



# 9th Annual Systems Engineering Research Center (SERC) Sponsor Research Review

**November 8, 2017**

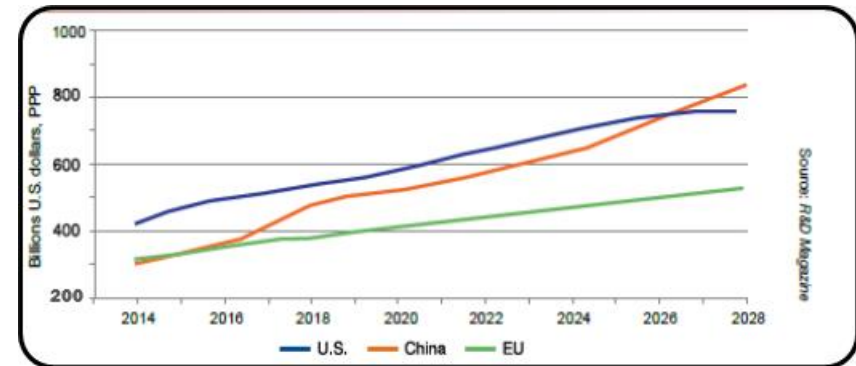
**Mary J. Miller**

Acting Assistant Secretary of Defense for Research and Engineering

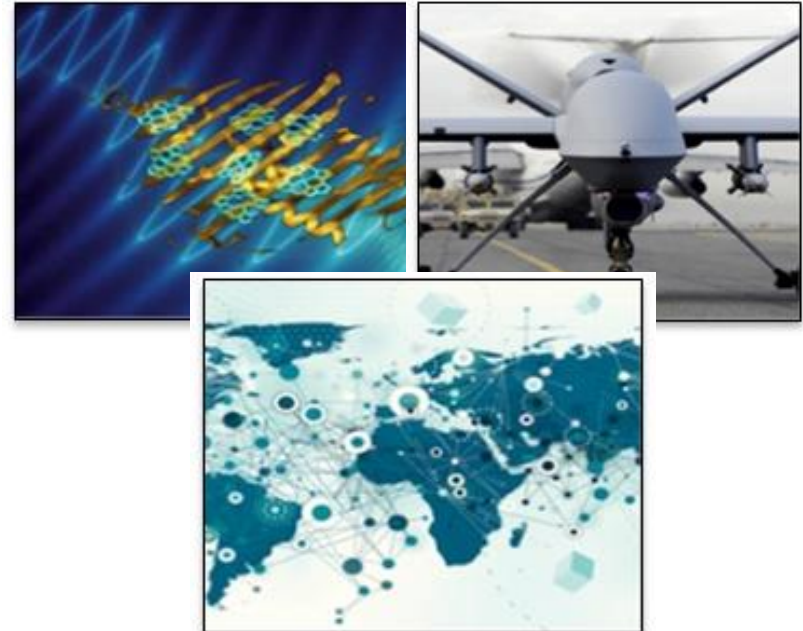


# Technology Transforming the Battlespace

- Increased rate of investment in military R&D from near-peers
- Easy proliferation of knowledge and technology has eroded US historic advantages
  - Increasing systems capabilities
  - Advanced production capabilities
    - Driving lower costs
    - Decreasing the “time to market”
- Speed and cycle time
- Increasingly Competitive National Security Technical Environment

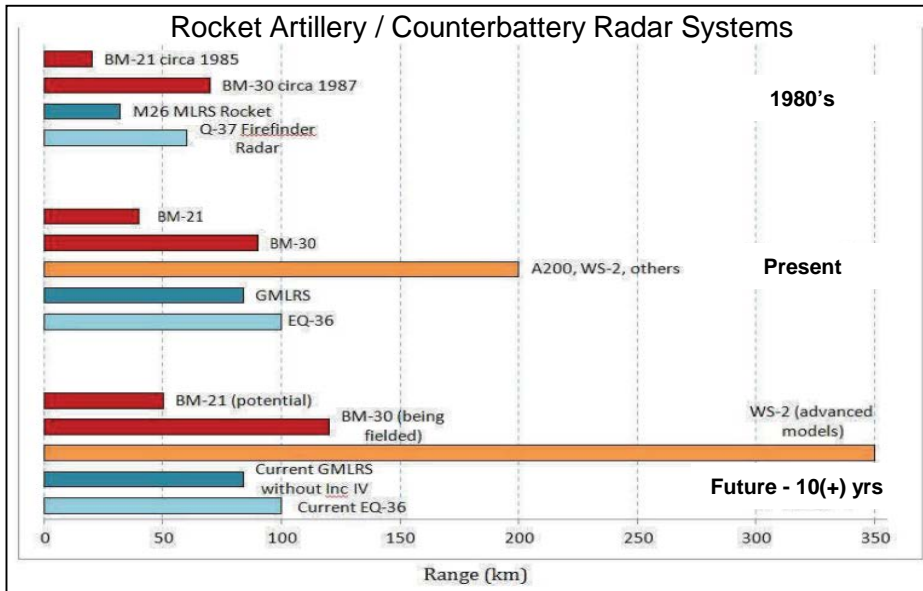


*China is the world's second largest investor in R&D with a forecast spending of \$396.3 billion for 2016*



# Threats Exist Across All Domains

- Adversaries are moving to next generation capabilities across all domains: Air, Land, Maritime, Space, & Cyber
- Advanced materials, ranges, speed, and lethality seen across Russian and Chinese platforms – approaching/at parity
- Increased ability to project power
  - We are now on-par or outranged by Russian and Chinese rocket and artillery capabilities
- China and Russia can hold U.S. and allied positions at risk
  - 10 years ago, China only had the ability to strike Taiwan



