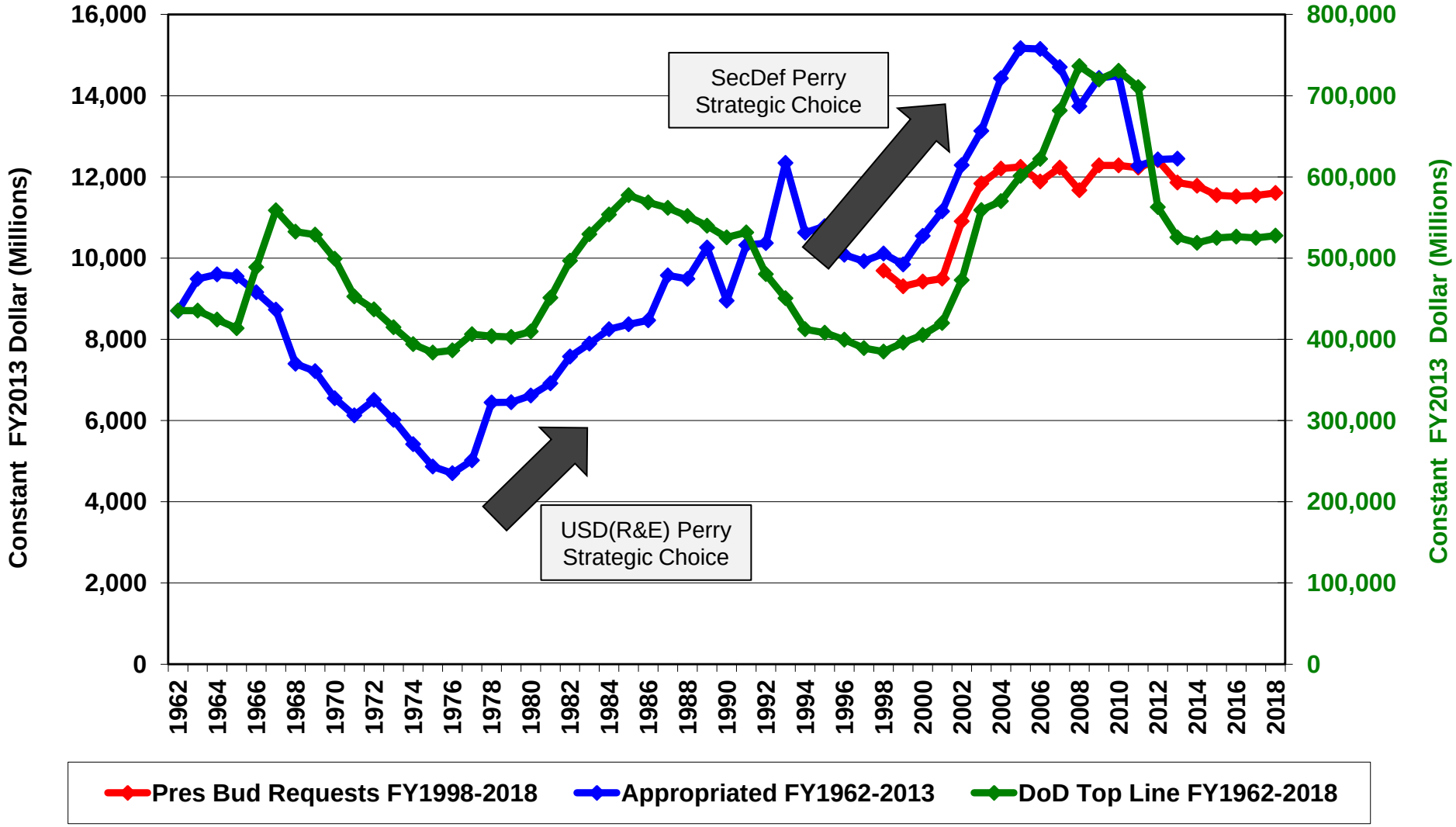
During Previous Budget Pressures, DoD Protects the Future through R&E



