National Defense Industrial Association Human Systems Conference

Al Shaffer
Principal Deputy Assistant Secretary of Defense
for Research and Engineering
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Distribution Statement A: Approved for public release; distribution is unlimited

Agenda

- **Strategic Direction**
  - Technology Offset
  - Better Buying Power 3.0
  - Defense Innovation Initiative
  - Long-Range Research and Development Program Plan

- **Strategic Guidance**
  - ASD(R&E) Strategic Guidance
  - DoD R&E International Strategy
  - Reliance 21: Operating Principles

- **Communities of Interest (COI)**
  - Technology Roadmaps / Portfolio Reviews
 - Human Systems COI

- **Communications Resources**
  - Defense Innovation Marketplace
 - ASD(R&E) Communities of Interest (COI) Wiki

Key Elements of Defense Strategic Guidance

SUSTAINING U.S. GLOBAL LEADERSHIP: PRIORITIES FOR 21ST CENTURY DEFENSE

JANUARY 2012

DEFENSE BUDGET PRIORITIES AND CHOICES

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 the Asia-Pacific region.

- Build 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.
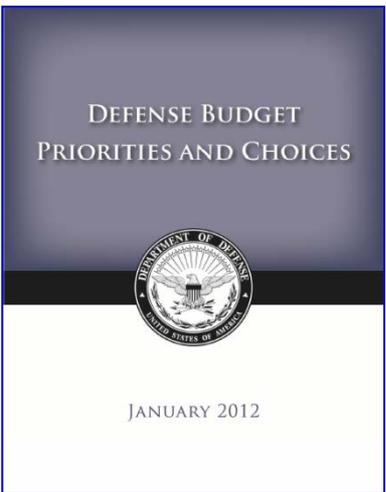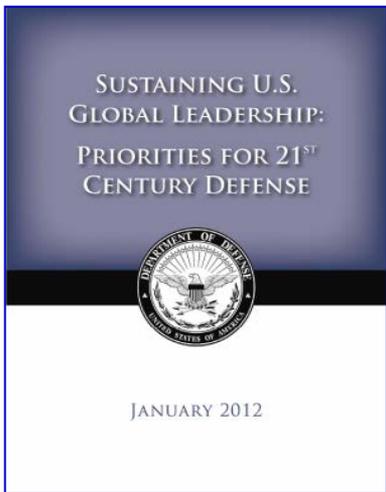
DoD at Strategic Crossroads

"The development and proliferation of more advanced military technologies by other nations means that we are *entering an era where American dominance on the seas, in the skies, and in space can no longer be taken for granted"*

Secretary Hagel
Budget Roll-Out Brief
24 Feb 2014

The strategic question is – will the force of tomorrow be:

- Larger with diminished capability or,
- Smaller with more technologically advanced capabilities

Enhanced Mutual Reliance Offsets Some of These Risks

Legend:
- 6.3 Advanced Technology Development
- 6.2 Applied Research
- 6.1 Basic Research
- DoD Topline

	FY 2014	FY 2015	FY 2016
DoD Topline	527	496	534
S&T Total	S&T $12.0B 2.3% of DoD Topline	S&T $11.5B 2.3% of DoD Topline	S&T $12.3B 2.3% of DoD Topline
6.3 Advanced Technology Development	5.2	5.0	5.5
6.2 Applied Research	4.6	4.5	4.7
6.1 Basic Research	2.2	2.0	2.1