Comparing U.S. Army Systems with Foreign Counterparts: Identifying Possible Capability Gaps and Insights from Other Armies, RAND, 2015 – For Illustrative Purposes Only

*What we are doing  
about it...*

# Secretary of Defense Focus Areas

- Strengthen military readiness by increasing *lethality* of the force
- Strengthen our *alliances* and collaborate with allies whenever and wherever possible
- *Reform* the Department of Defense through budget discipline and increased accountability



*“When it comes to security, no one goes their own way in this world alone.  
Security is always best when provided by a team.”*  
– Secretary Mattis, Munich Security Conference, February 2017



# ASD Research & Engineering (R&E) Mission

*The United States depends on science, technology and innovative engineering to not only protect the American people but to advance our national interests and to prepare us to meet the challenges of an uncertain future.*

*– ASD(R&E) Mission*

**Mitigate** current and anticipated **threat** capabilities.

Affordably **enable new capabilities** in existing and future systems.

**Create technology surprise** through science and engineering.

## Pursuing Sustained Technological Advantage

# Previous “Offset” Strategies

## “First Offset Strategy” – 1950s

**Nuclear deterrence to avoid a large increase in defense expenditures** to conventionally deter Warsaw Pact forces during the 1950s.



## “Second Offset Strategy” – 1970s

**Development of precision-guided munitions** to deter both conventional and unconventional aggression from Soviet Forces.



***Capabilities from the 2<sup>nd</sup> offset strategy continue to enable U.S. technological superiority today.***

# Technology Offset Approach

*Seeks to deny adversary objectives, and strengthen conventional deterrence by:*

- **Leveraging autonomy and artificial intelligence**
  - Get inside an adversary’s decision cycle
- **Greatly expanding manned-unmanned combat**
  - Extend our attack surface
- **Re-amplifying our guided-munitions advantage**
  - With ‘raid-breaking’ capabilities
- **Creating new mass**
  - Disaggregating complex systems to deliver combined effects
- **Developing ‘inside-out’ and ‘over-under’ capabilities**
  - Leverage dispersal, sanctuaries, and speed
- **Developing new forms of distributed maneuver**
  - Combining kinetic, Electronic Warfare, cyber

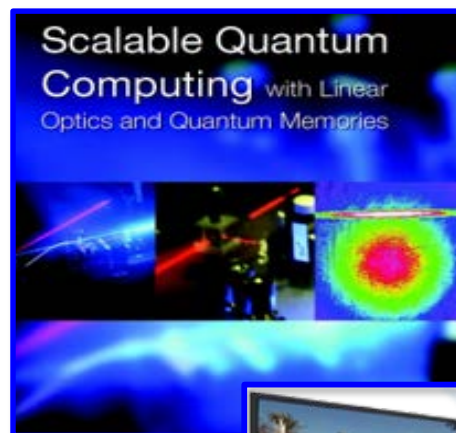




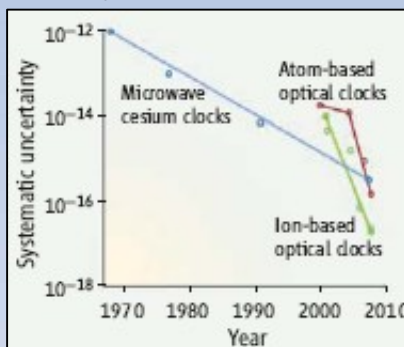
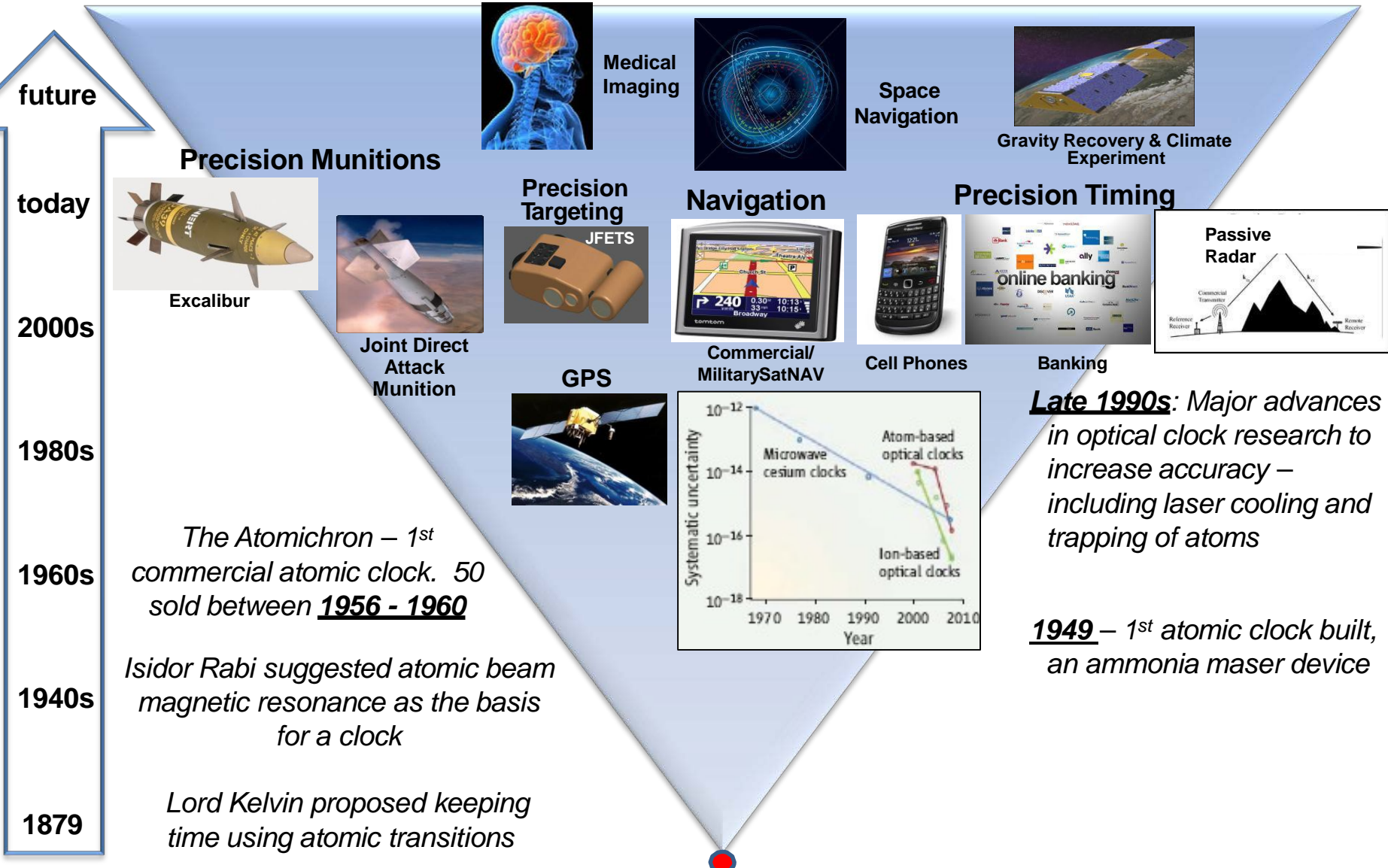
# *How does S&T Contribute?*