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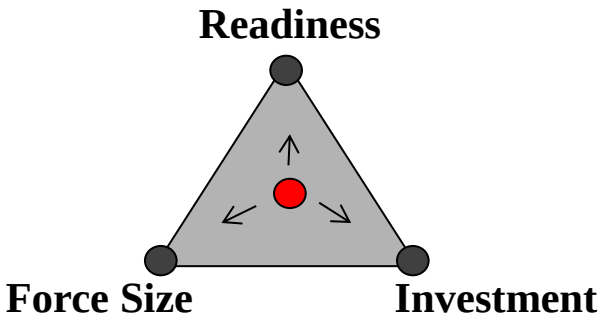
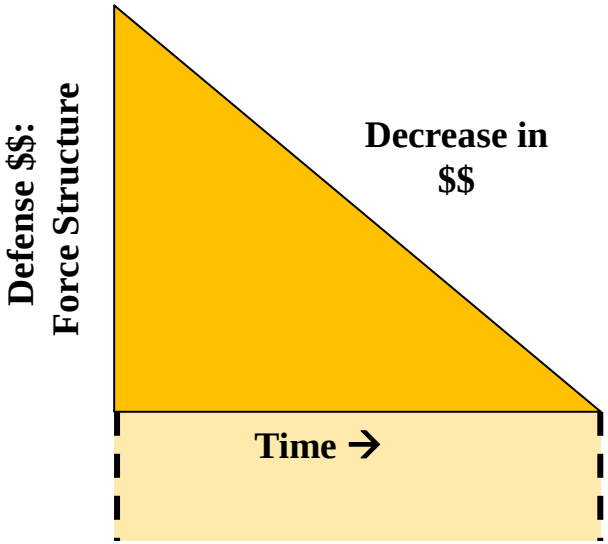
“The Orange Triangle”

- Budget Control Act directs $50Billion reduction each year FY13 – FY22
- Bipartisan budget action provided relief in FY14 & FY15
- Budget has 3 levers:
  - *Readiness*
  - *Force Size*
  - *Investment*
- Therefore, if DoD has the ability to move money, Investment Research Developmental Test & Evaluation (RDT&E) and Procurement will be disproportionately hit over the next couple of years





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Military Modernization Efforts

Nations continue efforts to counter US dominance in the commons through advances in technology

- **Air Warfare**
  - **Aircraft** – Low observability, high maneuverability, modern avionics and sensors with advanced targeting capabilities and protection against electronic countermeasures, and integrated electronic warfare systems matched with improved air to air missiles
  - **Ground Based Air Defense** – Increasing numbers of advanced, long-range SAMs which have the advertised capability to protect against aircraft, low-flying cruise missiles and ballistic missiles

- **Ballistic and Cruise Missiles**
  - **Ballistic Missiles** – Large numbers of missiles with improved ranges and sophisticated payloads, including anti ship variants
  - **Cruise Missiles** – Wide variety and numbers of both Land Attack and Anti-Ship cruise missiles with greater ranges and improved effectiveness

- **Counter-space**
  - As well as demonstrating Direct Ascent ASATs, the Chinese have written about "destroying, damaging, and interfering with the enemy's reconnaissance and communications satellites," suggesting that such systems, as well as navigation and early warning satellites, could be among the targets of attacks designed to "blind and deafen the enemy."

