DoD Research and Engineering Enterprise

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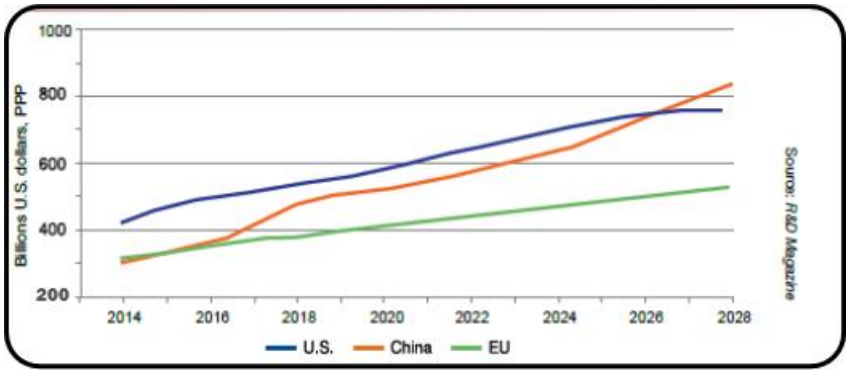
Technology Transforming the Battlespace

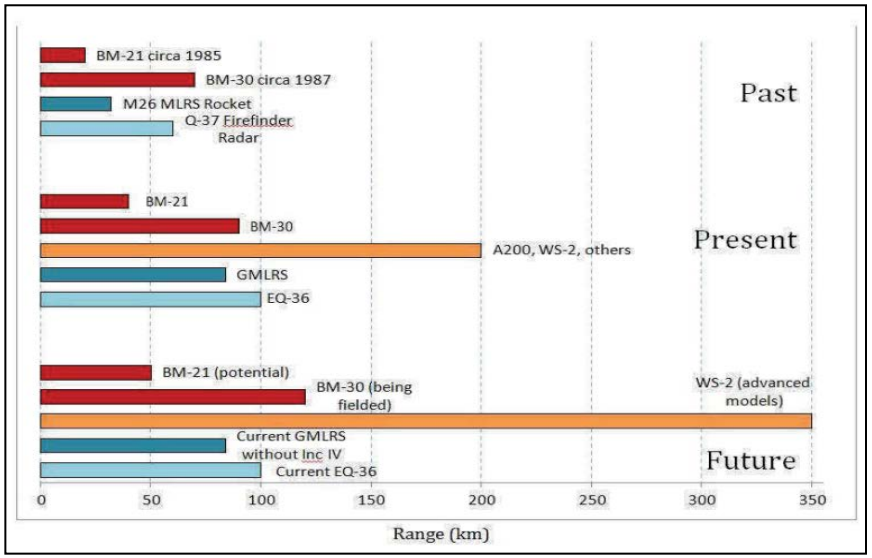
- **Increased rate of investment in military R&D from near-peers**
- **Easy proliferation of knowledge and technology has eroded US historic advantages**
  - Increasing systems capabilities
  - Advanced production capabilities
    - Driving lower costs
    - Decreasing the "time to market"
- **Speed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



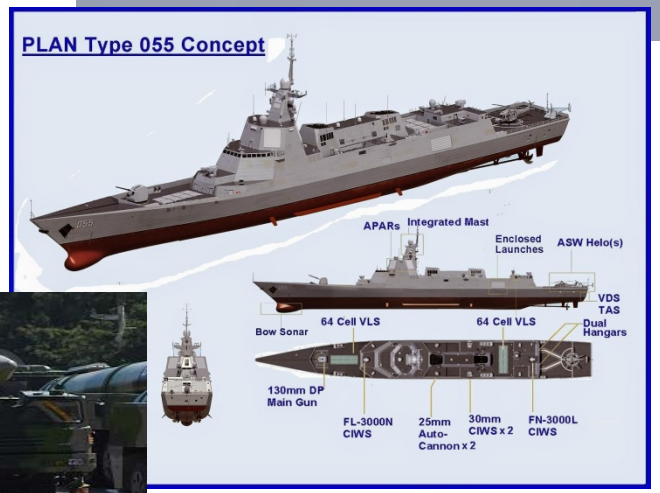
China is the world's second largest investor in R&D with a forecast spending of $396.3 billion for 2016