# What is “Science & Technology”

- **Basic Research (6.1):**
  - Investigation and analysis of basic laws of nature and phenomenon to increase scientific knowledge
- **Applied Research (6.2):**
  - Application of knowledge to develop useful materials, devices and systems or methods
- **Advanced Technology Development (6.3):**
  - Development of components and subsystems to integrate into system prototypes for field experiments and/or tests in a simulated environment

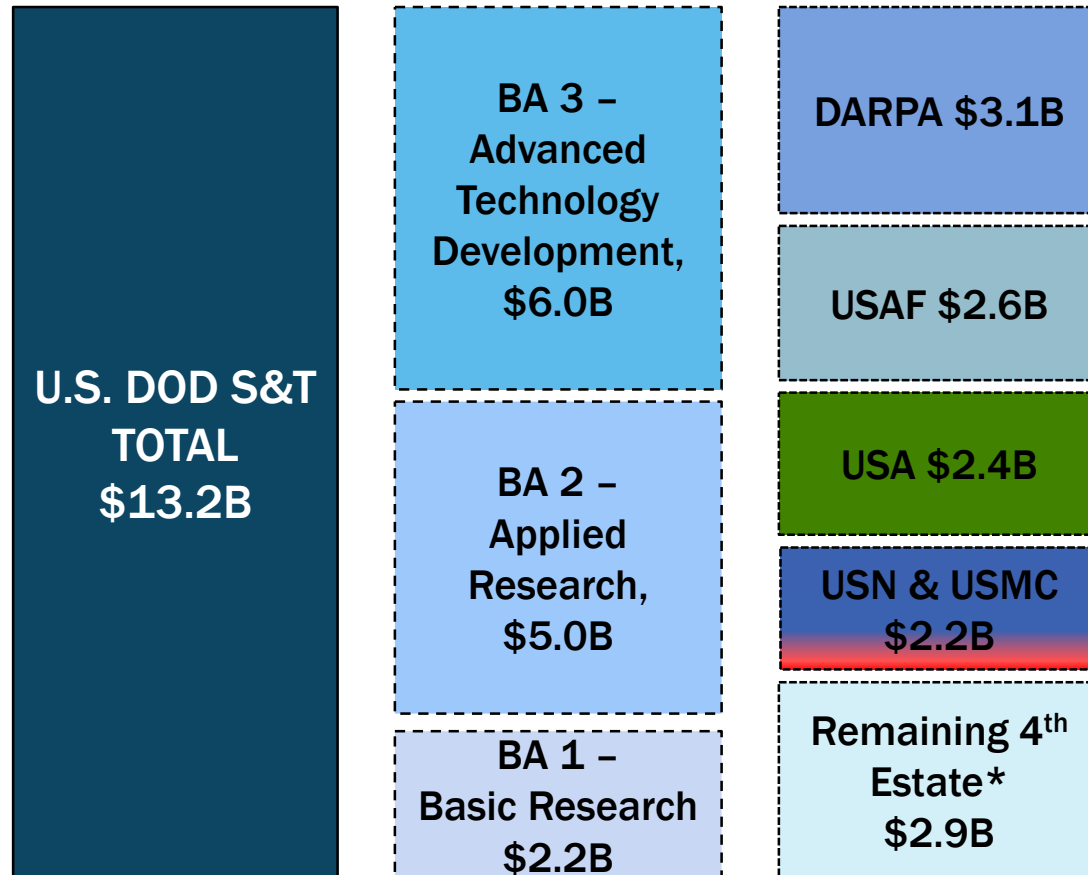


# From Basic Research to Multiple Applications



# U.S. DoD PB 2018 S&T Request

## Technology Development Budget

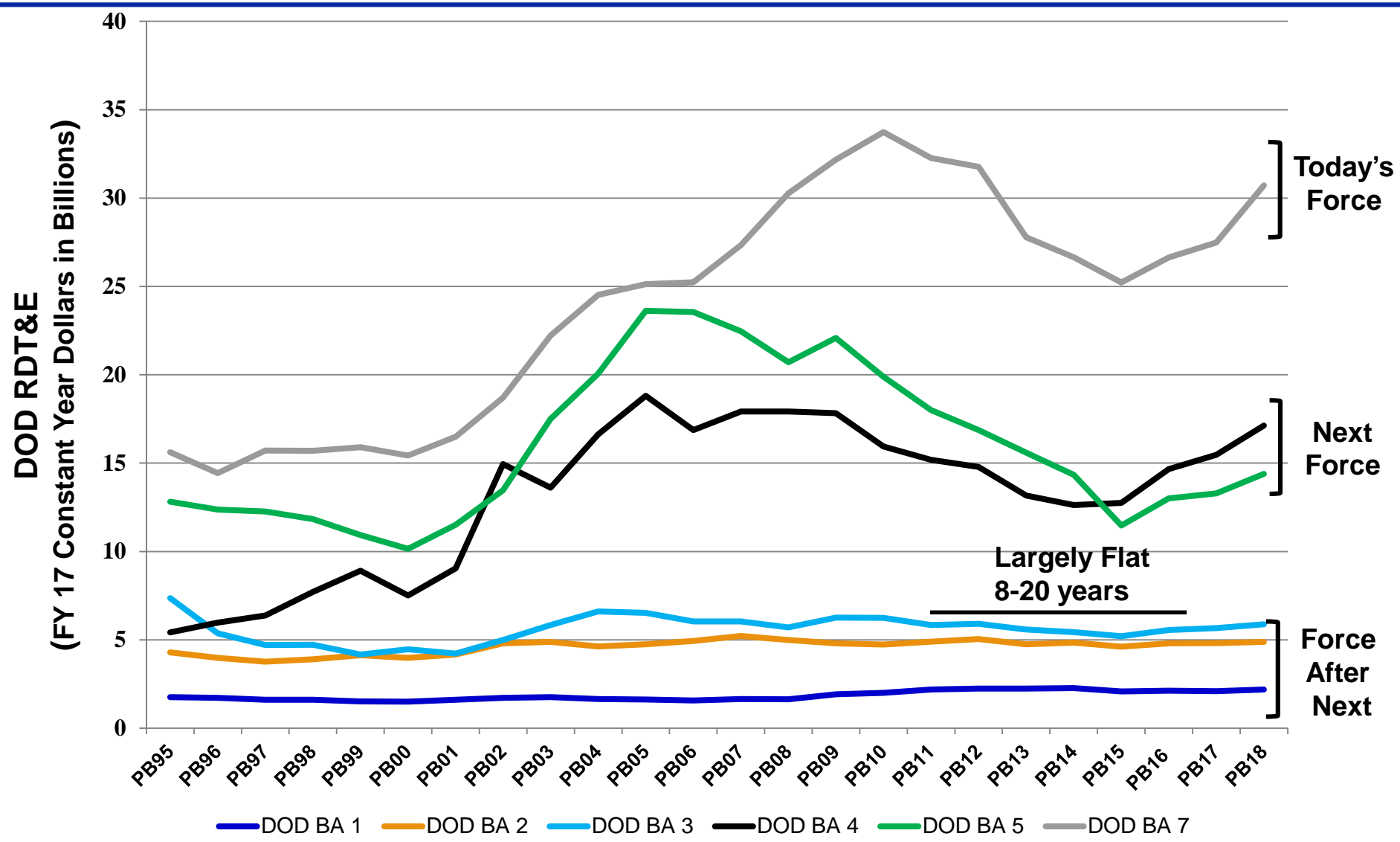


**\*NOTES:**

4<sup>th</sup> Estate includes Chem Bio, DTRA, OSD, and other DA.