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Defense R&E Strategy

"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 threat capabilities

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

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

- Systems Engineering
- Modeling and Simulation
- Prototyping
- Developmental Test & Evaluation

3. Develop technology surprise through science and engineering

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

Technology Needs

- Cyber / Electronic Warfare
- Engineering / M & S
- Capability Prototyping
- Protection & Sustainment
- Advanced Machine Intelligence
- Anti-Access/Area Denial

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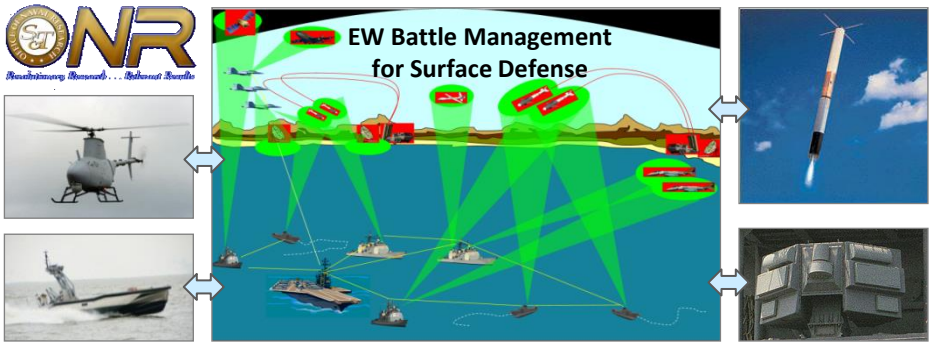
Mitigate:
EW, Cyber, Counter-Space, Counter-WMD

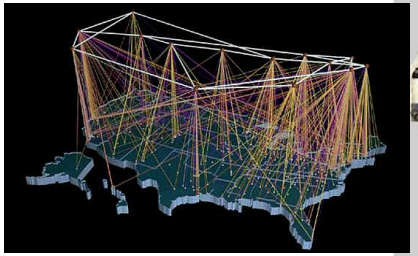
Electronic Warfare & Protection

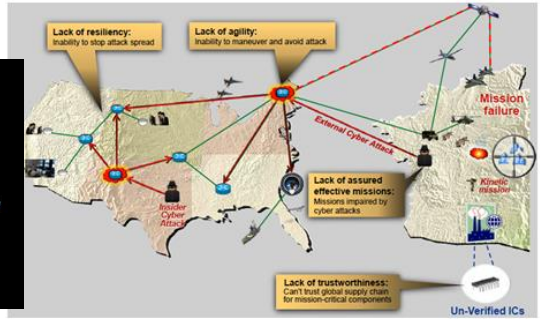
- RF/Mixed Signal Component Technologies
- EO/IR Component Technologies
- Underlying technology enablers



Cyber Science and Technology

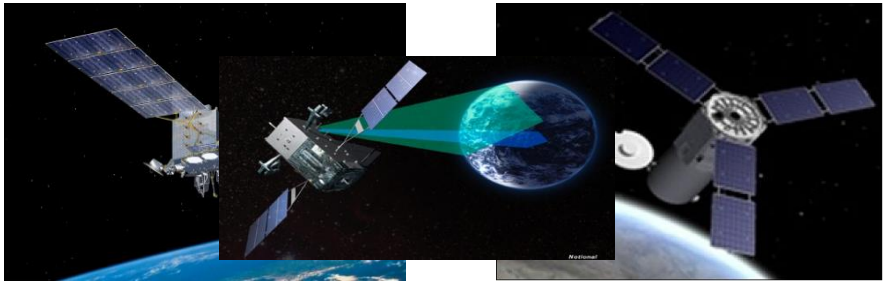
- Assuring Effective Missions
- Resilient Infrastructure Trust
- Cyber Experimentation & Measurement
- Agile Operations





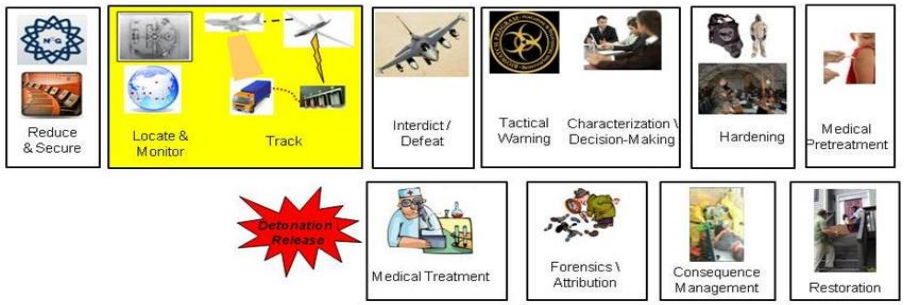
Counter-Space

- Contested domains with critical importance
- Gaining and maintaining space superiority
- Future enemies deny US operational access