Y-axis (left): Then Year Dollars in Billions (0–20)
Y-axis (right): 0–600

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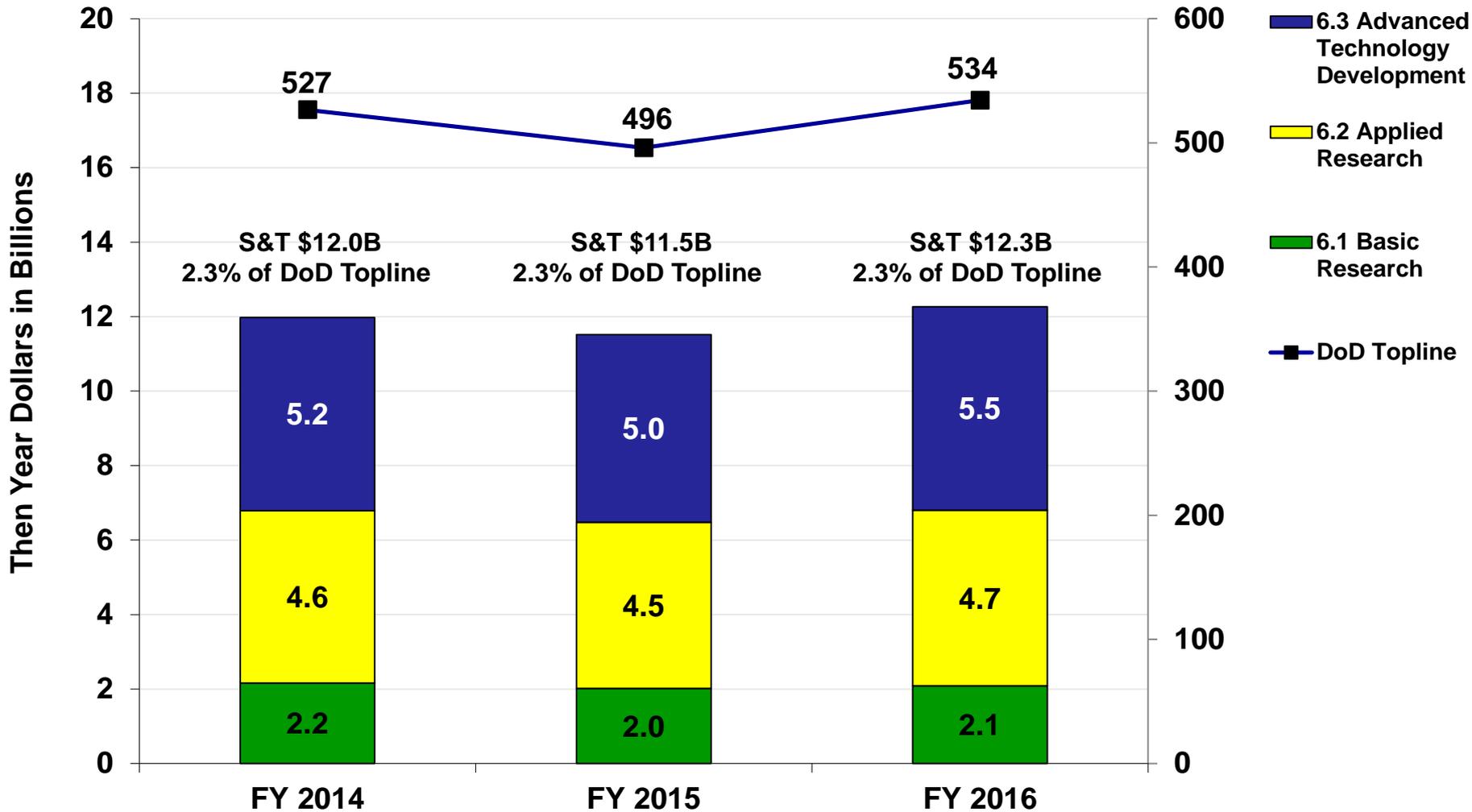
Technology Offset

- **Deputy Secretary of Defense Work Proposes *using Technology to Effect Capability Balance***

  - We now face a more uncertain strategic environment with an increasing range of threats to mitigate - others have researched our technology-based military superiority

  - We must benefit from globalization, enabling effective international collaboration, while leveraging and building on domestic advantages

  - We will need to leverage widely available commercial technology, while simultaneously creating unique advantage

Emerging Themes: Autonomy, Range, Quantity at Cost

Better Buying Power (BBP)
Continuous Improvement Process

- **USD(AT&L) Frank Kendall**

- **BBP 1.0**: Focused on **Best Practices** and Business Rules
  - Affordability, 'Should-Cost', Performance-Based Contracting

- **BBP 2.0**: Focused on **Critical Thinking**, making better business decisions
  - Supplier Incentive Programs, Open Systems Architectures and Risk Reduction

- **BBP 3.0: Continues and builds upon prior elements – and takes the focus to our Products**
  - *Innovation*
  - *Technical Excellence*
  - *Speed to Market*

