DoD Research and Engineering Enterprise

19th Annual National Defense Industrial Association Science & Emerging Technology Conference

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Mary J. Miller

Performing the Duties of Assistant Secretary of Defense
for Research and Engineering

What Drives Us…

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 power projection**
  - We are <u>now</u> on-par or outranged by Russian and Chinese rocket and artillery capabilities
  - Russia and China continue to develop and modernize their extensive nuclear forces and long range precision-guided conventional weapons systems

- **China and Russia can hold <u>U.S. and allied positions at risk</u>**
  - Amplifying capabilities to detect, track, and target threats in varying conditions, larger volumes, and at greater distances, extend China's integrated air defense systems
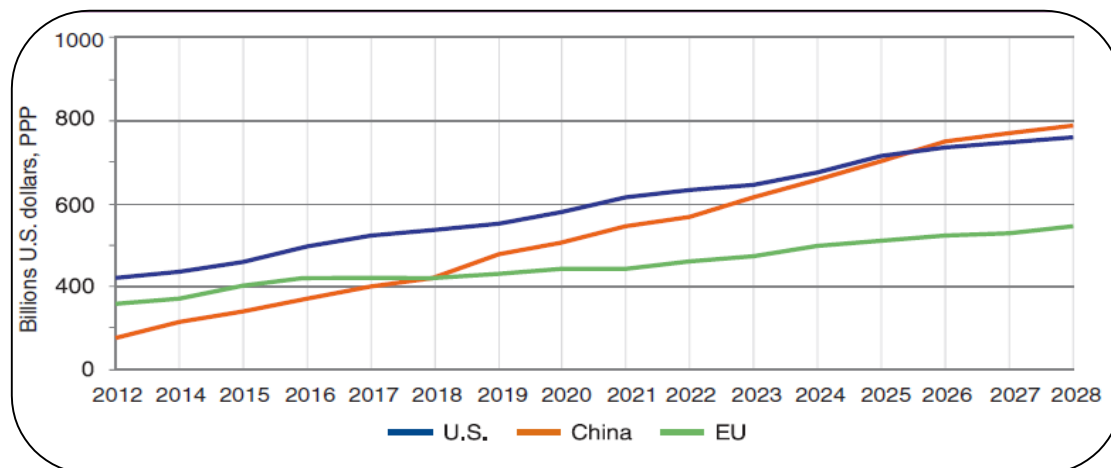
"China's 2017 (R&D) growth is basically twice the percentage change and twice the dollar amount of change as the growth forecast for the U.S.'s 2017 R&D spending"

- 2017 GLOBAL R&D FUNDING FORECAST WINTER 2017
Industrial Research Institute, R&D Magazine

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

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National Defense Strategy

- Sec Mattis unveiled the first National Defense Strategy in 10 years

- First comprehensive review in a decade and first major policy document of the Trump administration

- Sec Mattis' intent is "to pursue urgent change on a significant scale"

- US military is refocusing on fighting other nations rather than terrorist groups

  - Means buying new equipment and embracing innovations so they reach the battlefield faster

  - Erosion of US Military advantage vis-à-vis China and Russia, if unaddressed, could ultimately undermine our ability to deter aggression

"America must be the world's dominant technological powerhouse of the 21st century."
– President Trump, speech on National Security, Sept. 7, 2016

Need to Modernize

- The U.S. is now challenged to strike any adversary at will

- Equal access to emerging technologies, such as autonomy, artificial intelligence and synthetic biology, will disrupt future conflicts

- The U.S. still possesses the best military, however our adversaries' deliberate actions mandate change in what we buy and how we operate

- We must develop new lethal capabilities and accelerate the pace in which we get that capability to the warfighter

To Modernize, We Must Regularize Mission-Focus Thinking

Modernization seeks to **win the enduring competition** of military superiority

BUILD ON THREE STRENGTHS	&	**EXECUTE THREE PIVOTS**

investing in our differentiators:

JOINTNESS

incentivize investment for interoperability

Fighting together towards a common goal

EMPOWER AT THE EDGE

decentralized execution across workforce and in garrison, supported by systems.

Warfighter autonomy and mission command

ALLIES AND PARTNERS

A forethought across DOTMLPF

Leverage geography, assets, and capabilities of allies and partners to fight stronger together

shifts in emphasis:

DOMINANCE TO LETHALITY

From all-domain supremacy to fighting through adversity and ability to target and prosecute red before they act

resilient kill chains over invulnerable systems

PREDICTABILITY TO SURPRISE

From polishing proven practices to expanding & continuously refreshing playbook of employment concepts & technologies

heterogeneity over uniformity

DELIBERATE INERTIA TO CONTINUOUS SPEED

From a steady pace seeking major advances to rapid block upgrades & capability enhancements

agility & adaptability over performance

driving towards a **mission-focused department**

Path to Modernization

- **Establish a unifying goal** within the Department – Networked Adaptive Multi-Domain Joint Battle