Counter-WMD

- Sensors
- Predictive Tools
- Network Analytics
- Data Integration



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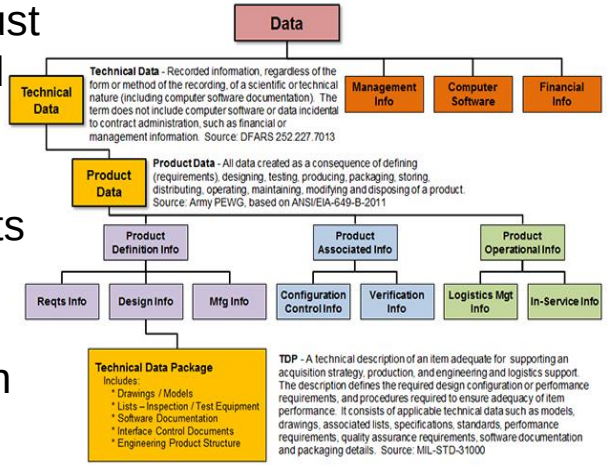
Affordability:
Modeling and Simulation, Data Reuse, Enhanced Prototyping

Modeling and Simulation

- Data (model) must be complete and accurate
- Simulation results (using accurate model) feeds analysis decision



Data Reuse

- Defense Innovation Marketplace
- Devoted to making it easier for you to find out about DoD's R&D and Program Investments
- IR&D Projects

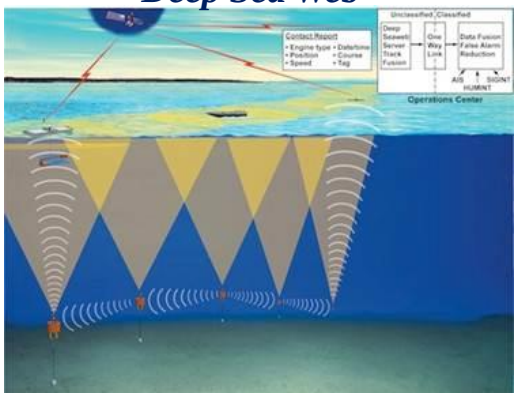
www.DefenseInnovationMarketplace.mil

Enhanced Prototyping

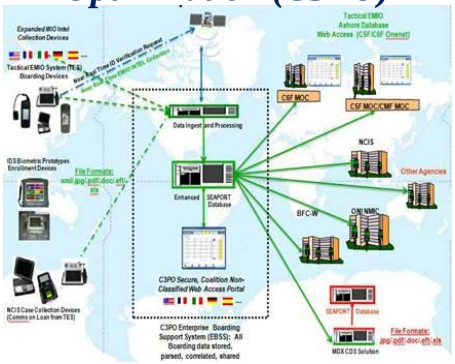
Kestrel Eye

SNaP 3

Deep Sea Web



Coalition End-to-End EMIO Performance Optimization (C3PO)



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Tech Surprise:
Human Systems, Data-to-Decisions, Autonomy

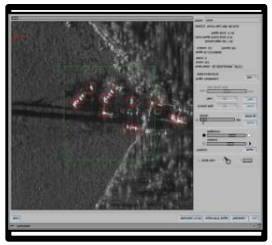
Human Systems

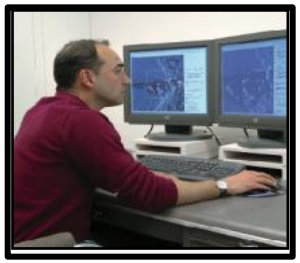
- System Interfaces
- Personnel & Training
- Protection & Sustainment
- Social & Cultural Understanding