BBP 1.0

BBP 2.0

BBP 3.0

http://bbp.dau.mil/
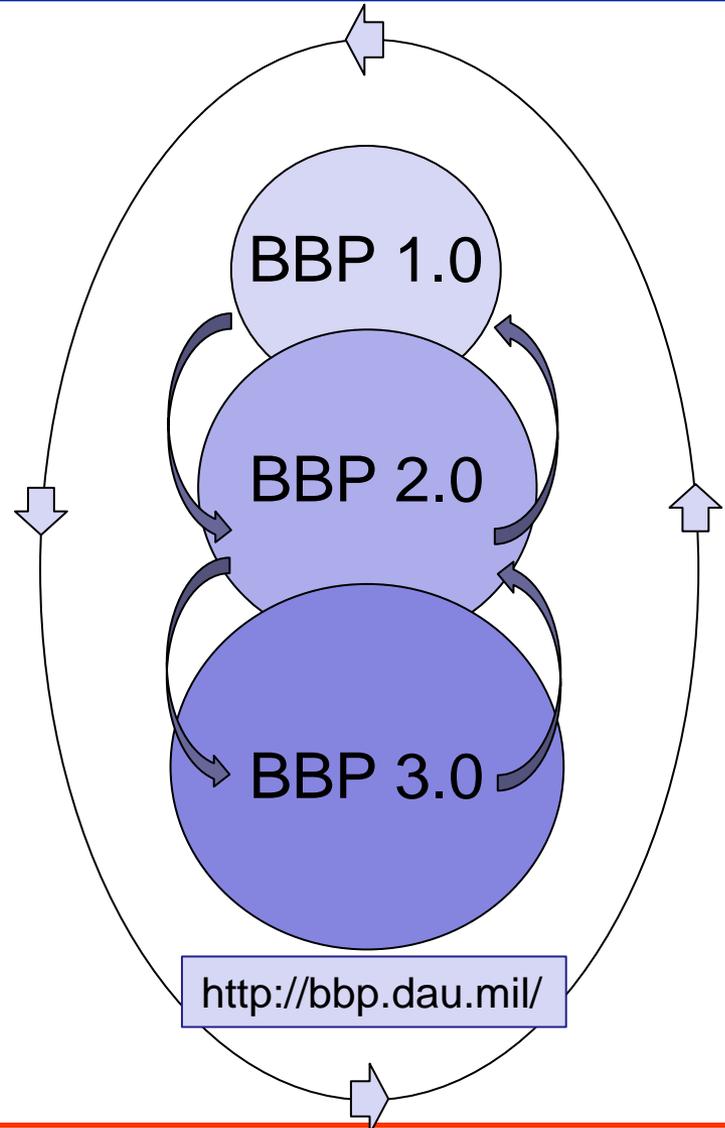
Better Buying Power 3.0

Achieve Affordable Programs
- Continue to set and enforce affordability caps

Achieve Dominant Capabilities While Controlling Lifecycle Costs
- Strengthen and expand "should cost" based cost management
- Build stronger partnerships between the acquisition, requirements, and intelligence communities
- Anticipate and plan for responsive and emerging threats
- Institutionalize stronger DoD level Long Range R&D Planning

Incentivize Productivity in Industry and Government
- Align profitability more tightly with Department goals
- Employ appropriate contract types, but increase the use of incentive type contracts
- Expand the superior supplier incentive program across DoD
- Increase effective use of Performance-Based Logistics
- Remove barriers to commercial technology utilization
- Improve the return on investment in DoD laboratories
- Increase the productivity of IR&D and CR&D

Incentivize Innovation in Industry and Government
- Increase the use of prototyping and experimentation
- Emphasize technology insertion and refresh in program planning
- Use Modular Open Systems Architecture to stimulate innovation
- Increase the return on Small Business Innovation Research (SBIR)
- Provide draft technical requirements to industry early and involve industry in funded concept definition to support requirements definition
- Provide clear "best value" definitions so industry can propose and DoD can choose wisely

Eliminate Unproductive Processes and Bureaucracy
- Emphasize AE, PEO and PM responsibility, authority, and accountability
- Reduce cycle times while ensuring sound investments
- Streamline documentation requirements and staff reviews

Promote Effective Competition
- Emphasize competition strategies and creating and maintaining competitive environments
- Improve technology search and outreach in global markets

Improve Tradecraft in Acquisition of Services
- Increase small business participation, including through more effective use of market research
- Strengthen contract management outside the normal acquisition chain – installations, etc.
- Improve requirements definition
- Improve the effectiveness and productivity of contracted engineering and technical services

Improve the Professionalism of the Total Acquisition Workforce
- Establish higher standards for key leadership positions
- Establish stronger professional qualification requirements for all acquisition specialties
- Strengthen organic engineering capabilities
- Ensure the DOD leadership for development programs is technically qualified to manage R&D activities
- Improve our leaders' ability to understand and mitigate technical risk
- Increase DoD support for STEM education

Strengthening Cost Consciousness, Professionalism, and Technical Excellence

Industry Engagement
DII and LRRDPP

- **Defense Innovation Initiative (DII):** Identify and *invest in innovative ways* to sustain and advance our national security into the 21st century.
    - *People*: Integrate leadership development with emerging opportunities and re-think how we develop mangers and leaders.