- **Establish a deliberate set of resources** for concepts that will be competitively selected to help achieve this goal

- **Move to a mission-focused, portfolio** managed schema, vice individual platform approach

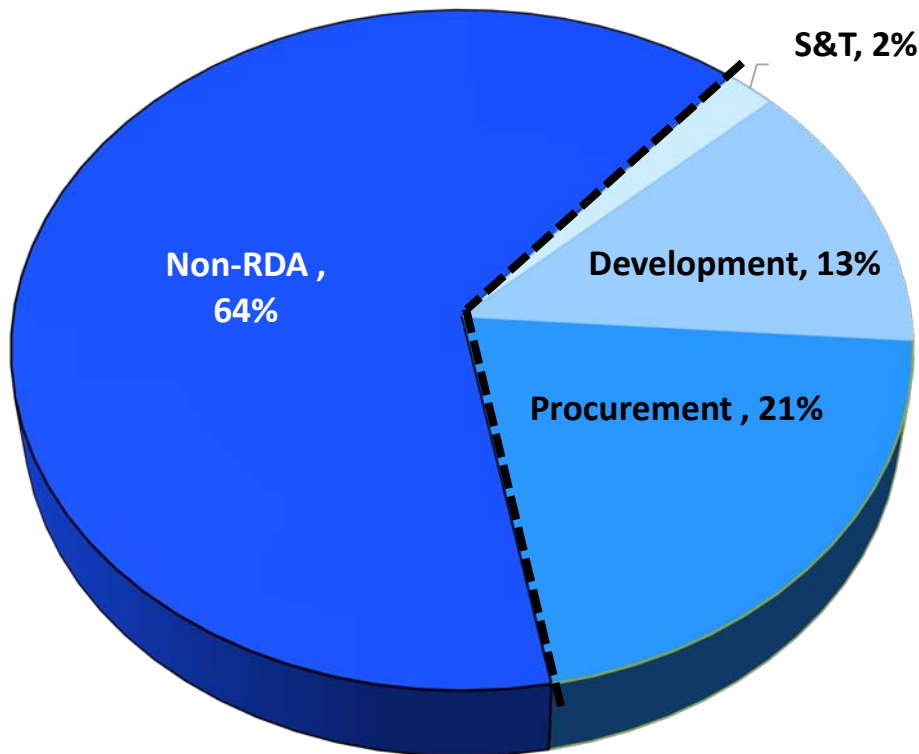- **Focus on both new capabilities** and operational constructs

Networked Multi-Domain Joint Battle

Accelerate getting capability to the Warfighter

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DoD Budget Status

PBR 2019 DoD S&T Funding In Perspective

DoD TOA (Base Only) = $617B

- Non-RDA, 64%
- S&T, 2%
- Development, 13%
- Procurement, 21%

RDT&E
(S&T + Development + T&E)

- S&T (BA 1- BA 3), 15%
- Development (BA 4- BA 7), 85%
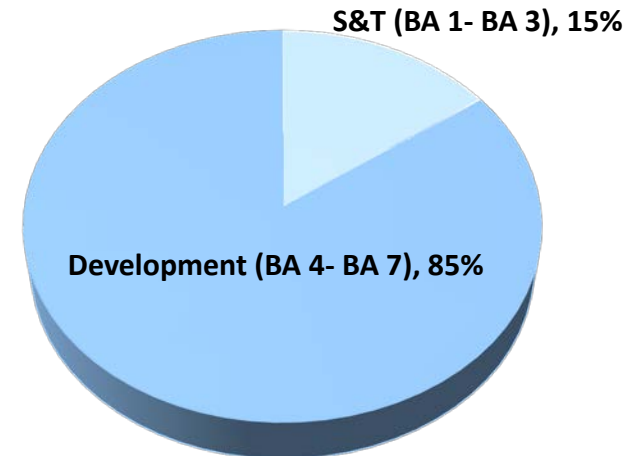
PBR19	FY19 ($B)
Non-RDA	394.4
RDA	222.6
Procurement	131.6
RDT&E	91.0
S&T (BA1-BA3)	12.7
Development BA4-BA7)	77.4

Note:
- *Dollars reflect Base Only, no OCO*
- *Non-RDA = Force Structure and Operational Readiness*
- *BA = Budget Activity*
- *S&T = Science and Technology*