Data-to-Decisions

- Data Management
- Analytics
- User Interface

Multi-Layer Approach

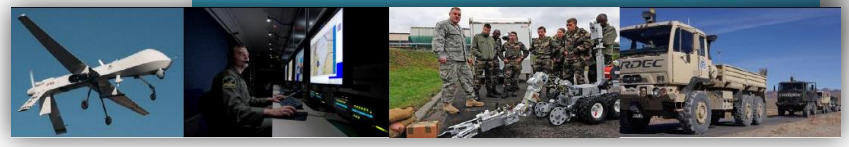




Autonomy

Advanced Machine Intelligence for Missions in Complex and Dynamic Environments

- Human/Autonomous Systems Interaction and Collaboration
- Scalable Teaming of Multiple Autonomous Systems
- Machine Reasoning, Perception and Intelligence
- Optimized teaming between operators and their machine "partners"
- Scalable operations across air, land, sea, cyber, and space domains
- Predictable system safety and mission effectiveness



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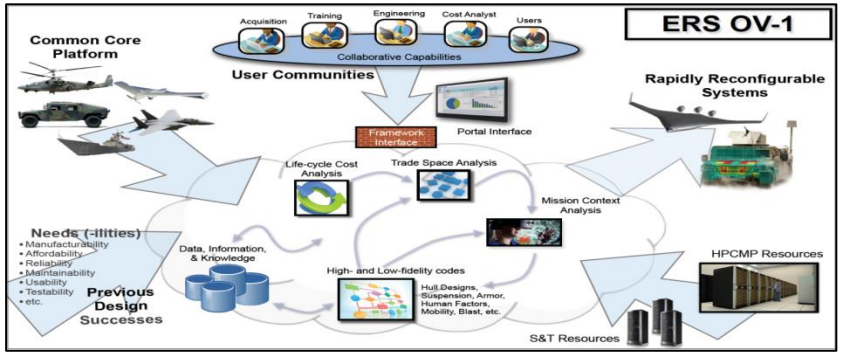
Affordability:
Engineered Resilient Systems (ERS), Data Reuse, Enhanced Prototyping

Engineered Resilient Systems (ERS)

- Decrease time and cost of system development
- Improve effectiveness of fielded systems



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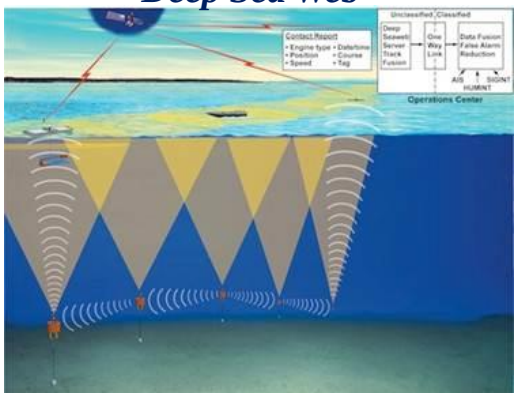

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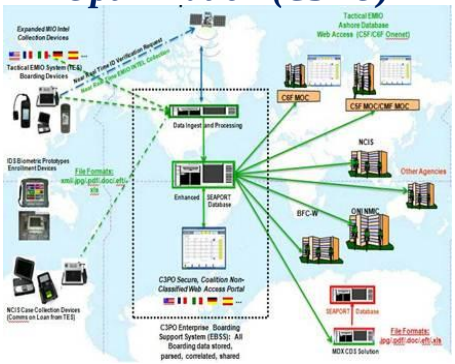

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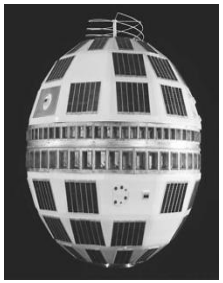
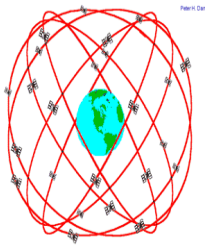
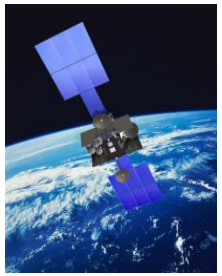
Basic Research Enables Progress