    - *Wargaming*: Reinvigorate wargaming to test alternative ways of achieving strategic objectives, and help us think more clearly about the future security environment.

    - *New Operational Concepts*: Explore how to employ resources to greater strategic effect and deal with emerging threats in more innovative ways.

    - *Business Practices*: Find ways to be more efficient and effective through external benchmarking and focused internal reviews.

    - **Long-Range Research and Development Program Plan (LRRDPP)**: Study and prioritize *new or unconventional technology* that could provide significant, national security advantages.
        - Reach out to the best and brightest minds inside and outside the DoD

        - Help us think through the technologically-enabled systems and architectures that we will want to have available post-2025.

        - **Share your Ideas** (Submission portal and more information on the Defense Innovation Marketplace)

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DoD Research and Engineering Strategic Guidance

"Our technological superiority is not assured, and in fact it is being challenged very effectively right now." — Frank Kendall, USD(AT&L) 19 Sec 2014
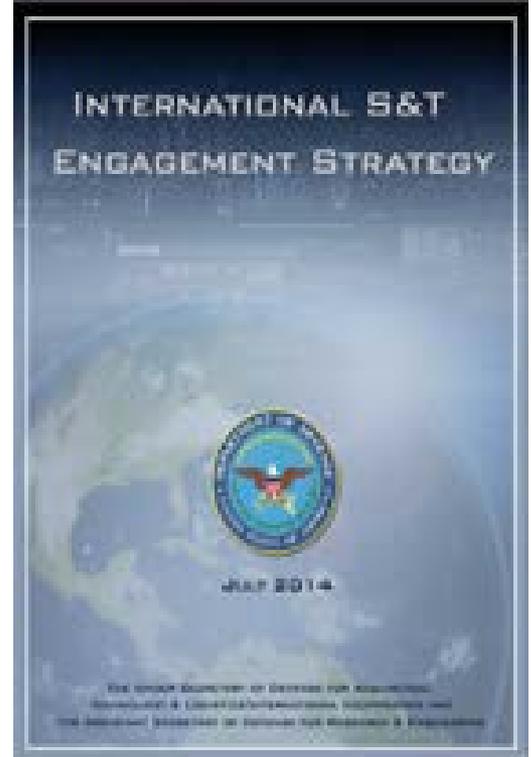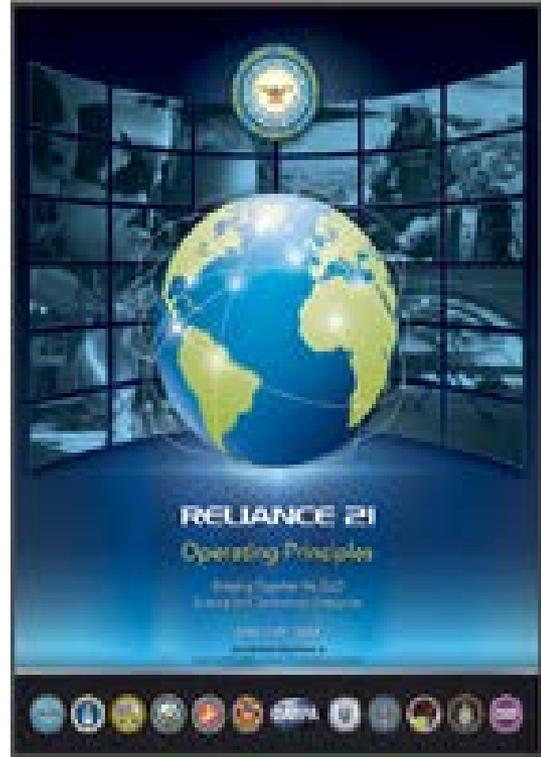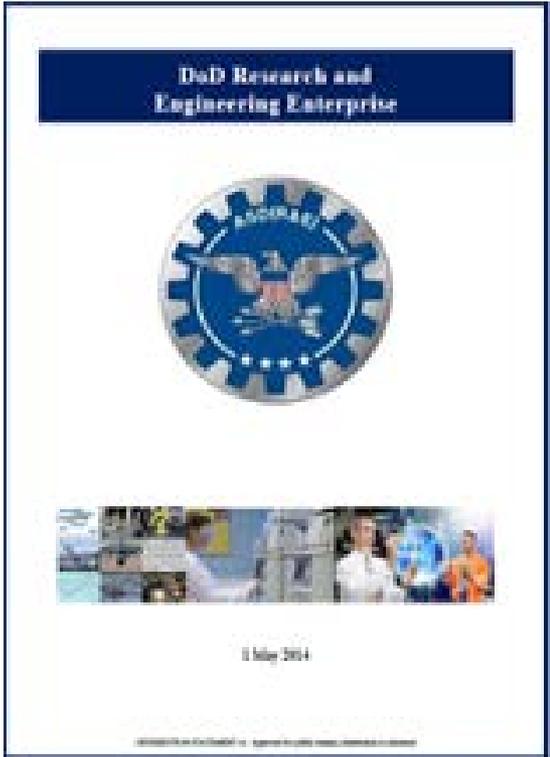
Available at www.DefenseInnovationMarketplace.mil