U.S. DoD PB 2019 S&T Request
Technology Development Budget

U.S. DOD S&T TOTAL $13.7B	BA 3 – Advanced Technology Development, $6.3B	DARPA $3.4B
		USAF $2.6B
	BA 2 – Applied Research, $5.1B	USA $2.4B
		USN & USMC $2.2B
	BA 1 – Basic Research $2.3B	Remaining 4th Estate* $3.0B
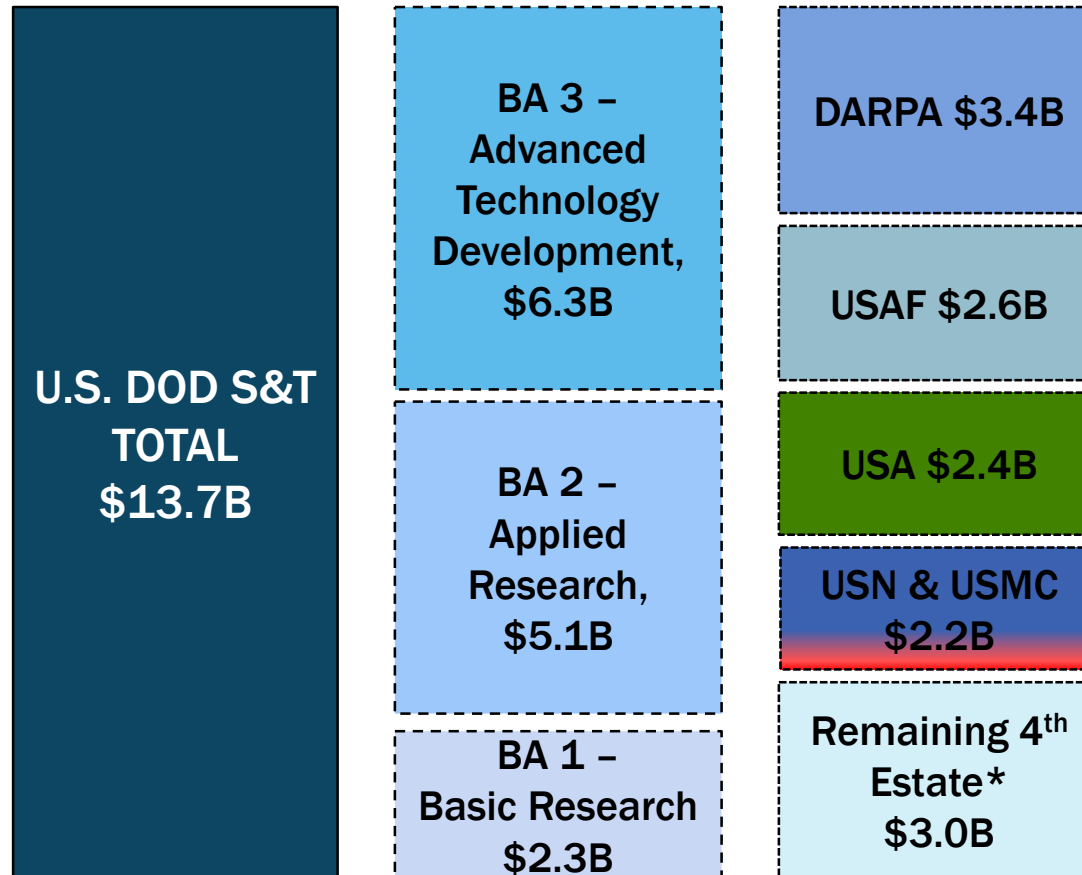
*NOTES:

4th Estate includes Chem Bio, DTRA, OSD, USSOCOM, and other DA.

PBR18 FY18 RDT&E = $ 82.7B (Budget Activities 1-7)

($B)

- BA6 + BA7 = $37.4B
- BA4 + BA5 = $32.1B
- S&T: BA1 BA2 + BA3 = $13.2B

- BA7 Operational Systems Development ($31.3B)
- BA6 RDT&E Management Support ($6.1B)
- BA5 System Development & Demonstration ($14.7B)
- BA4 Advanced Component Development & Prototypes ($17.4B)
- BA3 Advanced Technology Development ($6.0B)
- BA2 Applied Research ($5.0B)
- BA1 Basic Research ($2.2B)
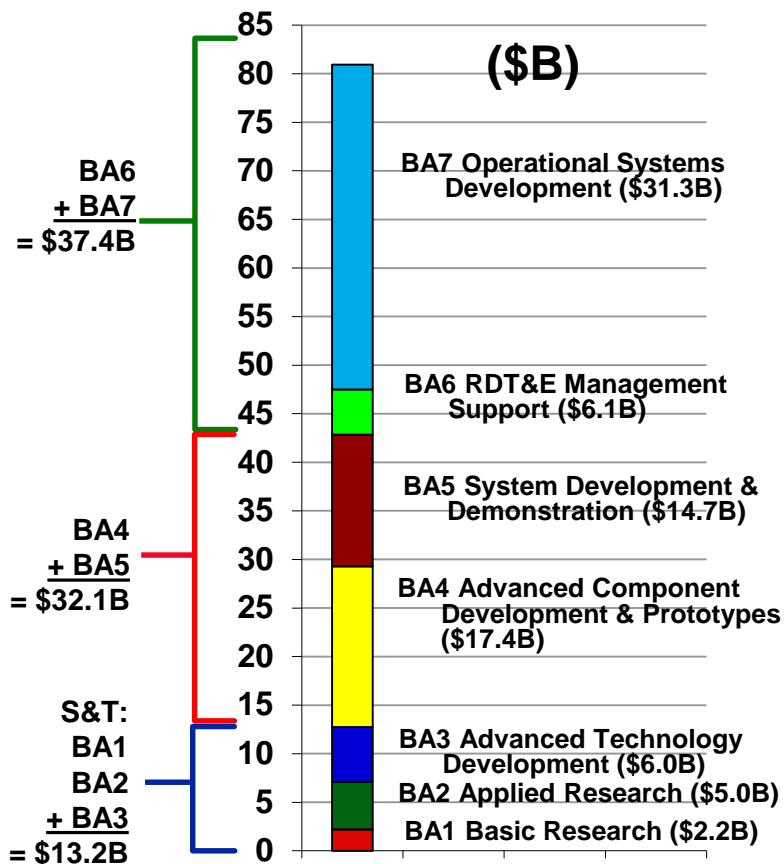
Technology Base (BA1 + BA2) = $7.1B