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 <u>now</u> on-par or outranged by Russian and Chinese rocket and artillery capabilities
- China and Russia can hold <u>U.S. and allied positions at risk</u>
  - China only had the ability to strike Taiwan 10 years ago



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…

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.

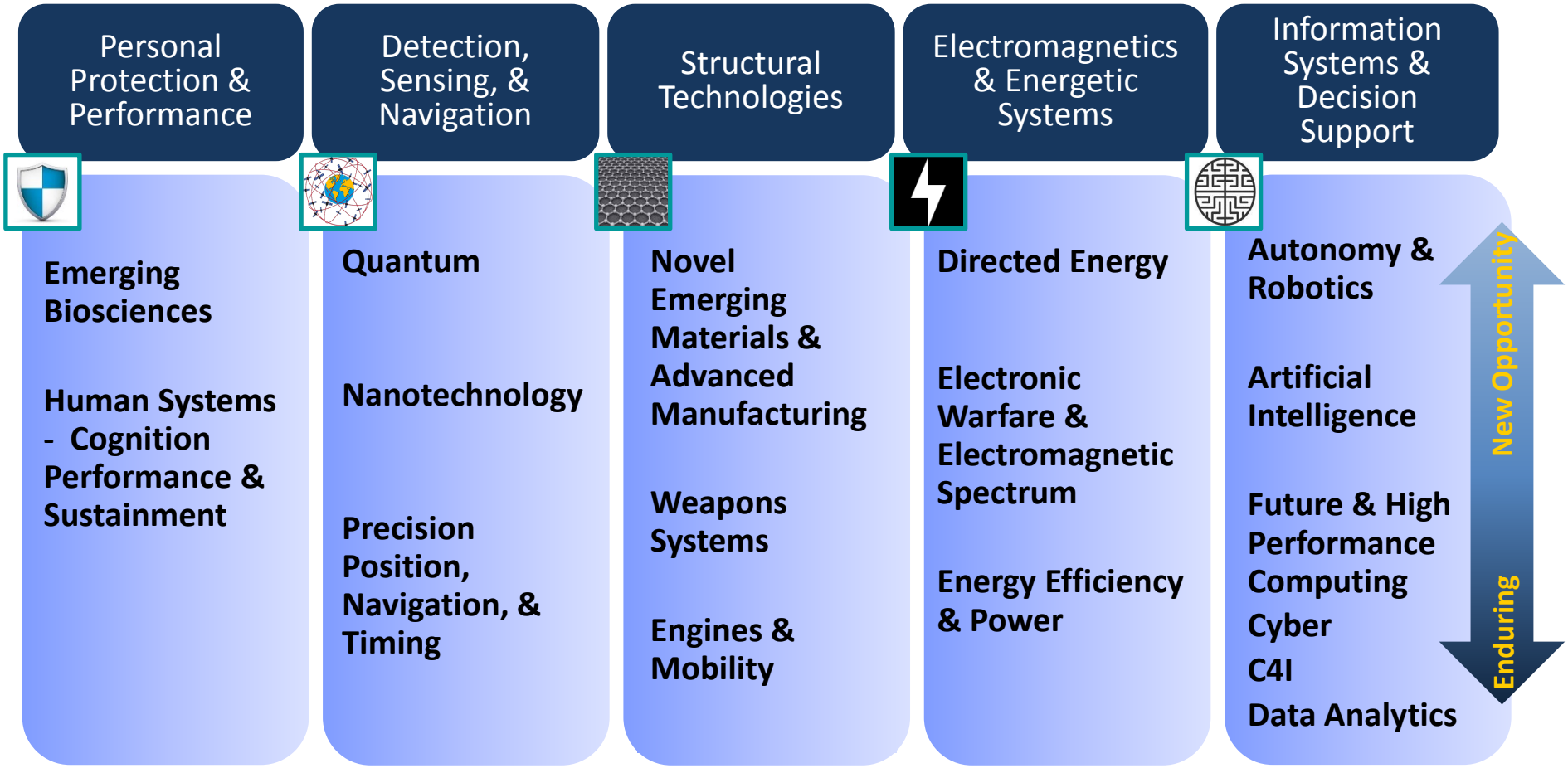
Pursuing Sustained Technological Advantage