DoD Research & Engineering (R&E) Strategic Guidance

- **Provides strategic guidance for DoD components to shape their R&E programs**

  - Why we do R&D? "*Three Enduring Principles*":

    1. *Mitigate* or eliminate current and emerging threats to national security

    2. *Affordably* enable new or extended military capabilities

    3. Create *technology surprise* through science and engineering

  - Supports the Defense Strategic Guidance, signed January 2012, "*Sustaining U.S. Global Leadership, Priorities for 21st Century Defense*"

Available at www.defenseinnovationmarketplace.mil/resources/ASD(R&E)_Strategic_Guidance_May_2014.pdf

DoD Research & Engineering (R&E)
International S&T Engagement Strategy

- **Coordinated DoD Global S&T Engagement to:**

  - Guide DoD S&T toward enhanced, global interoperability

  - Strengthen existing and expand into new relationships and cooperation with partner nations

  - Accelerate the pace of U.S. research and development

  - Leverage emerging global opportunities

  - Mitigate the risk of global threats to improve our capabilities and those of our allies and partner nations

  - Gain economic efficiencies

- **Signed July 2014**

Available at www.defenseinnovationmarketplace.mil/resources/jp3_18.pdf

Reliance 21: Operating Principles

- **Operational Framework of the DoD S&T Joint Planning and Coordination process (Updated January 2014)**

  - Executes the DoD R&E Strategies

  - Portfolio Management infrastructure to enable:
    - Information sharing
    - Alignment of effort against capability gaps
    - Coordination of priorities and investments
    - Exploit synergies and develop new opportunities
    - Support for scientists and engineers across the DoD R&E Enterprise

  - Communities of Interest (COI)
    - 17 *cross-domain* technical areas, each with their own Steering Group Lead and multiple technical 'challenge areas' or sub-groups, staffed with Subject Matter Experts (SMEs)

    - Specific cross-cutting technology areas where there is substantial investment *across multiple Components*
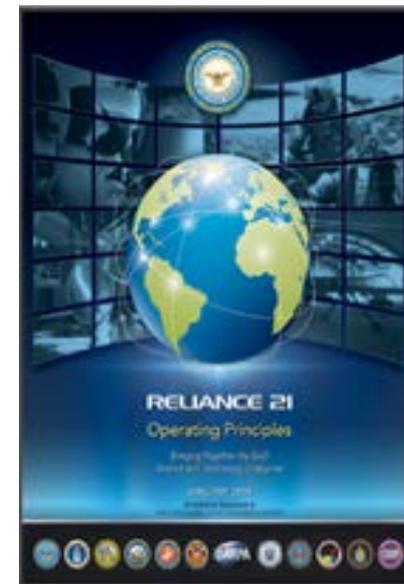
Available at www.defenseinnovationmarketplace.mil/resources/2014-Reliance21OperatingPrinciples.pdf

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DoD Engagement Strategy
Communities of Interest

Mission: **Leverage global commercial and non-commercial research and development (R&D) to ensure superior and affordable development in areas critical to defense, including but not limited to:**

Advanced Electronics	Air Platforms	Autonomy *	Biomedical (ASBREM)
Command, Control Comms, Computers, and Intelligence (C4I) *	Counter-IED	Counter-WMD *	Cyber *
Energy & Power Technologies	Engineered Resilient Systems *	Electronic Warfare / Electronic Protection *	Ground & Sea Platforms
Human Systems *	Materials & Manufacturing Processes	Sensors & Processing	Space
	Weapons Technologies		

* Denotes DoD cross-cutting S&T Priorities (Data-to Decisions is found in C4I)

Reliance 21
Technology Roadmaps

COIs Build Technology Roadmaps

| Near (FYDP) | Mid (Next FYDP) | Far (15 years +) |

- Collect, coordinate and align technical capabilities, requirements, gaps, opportunities and priorities into Investment-grade Technology Roadmaps for their respective focus area

- Motivations: What is military need / impact of meeting these technical needs?