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• Nuclear weapons • Radar • Proximity fuse • Sonar • Jet engine • LORAN	• Digital computer • ICBM • Transistor • Laser technology • Nuclear propulsion • Digital comm.	• Satellite comm. • Integrated circuits • Phased-array radar • Defense networks • Airborne surv. • MIRV	• Airborne GMTI/SAR • Stealth • Strategic CMs • IR search and track • Space track network • C2 networks	• GPS • UAVs • Night vision • Personal computing • Counter-stealth • BMD hit-to-kill	• Wideband networks • Web protocols • Precision munitions • Solid state radar • Advanced robotics • Speech recognition	• GIG • Armed UAVs • Optical SATCOM • Data mining • Advanced seekers • Decision support

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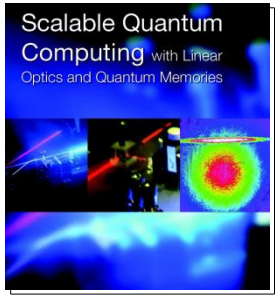
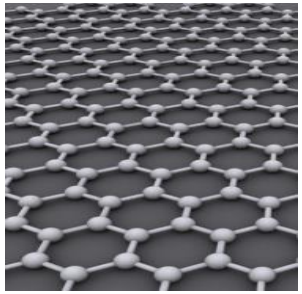
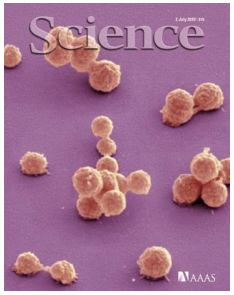
Basic Research Program

- **6 High Priority S&T areas for DoD**
  - 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

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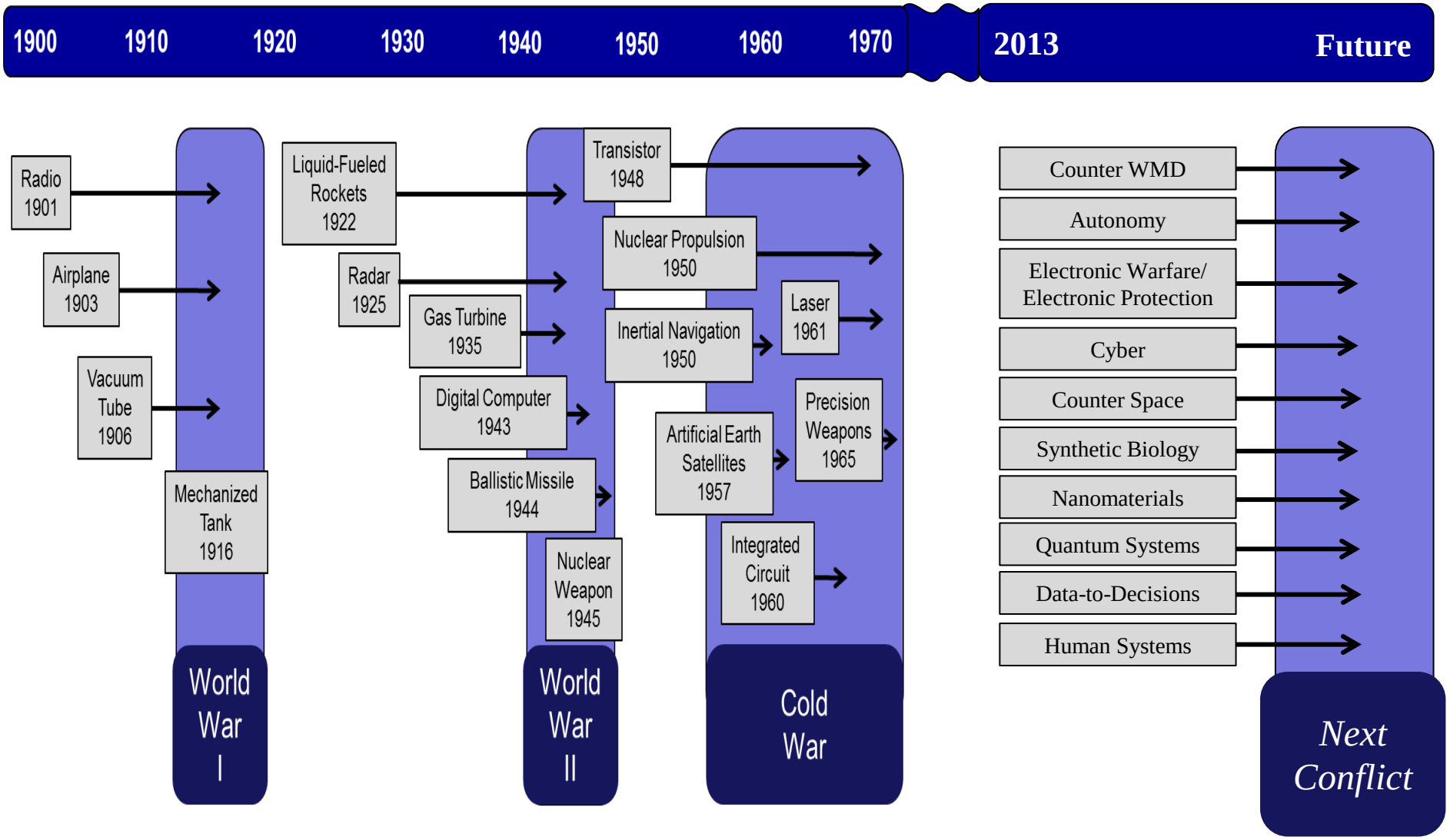
Lab Demo to Forcing Function: Technology Investment Stocks Cupboard