S&T is 15.9% of RDT&E;
RDT&E is 14.4% of DOD Topline (Base only)

PBR19 FY19 RDT&E = $ 90.6B (Budget Activities 1-7)

($B)

- BA6 + BA7 = $40.9B
- BA4 + BA5 = $36.1B
- S&T: BA1 BA2 + BA3 = $13.7B

- BA7 Operational Systems Development ($34.3B)
- BA6 RDT&E Management Support ($6.5B)
- BA5 System Development & Demonstration ($15.3B)
- BA4 Advanced Component Development & Prototypes ($20.8B)
- BA3 Advanced Technology Development ($6.3B)
- BA2 Applied Research ($5.1B)
- BA1 Basic Research ($2.3B)
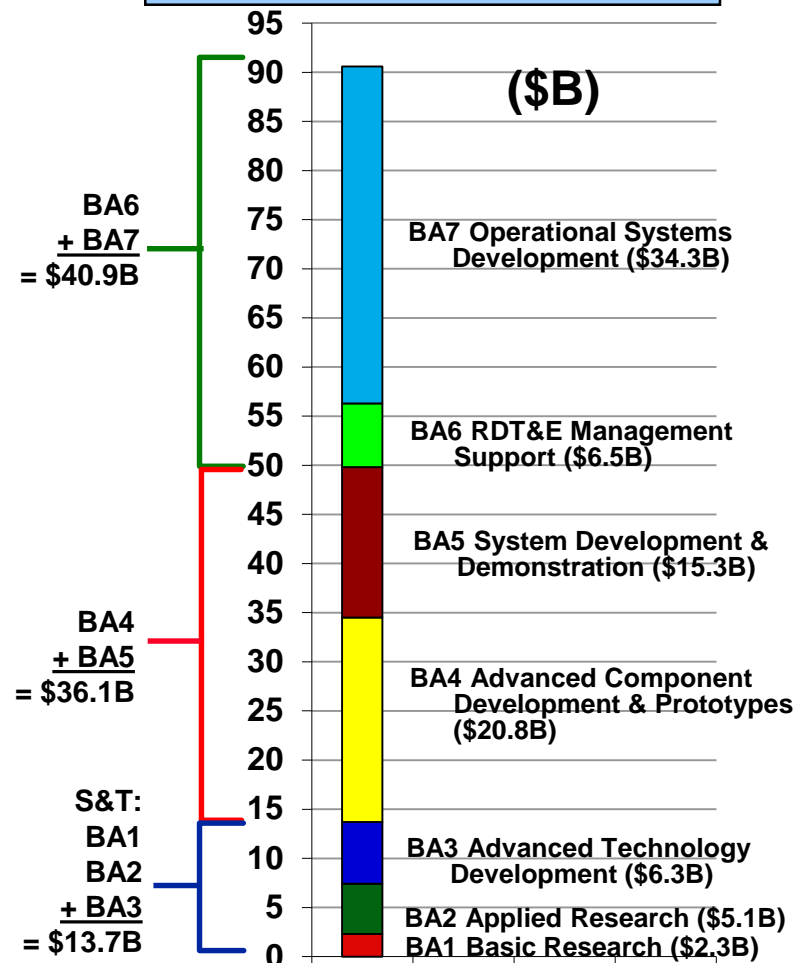
Technology Base (BA1 + BA2) = $7.4B

S&T is 15.1% of RDT&E;
RDT&E is 15.1% of DOD Topline (Base only)

- in Then Year Dollars -

Who are the players???