- Goals and Metrics: What technical plans are in place and where are the gaps?

- Analysis: Where are the opportunities to leverage external investments and expertise?

- Produced every two years, used to update the COI Portfolio Reviews, and the Annual S&T Overview

  – Public versions will be posted on the *Defense Innovation Marketplace*

  – More detailed versions will be posted on *DoD Techipedia ASD(R&E) COI Wiki*

COI Leads — Senior Executive Service (10s)
- Prioritizing Gaps and Opportunities
- Articulating Military Impact

COI Technology Sub-Areas — Subject Matter Experts (100s)
- Technology Coordination
- Technology Roadmaps
- Technology Goals and Gaps

Advance Electronics Air Platforms Autonomy ASBREM C4I C-IED C-WMD Cyber Energy and Power Technologies ERS EW/EP Ground and Sea Platforms M and MP Human Systems Sensors and Processing Space Weapons Technologies (1,000s)
- Engaging Scientists and Engineers across DoD Labs

Industry Academia International Partners Global Science and Technology (10,000s)
- Leveraging Global Science and Technology Community

COI Roadmaps: An ideal framework to improve engagement with Industry; identify technical challenges

Notional Concept of the Human System

Extend & Enhance

Sustain

Repair

Functional State

Intervention
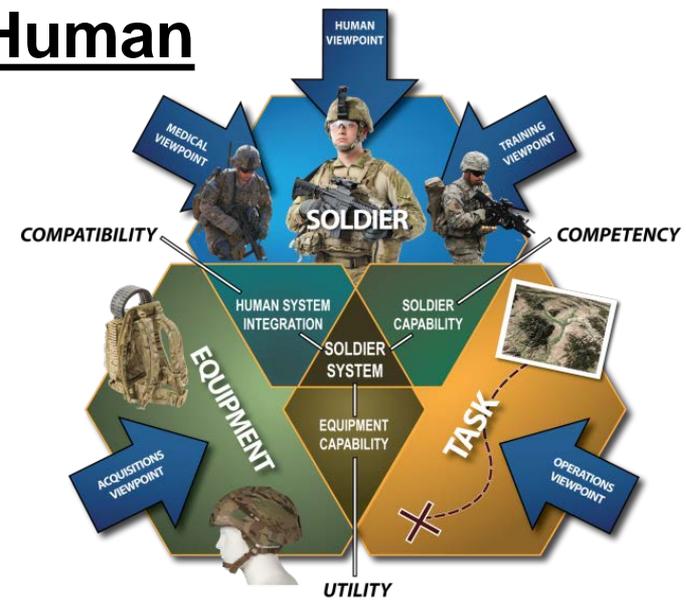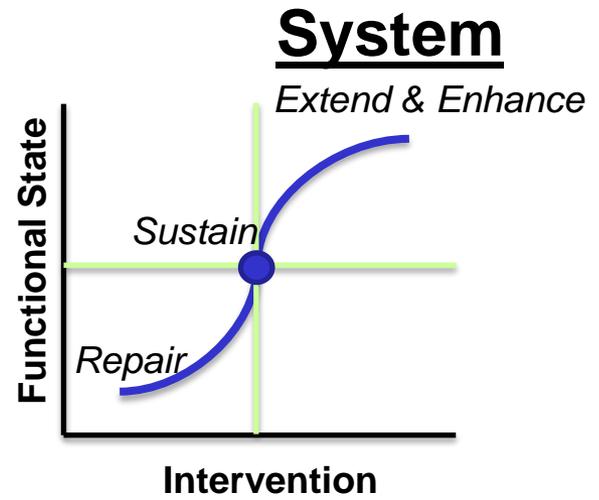
COI TAXONOMY