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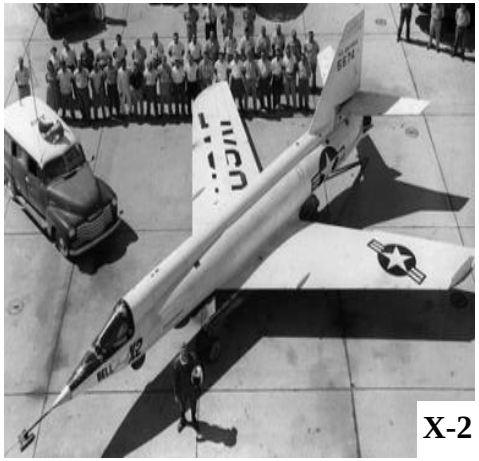
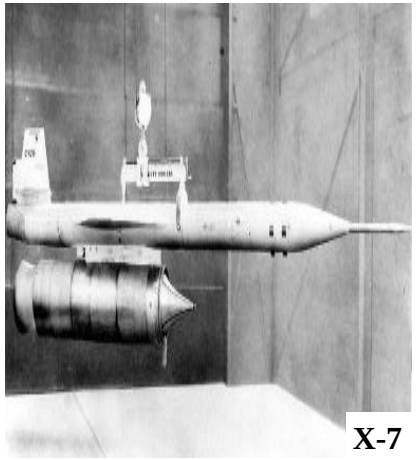
Capability Prototyping
High Speed X-Planes

First flight: 1947
Speed: Mach 1.26



First flight: 1952
Speed: Mach 3.2



First Flight: 1951
Speed: Mach 4.31

First Flight: 1953
Speed: Mach 2

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Capability Prototyping
High Speed X-Planes

First Flight: 1959
Speed: Mach 6.7

First Flight: 2001
Speed: Mach 6.83

First Flight: 2010
Speed: Mach 5.1

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Summary

- Budgets are Tight
- Challenges Are Increasing
- Use More Prototyping / Higher Risk Activity to “Hedge Bets”

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