# DoD RDT&E - PB 1995-PB 2018



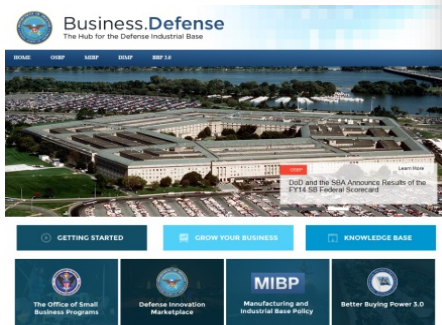


# Leveraging the Entire R&E Ecosystem

*Engaging with all partners to ensure technological superiority...*



Win today's fight



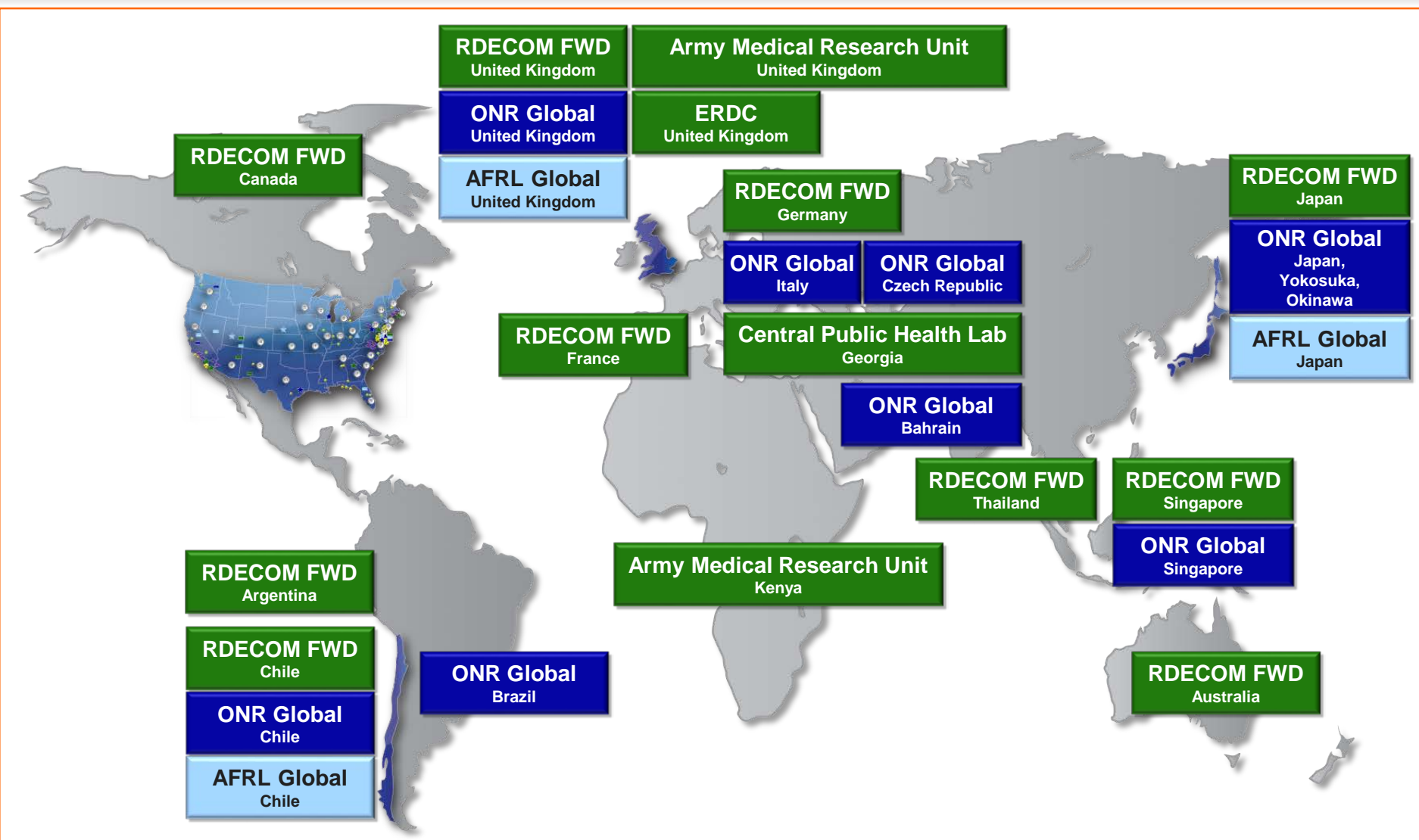
Design and acquire for the next fight



Force acceleration of science and engineering – driving ideas to capability



# DoD Research and Engineering World Class Capabilities





# U.S. Communities of Interest

*Cols lead the innovation and the acceleration of advanced concepts and prototypes across three main focus areas:*

<p><b>Mission Focus</b> Capabilities enabled by advanced technologies &amp; systems</p>		<p><b>Counter-Improvised Explosive Devices (IED)</b></p>		<p><b>Counter-Weapons of Mass Destruction (WMD)</b></p>		<p><b>Biomedical (ASBREM*)</b></p>
<p><b>Systems / Capability Focus</b> Multiple technologies are integrated into complex systems to achieve mission impact</p>		<p><b>Human Systems</b></p>		<p><b>Sensors</b></p>		<p><b>Space</b></p>
<p><b>Autonomy</b></p> 		<p><b>Ground and Sea Platforms</b></p>		<p><b>Electronic Warfare</b></p>		<p><b>Weapon Technologies</b></p>
<p><b>Cyber</b></p> 	<p><b>Cyber</b></p>	<p><b>Cyber</b></p>		<p><b>Command, Control, Communication, Computers and Intelligence (C4I)</b></p>		<p><b>Air Platforms</b></p>
<p><b>Technology Focus</b> Technology goals with multiple applications</p>		<p><b>Energy and Power Technologies</b></p>		<p><b>Advanced Electronics</b></p>		<p><b>Materials and Manufacturing Processes</b></p>

# *Looking Forward...*



# Continuously Refine our Strategic Thinking and Planning

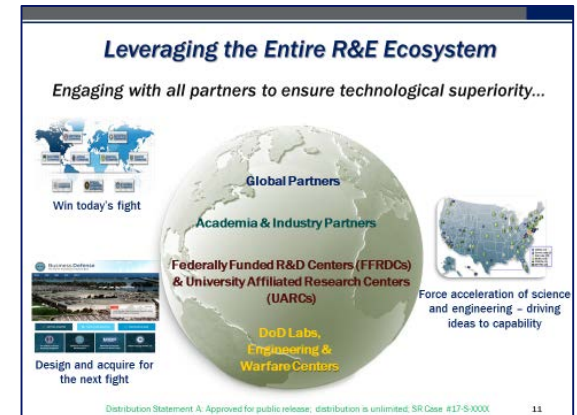
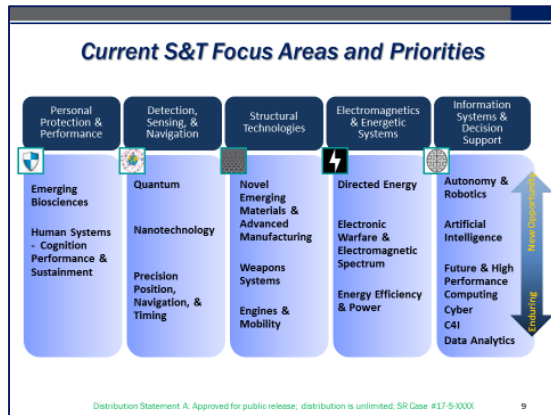