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 combine effec
- **Developing 'inside-out' and 'over-under' capabilities**
  - Leverage dispersal, sanctuaries, and speed
- **Developing new forms of distributed maneuver**
  - Combining kinetic, EW, cyber

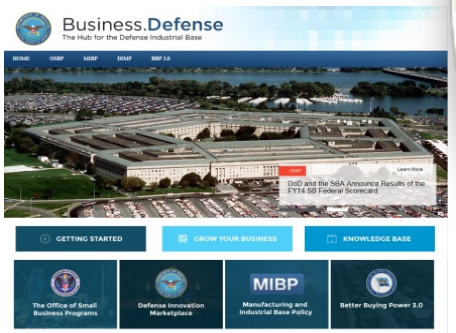
Current S&T Focus Areas and Priorities



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

U.S. Communities of Interest

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

Mission Focus
Capabilities enabled by advanced technologies & systems

Counter-Improvised Explosive Devices (IED)

Counter-Weapons of Mass Destruction (WMD)

Biomedical (ASBREM*)

Systems / Capability Focus
Multiple technologies are integrated into complex systems to achieve mission impact

Human Systems

Sensors

Space

Ground and Sea Platforms

Electronic Warfare

Weapon Technologies

Autonomy

Cyber

Command, Control, Communication, Computers and Intelligence (C4I)

Air Platforms

Technology Focus
Technology goals with multiple applications

Energy and Power Technologies

Advanced Electronics

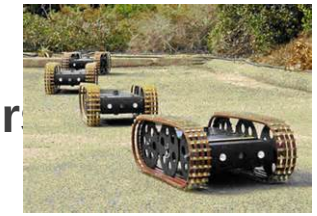
Materials and Manufacturing Processes

Alumni CoIs: Engineered Resilient Systems

***ASBREM: Armed Services Biomedical Research Evaluation and Management**

Additional Influences on DoD Efforts

- Increase the use of **Prototyping and Experimentation**
- Use Modular **Open Systems** Approaches
- Strengthen **Cybersecurity:** Counter Threats and Protect our Capabilities
- Remove barriers to utilizing **Commercial Technology**
- Improve DoD **outreach** to **Global Markets**
  - **Create strong internal and external partner**



Accelerate Speed to Market –
Get Capabilities into the Hands of the Warfighter

Looking Forward…

Capability Gaps

Opportunities for Collaboration

INPUT FACTORS

- **Threats**
- **Planning**
  - LRDDPP
- **Hard Problems**
  - A2/AD
- **Tech Trends**
  - Globalization
- **Affordability**