Personalized Assessment, Education, & Training

Systems Interfaces & Cognitive Processing

Human Aspects of Operations in Military Environments

Protection, Sustainment, & Warfighter Performance

Goals of the Human Systems COI

Enhance Mission capability by:
- Out-thinking the adversary
- Designing human-factored interfaces
- Understanding PMESII* battle space
- Optimizing body-worn equipment systems

Reduce:
- Attrition/injuries/death
- Manpower needs per system
- Fog of war
- System burden on human performance

Political, Military, Economic, Social, Infrastructure, & Information

HS COI Subareas & Scope

Personalized Assessment, Education, & Training

- *Objective:* *Provide innovative human science solutions to enhance the readiness & reduce cost*

- *Technical Challenges:* *Integrated measures & adaptive training and testing to improve individual potential assessment*

- Operational Opportunities*: Improve selection screening to reduce personnel lifecycle costs; personalized training*

System Interfaces & Cognitive Processing:

- **Objective:** *Develop natural & intuitive human-machine interaction to improve Warfighter efficiency and effectiveness*

- **Technical Challenges:** *Real-time physical, cognitive, & psychological state assessment; natural language & gestural interfaces*

- **Operational Opportunities:** *More intuitive technologies to assist Warfighters on the battlefield*

Human Aspects of Operations in Military Environ's:

- **Objective:** *Improve warfighters access to & understanding of changes in political, military, economic, social, infrastructure, & information affecting the operational environment*

- **Technical Challenges:** *interpretation / evaluation of behaviors in chaotic, culturally complex environs*

- **Operational Opportunities:** *Interaction with combatants & non-combatants in contested & adverse urban environments*

Protection, Sustainment, & Warfighter Performance:

- **Objective:** *Support a safer & more agile force on the battlefield*

- **Technical Challenges:** *Collecting relevant performance data and metrics in operational environments*

- **Operational Opportunities:** *Optimizing individual warfighter cognitive & physical performance*

COI Investment Profile
DoD PB15 FY 2015

COI Sub Areas ($M)

Total = $450M
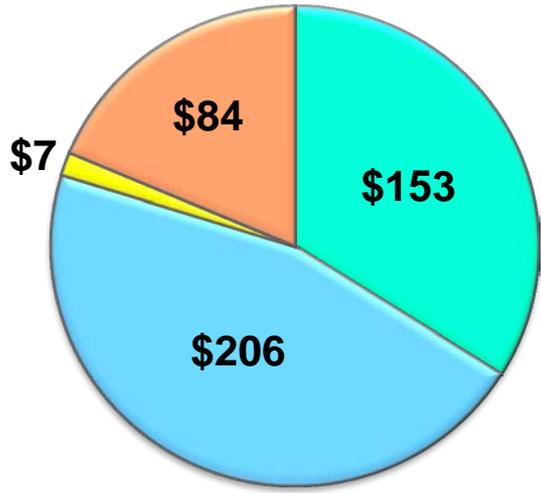
- **Personalized Assessment, Education, & Training** — $153
- **Protection, Sustainment & Warfighter Performance** — $206
- **Human Aspects of Operations in Military Environments** — $7
- **System Interfaces & Cognitive Processing** — $84

Component Investment

- Air Force — 21%
- Army — 49%
- Navy — 12%
- DARPA — 6%
- Other Components — 12%

Budget Activity

- BA 3 — 44%
- BA 2 — 56%
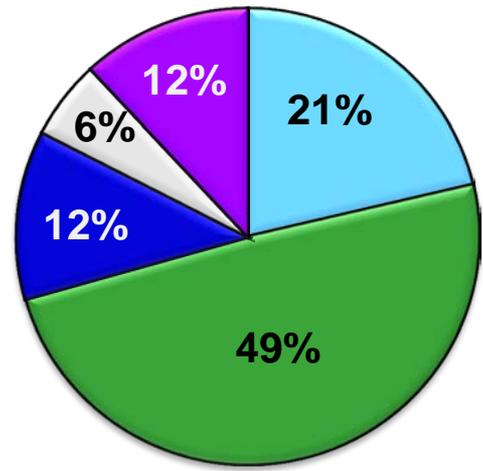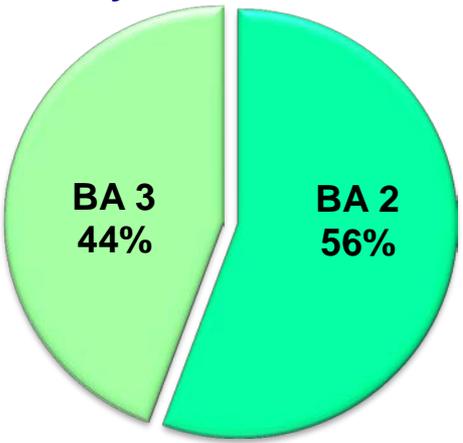
Industry Collaboration