Leveraging the Entire R&E Ecosystem

Engaging with all partners to ensure technological superiority...
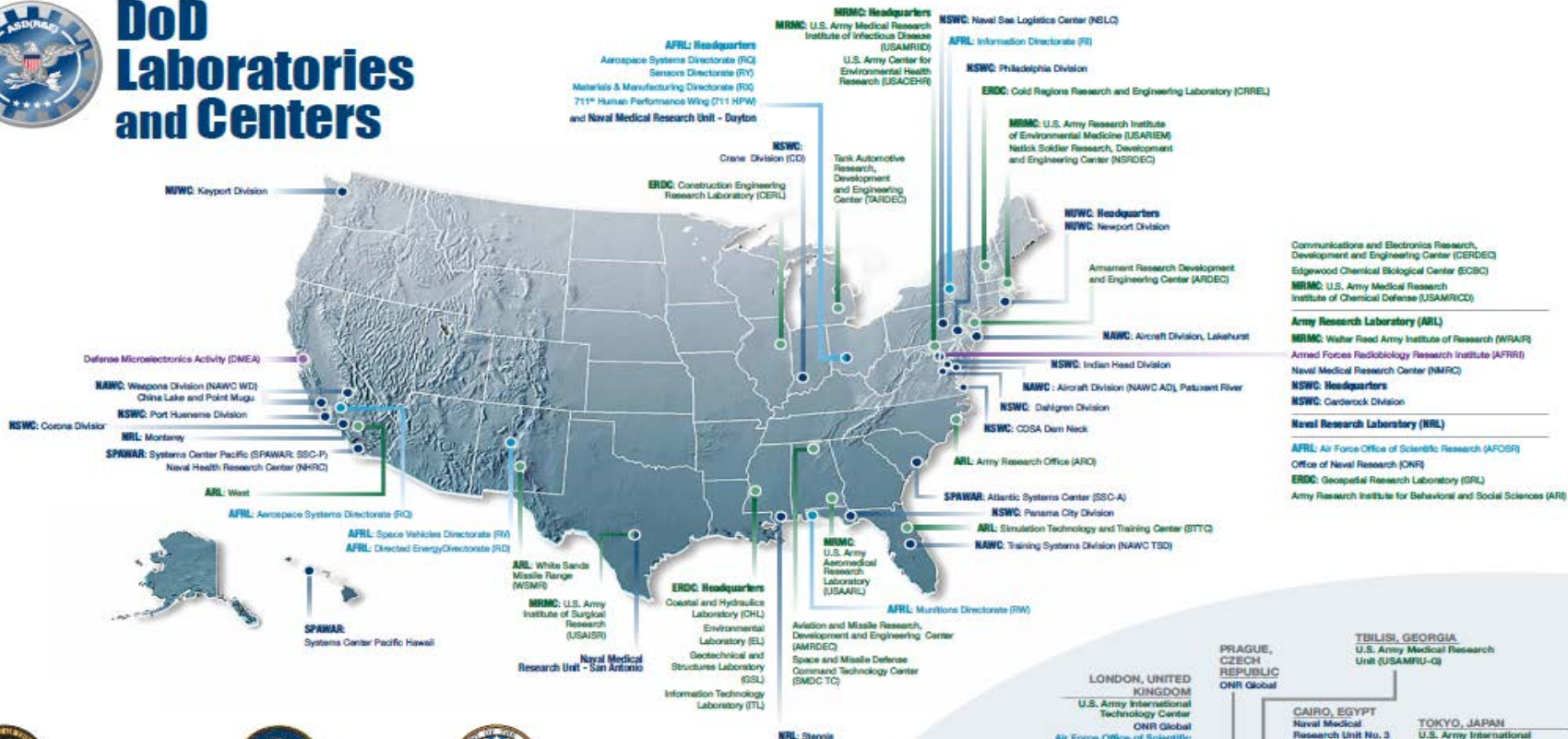

Win today's fight

Design and acquire for the next fight

Global Partners
Academia & Industry Partners
Federally Funded R&D Centers (FFRDCs) & University Affiliated Research Centers (UARCs)
DoD Labs, Engineering & Warfare Centers

Force acceleration of science and engineering – driving ideas to capability

DoD Laboratories and Centers

63 Department of Defense laboratories and engineering centers provide expertise and insight to enhance our warfighter's 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

DoD S&T Enterprise Strategy

Continuously Refine our Strategic Thinking and Planning

Mission

"Where we are and who we are now"

"Where we are going and who we will be"

Vision

Strategic Plan

"How we get there"