*"Where we are going and who we will be"*



*"How we get there"*

*"Where we are and who we are now"*



**- Refine our Mission, Strategic Plan, and Vision for Technical and Enterprise Priorities**

**- Continuous look at the Technology, Focus Areas, Cols, and Partnering**

***Are we addressing the right problems?***

# ***Long-Range Research & Development Planning Program (LRRDPP)***

- **Purpose:** Identify **high-payoff enabling technology investments** to provide U.S. forces with decisive advantage in the operations in the **2030** timeframe
- An opportunity to:
  - **Shape** key future U.S. materiel investments
  - **Ensure** sustained U.S. **technology superiority**, and
  - **Seize** the initiative in **shaping** a competitive future national security environment
- Focused on identifying **critical technologies** that can drive materiel concepts with potential to contribute to a **technology offset strategy**
- **Unconstrained** by current U.S. materiel inventory, plans, or investments
- Will be re-accomplished every **four years** to inform **Defense Strategic Review**

***Bottom Line: Study and prioritize new or unconventional technology that could provide significant U.S. national security advantages***

# Capability Gaps

## Opportunities for Collaboration

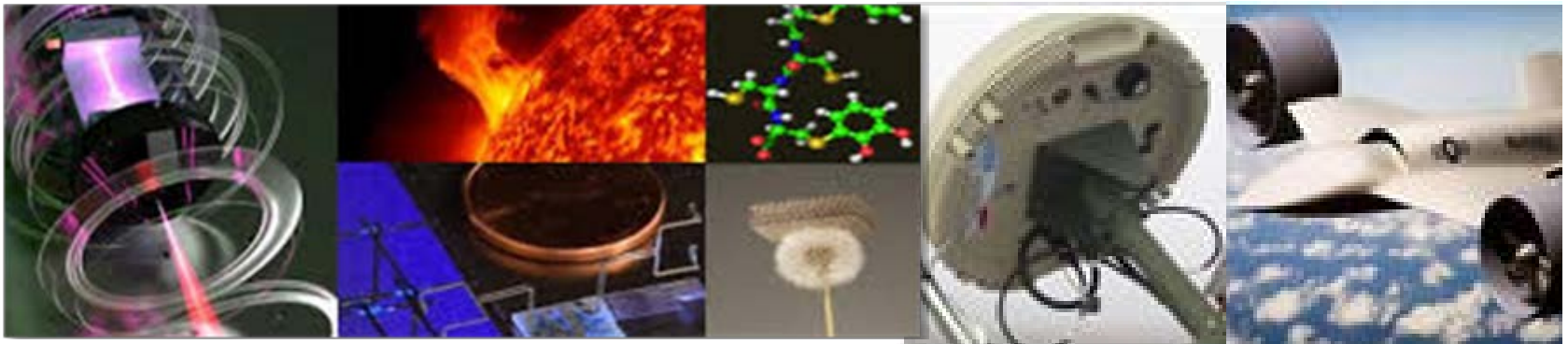


LRRDPP – Long-Range Research & Development  
Planning Program

A2/AD – Anti-Access/Area Denial

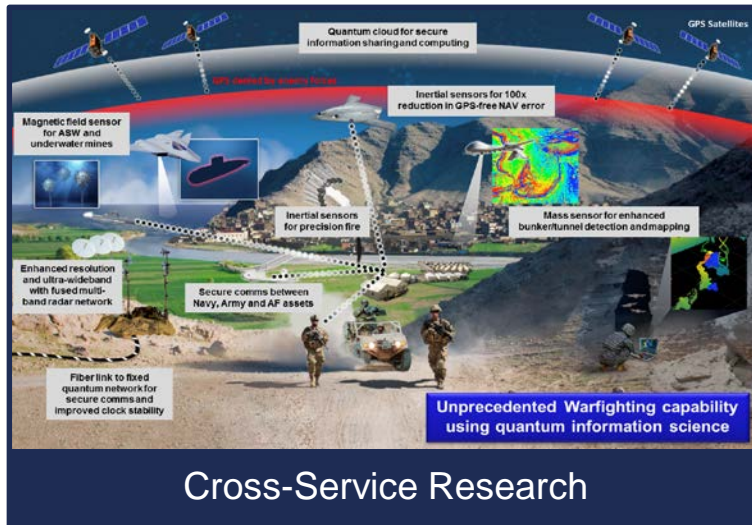
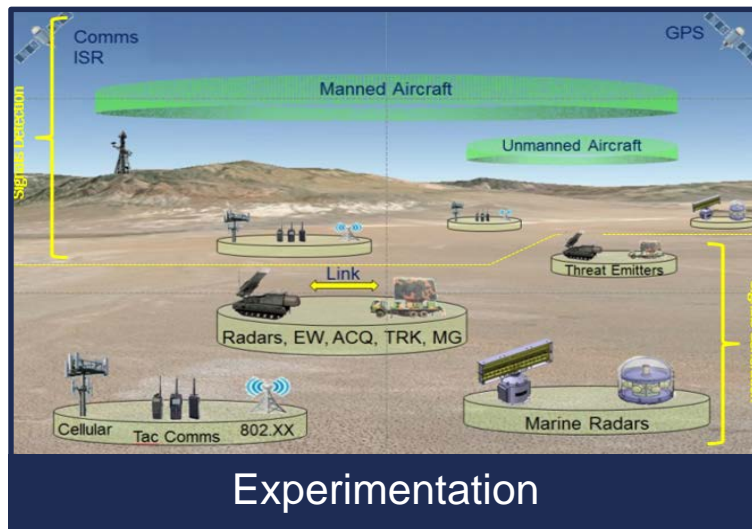
# Research and Development — On-going Activities—