Speed

Situational Awareness

Survivability/ Protection

Training Fidelity

Range

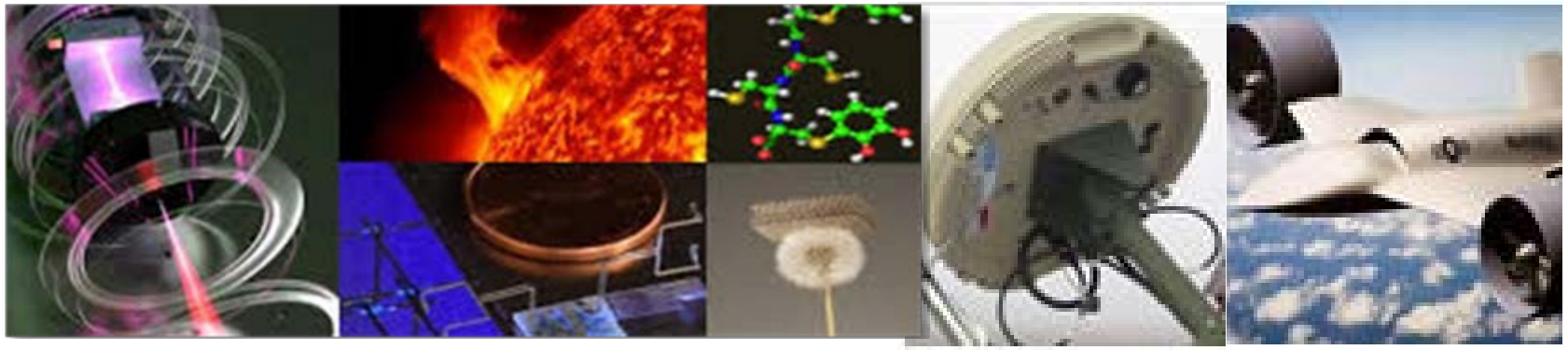
Weight/ Mobility

Lethality

Ability to Communicate

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

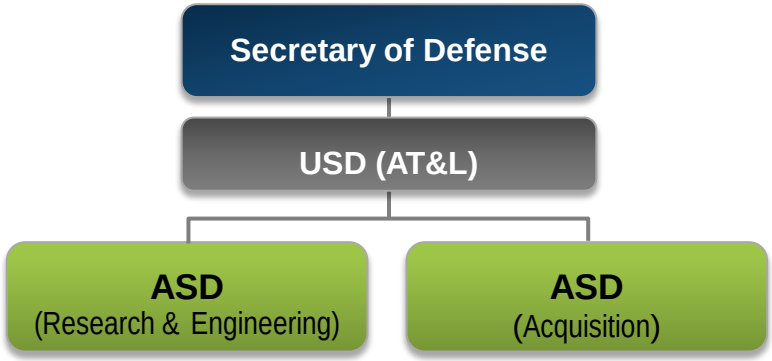


2017 National Defense Authorization Act (NDAA), §901
Organization of the Office of the Secretary of Defense

"Establish policies on, and supervising…":

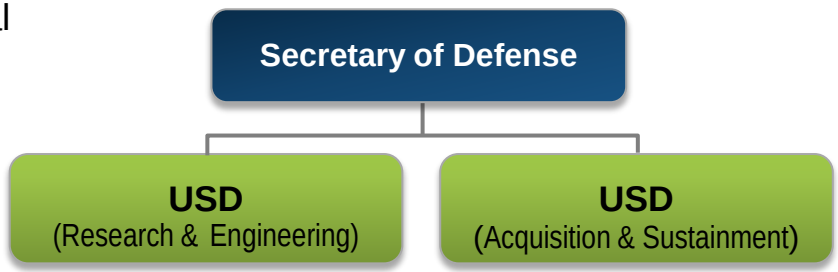
Undersecretary of Defense (R&E)

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



Culture Shifts

Strategies needed to realize a technological advantage under new organizational constructs…

- Develop long-term and sustainable **disruptive advantages**
- Create **operational capability** – **not just technology**
- Invent **new techniques and processes** – create **opportunities**
- Engage in the art of the possible – with **allies and partners**
- Add **cost-effective capabilities** for the warfighter
- Collaborate **internally** (labs) and **externally** (e.g., industry, academia, international partners)
- Enable USD(R&E) construct to **ensure DoD investments are guaranteeing technological superiority in the**

DoD R&E Enterprise:

Innovation Fueling the Future