Current S&T Focus Areas and Priorities

U.S. Communities of Interest

Leveraging the Entire R&E Ecosystem
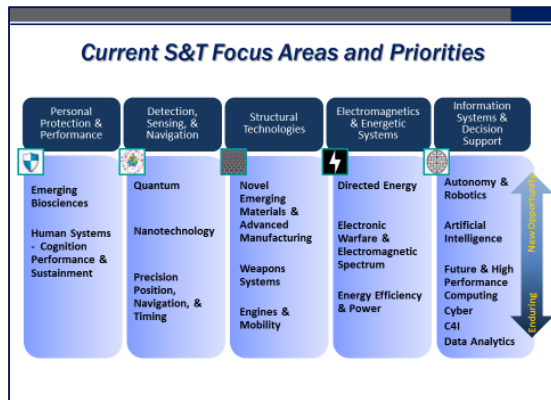
- Refine our Mission, Strategic Plan, and Vision
for Technical and Enterprise Priorities
- Continuous look at the Technology, Focus Areas, CoIs, and Partnering
Are we addressing the right problems?

DoD S&T Enterprise Strategic Vision: One Enterprise

- Mitigate challenges by **strengthening the DoD S&T Enterprise's focus, policies and processes** to unleash the full potential and ingenuity of our S&T workforce

- Anticipate the future S&T environment and **transform the S&T Enterprise toward efficient cross functional practices** that will boost innovation, lower barriers to technology transition, and accelerate response to warfighters

- The new *DoD S&T Enterprise Strategy* **provides strategic directions** and initiatives to support the One Enterprise vision

- The focus is in three areas:
  - Addressing new S&T priorities
  - People and culture
  - Supporting business practices and operations

The DoD S&T Enterprise will operate as One Enterprise to deliver responsive, relevant, lethal and affordable technical solutions to deter or defeat known and emerging threats to U.S. national security

Capability Gaps
Opportunities for Collaboration

INPUT FACTORS

Threats

Planning
- LRRDPP

Hard Problems
- A2/AD

Tech Trends
- Globalization

Affordability

Speed

Survivability/ Protection

Situational Awareness

Training Fidelity

Range

Lethality

Ability to Communicate

Weight/ Mobility

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

- **Advanced Computing**
- Novel Engineered Materials
- Precision Sensing: Time, Space, Gravity, Electromagnetism
- **Emerging Biosciences**
  - Synthetic Biology
- Understanding Human and Social Behavior
- Human Performance

Rapid technological change includes developments in advanced computing, big data analytics, artificial intelligence, autonomy…directed energy, and hypersonics – the very technologies that ensure we will be able to fight and win the wars of the future."

– Secretary of Defense Mattis, HASC Posture Hearing, June 12, 2017

Enhancing Capabilities

Prototyping
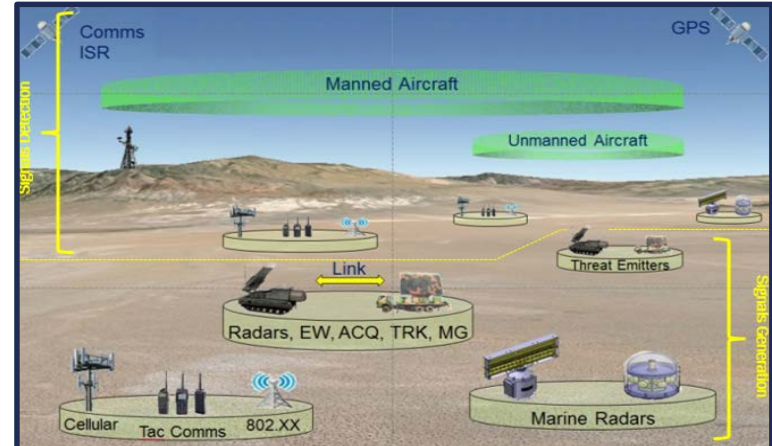
Experimentation

Manned, Unmanned and Dismounted Soldier Systems Models and Simulations
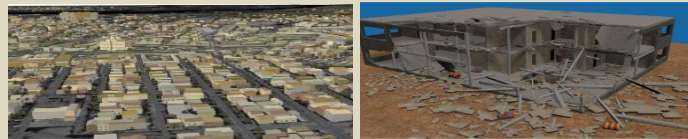
Megacity Environment

New Approaches; Problems, Environments
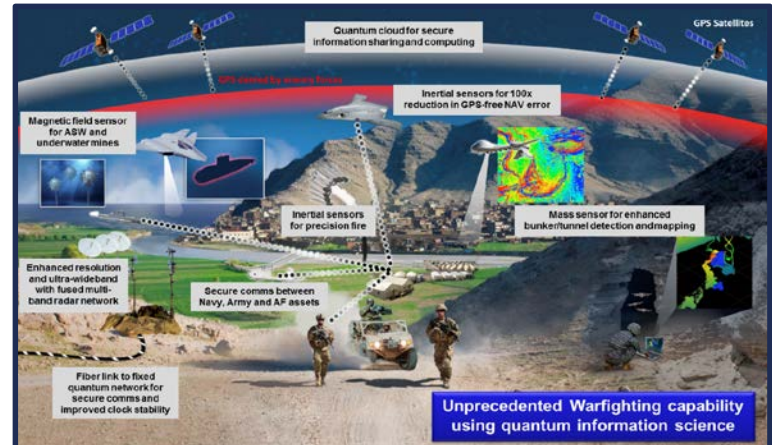
Cross-Service Research