- **Autonomy & Robotics**
- **Artificial Intelligence /  
Man-Machine Interface**
- **Micro-electronics**
- **Hypersonics**
- **Directed Energy**
- **Manufacturing**
- **Electronic Warfare**
- **Cyber**
- **Future of Computing**
- **Novel Engineered Materials**
- **Precision Sensing: Time, Space,  
Gravity, Electromagnetism**
- **Emerging Biosciences**
  - Synthetic Biology
- **Understanding Human and Social  
Behavior**
- **Human Performance**





# Enhancing Capabilities





# Systems Are Changing

## From:

- Systems built to last
- Heuristic-based decisions
- Deeply integrated architectures
- Hierarchical development organizations
- Satisfying requirements
  
- Automated systems
- Static certification
- Standalone systems

## To:

- Systems built to evolve
- Data-driven decisions
- Layered, modular architectures
- Ecosystems of partners, agile teams of teams
- Constant experimentation and innovation
- Learning systems
- Dynamic, continuous certification
- Composable sets of mission focused systems

**Systems Engineering Needs to Change**

**Credit: Derived from David Long, Former INCOSE President**

Distribution Statement A: Approved for public release; distribution is unlimited.

# Competition for Talent



- Need to continue to **attract** the **best** and **brightest** to national security service
- Direct **competition** for talent



- **Eliminate** barriers to service
- **Increase** recognition of unique and relevant technical work **and innovative thinking**
- **Leverage** all sources of **talent**

# *USD(AT&L) Reorganization...*

# 2017 National Defense Authorization Act (NDAA), §901 Organization of the Office of the Secretary of Defense

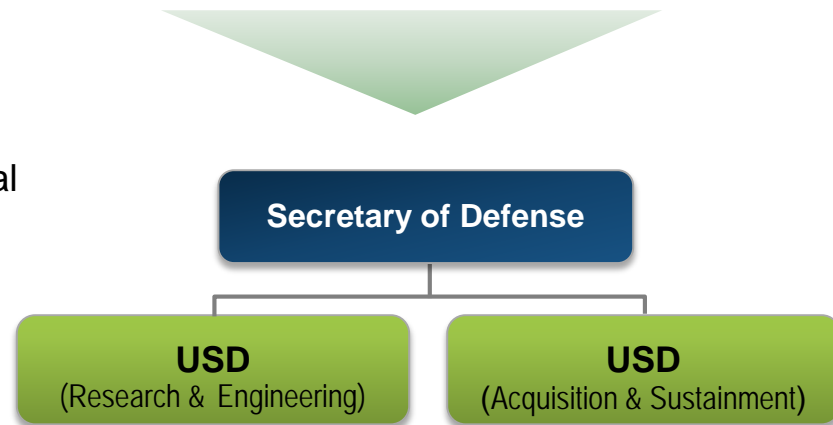
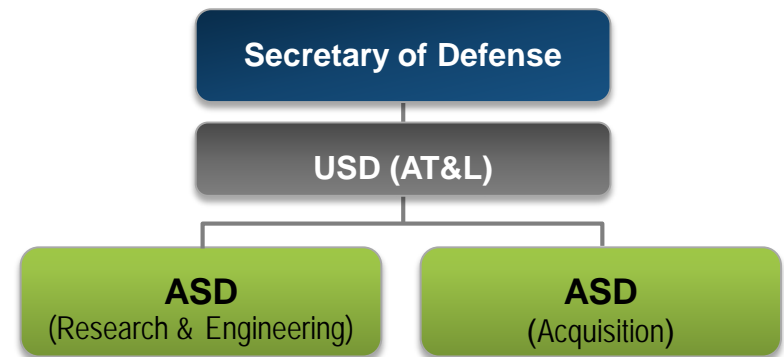
“Establish policies on, and supervising...”:

## Undersecretary of Defense (R&E)

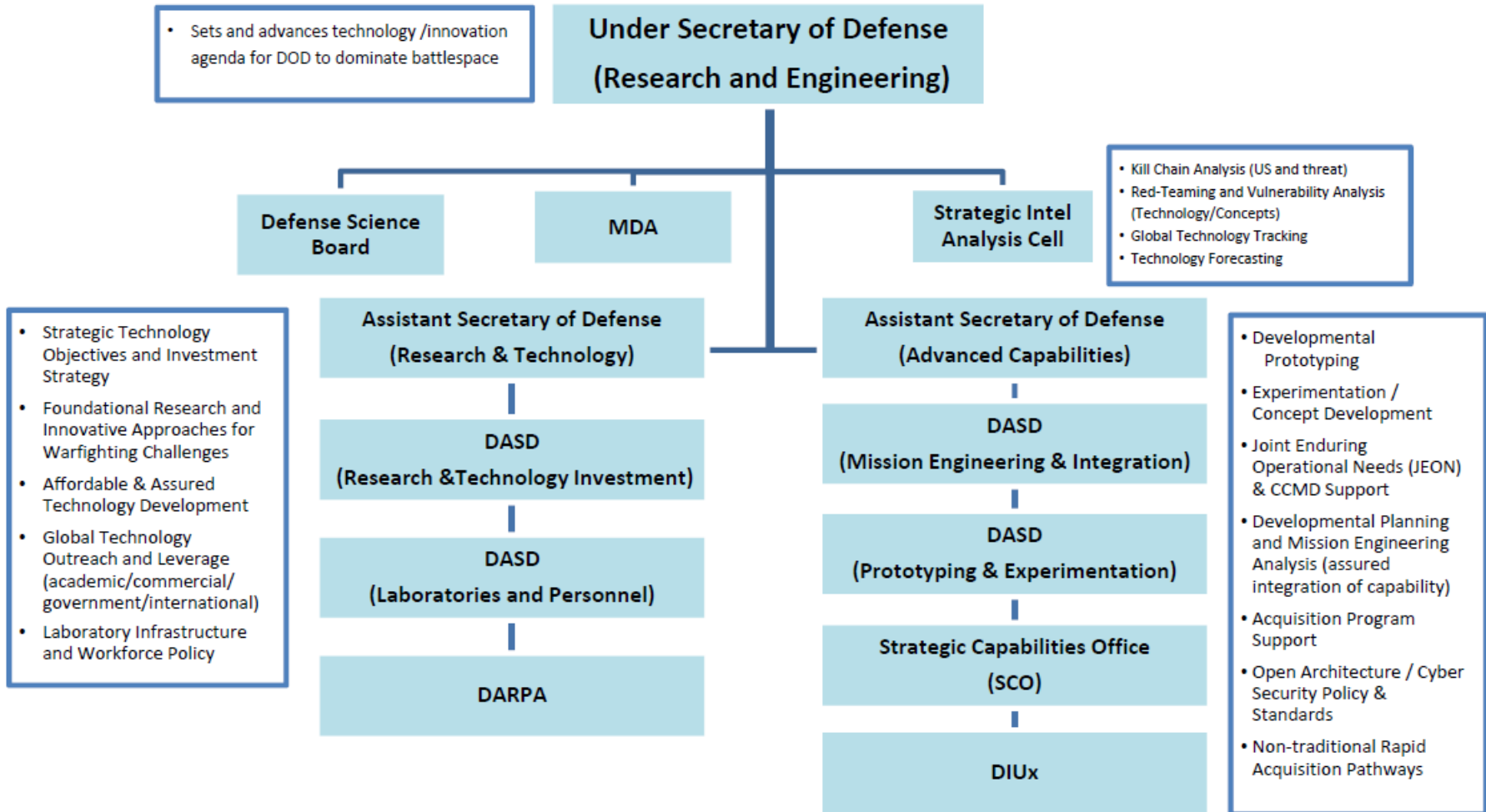
- Defense research and engineering
- Technology development
- Technology transition
- Prototyping
- Experimentation
- Developmental testing activities and programs...
- Allocation of resources for defense research and engineering
- Unifying defense research and engineering efforts across the DoD

## Undersecretary of Defense (A&S)

- Acquisition policy
  - system design, development, and production
  - procurement of goods and services
- Sustainment policy
  - logistics
  - maintenance
  - materiel readiness
- Defense industrial base policy
- Materials critical to national security
- Contract administration policy
- Modernization of nuclear forces
- Development of counter-WMD capabilities



# USD(R&E) Proposed Organization





# ***USD(R&E) – Guiding Principles***

## **USD(R&E) Key Concepts**

### **Imperatives**

- 1. Technical Superiority**
- 2. Affordability**
- 3. Accelerate Capability to the Warfighter**

- Provide Major Tech Investment Shaping & Strategic Direction**
- Focus on Joint, Cross-Cutting Missions**
- Tightly Couple with Warfighter**
- Integrate Intelligence & Analysis to Inform Decisions**
- Incentivize/Prove New Tech Solutions**
- Mandate Technology Insertion Opportunities / Institutionalize MOSA**
- Implement Cyber Resilience & Cross-Cutting Enablers**
- Inform S&T & Prototyping Development with Sustainability/ Manufacturability**
- Inform Requirements, Vice Waiting for JCIDS**
- Identify New Pathways to Acquisition**
- Ensure Transparency & Inclusion**

# Maintaining Technology Superiority

- The U.S. military has long relied on *high quality people, technological superiority, innovative operational* and *organizational constructs*, and our *unmatched ability to fight as a Joint Force*
- We are addressing the erosion of technological superiority by identifying and investing in *innovative technologies and processes*
- We are pushing the envelope with *innovative* and *cutting edge research*
- Beyond technical innovation, we are pursuing *new practices* and *organizational structures* to ensure future U.S. technical dominance
- From *basic research* to *advanced capabilities*, the DoD R&E enterprise provides the *technological foundations* that ensures our military of the future remains the *most capable in the world*

***DoD R&E Enterprise: Solving Problems Today – Designing Solutions for Tomorrow***

# DoD R&E Enterprise

## Solving Problems Today – Designing Solutions for Tomorrow



**DoD Research and Engineering Enterprise**  
<https://www.acq.osd.mil/chieftechologist/>

**Defense Innovation Marketplace**  
<http://www.defenseinnovationmarketplace.mil>

**Twitter**  
[@DoDIInnovation](https://twitter.com/DoDIInnovation)