People and Culture

- **Retain** and continue to **build** our talented R&E workforce

- **Attract** the **best** and **brightest** to **national security service and eliminate barriers** to service

- Bolster programs such as the *S*cience, *M*athematics, *A*nd *R*esearch for *T*ransformation **(SMART)** Scholarship for Service Program

- **Increase recognition** of unique and relevant technical work and **innovative thinking**

- **Leverage all** sources of **talent – internal, industry, academia**

USD(R&E) Organization…

USD(R&E) Proposed Organization

- Sets and advances technology /innovation agenda for DOD to dominate battlespace

Under Secretary of Defense (Research and Engineering)

Defense Science Board

MDA

Strategic Intel Analysis Cell

- Kill Chain Analysis (US and threat)
- Red-Teaming and Vulnerability Analysis (Technology/Concepts)
- Global Technology Tracking
- Technology Forecasting

Assistant Secretary of Defense (Research & Technology)

Assistant Secretary of Defense (Advanced Capabilities)

- Strategic Technology Objectives and Investment Strategy
- Foundational Research and Innovative Approaches for Warfighting Challenges
- Affordable & Assured Technology Development
- Global Technology Outreach and Leverage (academic/commercial/government/international)
- Laboratory Infrastructure and Workforce Policy

DASD (Research &Technology Investment)

DASD (Laboratories and Personnel)

DARPA

DASD (Mission Engineering & Integration)

DASD (Prototyping & Experimentation)

Strategic Capabilities Office (SCO)

DIUx

- Developmental Prototyping
- Experimentation / Concept Development
- Joint Enduring Operational Needs (JEON) & CCMD Support
- Developmental Planning and Mission Engineering Analysis (assured integration of capability)
- Acquisition Program Support
- Open Architecture / Cyber Security Policy & Standards
- Non-traditional Rapid Acquisition Pathways

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USD(R&E) Tenets

What has changed as we stand up the USD(R&E)?

- USD(R&E) will **operate with a Mission Focus**
  - Move from Service oversight focus to CCMD enabling focus
  - Assess capability gaps/needs by mission, vice system or Service
  - Resource integrated prototyping/experimentation activities (leveraging Service efforts) with outcomes focused on mission effectiveness
  - Engage CCMDs/operators in mission analysis/experimentation to develop new CONOPs

- USD(R&E) will **set the Technical Direction for the Department**, not just recommend

- USD(R&E) **will utilize intelligence products, technology forecasting and analysis to inform decisions** on investment, prototyping, experimentation and emerging capabilities and concepts of operation

- USD will **focus on driving effectiveness and affordability** by addressing drivers in acquisition, testing and sustainment into the system design phase – setting and adhering to open architectures and interface standards while implementing good systems engineering/cyber resiliency practices

- USD(R&E) will pilot new acquisition pathways to speed capability to the Warfighter

USD(R&E) will establish and embrace a collaborative culture focused on providing effective and affordable capability to the Warfighter

Opportunities

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Industry Support

There are opportunities for industry to provide valuable support to an array of technical and operational challenges across the Department.

- **Improve** communication, coordination, and **research and development** in **artificial intelligence, hypersonics, advanced computing, synthetic biology,** and other emerging technologies.

- **Establish** known degree of assurance that **devices, networks, and cyber-dependent functions** perform as expected, **despite attack** or error

- **Reduce size, weight, and power** across all sensor modalities while **preserving sensor capability** and sensitivity

- Provide **delivery, maneuvering, and recovery of payloads to and from space**

- **Deliver** materials, processing, and fabrication **techniques** that significantly change the **manufacturing cost curve**

The opportunities mentioned above are not an exhaustive list, but a representative sample of some areas where industry can play a key role.

DoD Innovation Marketplace

The Marketplace addresses the Department's need for increased collaboration with industrial base partners and small businesses.
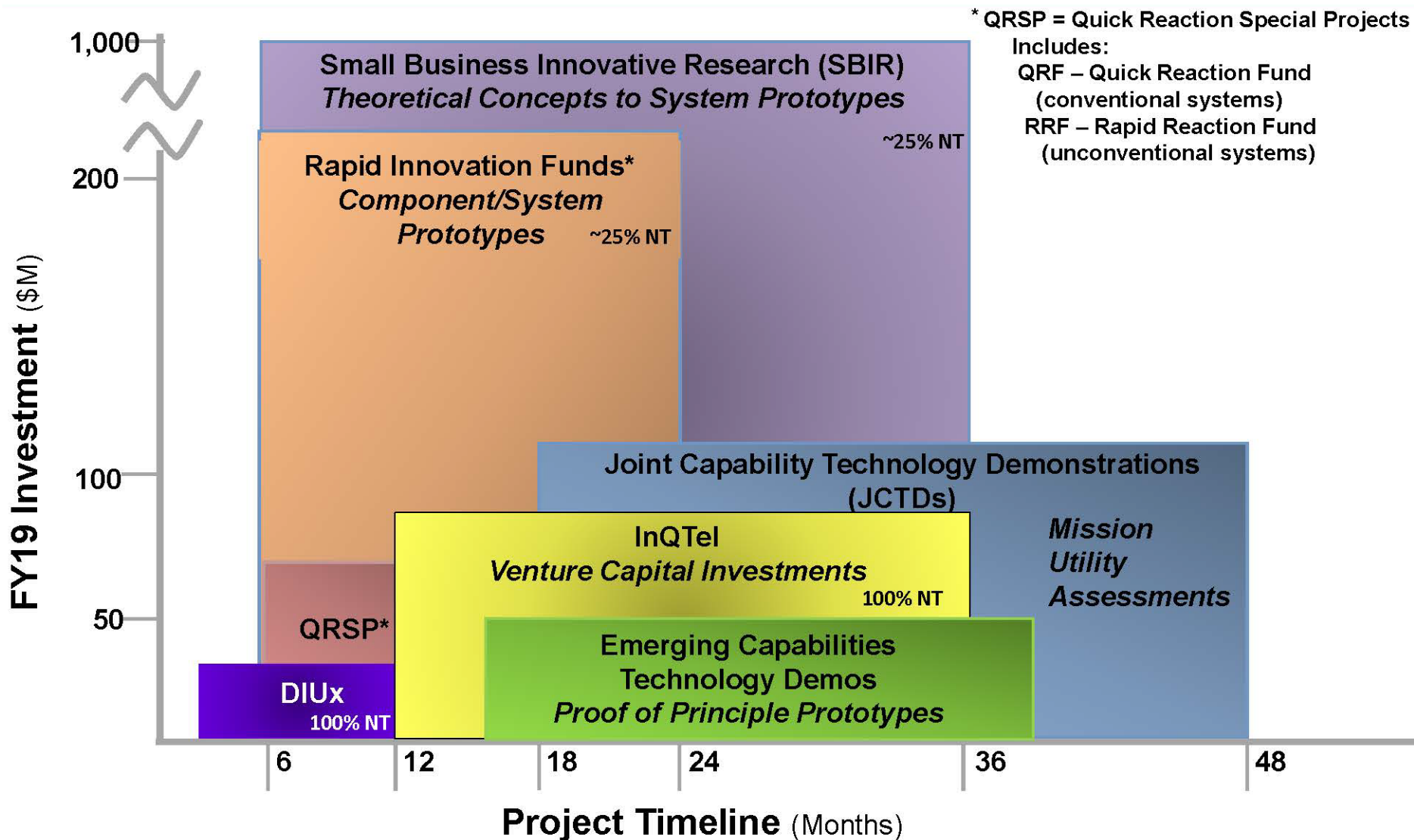
What can be found at the site?

- **New Business Opportunities**
  - Request for Information/Proposals Presolicitations
  - Broad Agency Announcements
  - Rapid Innovation Fund
- **Small Business Resources**
  - Small Business Innovation Research (SBIR)
  - Mentor-Protégé
- **Acquisition Instruments**
  - Other Transaction Authority (OTA)
  - Consortiums (e.g., STEM R&D)
- **Technology Interchange Meetings**
  - Sensors, Air Platforms, etc.

Defense Innovation Marketplace, the one-stop-shop for connecting Industry to DoD.

Non-Traditional Prototyping Outreach

FY19 Investment ($M) — vertical axis: 1,000; 200; 100; 50

Project Timeline (Months) — horizontal axis: 6, 12, 18, 24, 36, 48

* QRSP = Quick Reaction Special Projects
  Includes:
  QRF – Quick Reaction Fund
  (conventional systems)
  RRF – Rapid Reaction Fund
  (unconventional systems)

Small Business Innovative Research (SBIR)
Theoretical Concepts to System Prototypes   ~25% NT

Rapid Innovation Funds*
*Component/System
Prototypes*   ~25% NT

Joint Capability Technology Demonstrations (JCTDs)

*Mission
Utility
Assessments*

InQTel
Venture Capital Investments   100% NT

QRSP*

Emerging Capabilities
Technology Demos
Proof of Principle Prototypes

DIUx
100% NT

NT = Non-traditional

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/chieftechnologist/

Defense Innovation Marketplace
http://www.defenseinnovationmarketplace.mil

Twitter
@DoDInnovation

2018 NDIA S&T Overview

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