- **IR&D Technology Interchange (2013)**
  - All 19 companies provided follow-on opportunities
    - Meetings, site visits, data exchanges
    - Working Cooperative R&D Agreements (CRADAs) & Memorandum of Agreement (MOA)
    - Supported by the Defense Innovation Marketplace
- **NDIA HS Conference (Feb 2015):** *Maintaining our Physical Edge, Enabling our Cognitive Edge*
  - NDIA HS Division & Conference structured around COI sub areas
  - 2014 Conference: 108 attendees
    - Informed topics for 2015 Conference

Converge Multiple Domains
Focus on one outcome: natural human-technology interactions

HUMAN

MACHINE

Computational Modeling
Simulate human information processing

Context Inference
Reason about a situation

Neuroscience
Brain's operating principles

Knowledge Systems
Store/search for information

Evolutionary Biology / Social Psychology
Cognitive & Behavioral operating principles

Computer Vision
Lays groundwork for reasoning about a situation

Designing Technology to Optimize Human Potential
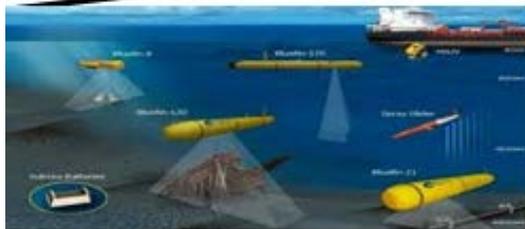
Today, Human–Technology Interactions use interfaces that:

- Do not support bi-directional communication
- Do not learn with experience
- Require specialized operator selection and training

S&T is needed to augment natural human capacities for Data Volumes, Processing, and Decision Speeds

- *Easy to use*
- *Limited functionality*

- *Hard to use*
- *Ample functionality*

Augmented Cognition

- **Research and develop technologies capable of extending – without overloading - the information management capacity of 21st century warfighters**

  - Allow complex information to be absorbed and analyzed in high volume and density

  - Accelerate novel concepts in human-systems integration – address cognitive bottlenecks in real-time, such as:

    - Attention

    - Memory

    - Learning

    - Comprehension

    - Decision Making

  - Employ behavioral, psychophysiological and / or neurophysiological data

    - Adapt or augment to significantly improve performance

  - Benefits to all current and future warfighter systems

Current HS COI Interactions

Collaborations

Advanced Electronics	Air Platforms	Autonomy	Biomedical (ASBREM)
Counter-IED	Counter-WMD	Cyber Security	Electronic Warfare / Electronic Protection
Energy & Power Technology	Engineered Resilient Systems	Ground & Sea Platforms	Human Systems
Command, Control, Comms, Computers, & Intelligence (C4I)	Materials & Manufacturing Processes	Sensors & Processing	Space
Weapons Technologies			

Intend to collaborate with all COIs since all technologies support the Warfighter in accomplishing their missions

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DoD-Industry Engagement
The Marketplace: Your DoD S&T/R&D Resource

Defense Innovation Marketplace website is *__the__* **communication resource** between DoD S&T/R&D and Industry/Academia, hosting:

- **DoD R&E Strategic Guidance**

- **Long-Range Research and Development Program Plan**

- **Virtual Technology Interchanges**

  - *Human Systems COI Virtual Technology Interchange – June 2015*

- **Independent Research & Development (IR&D) Secure Portal**

Are YOU using the Marketplace and the IR&D portal?

The Marketplace:
Industry Engagement – DII and LRRDPP

- **Defense Innovation Initiative (DII)**
  - Identify and invest in innovative ways to sustain and advance our national security into the 21st century.
  - People
  - Wargaming
  - New Operational Concepts
  - Business Practices
  - LRRDPP

- **Long-Range Research and Development Program Plan (LRRDPP)**:
  - Study and prioritize new or unconventional technology that could provide significant, national security advantages.

  - *Share your Ideas* (*Link*)

www.DefenseInnovationMarketplace.mil/LRRDPP.html

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COI Industry Engagement Strategy

- <u>Virtual Technology Interchanges</u> hosted on the Marketplace

  - Air Force (AFRL) has hosted, since 2013, six Virtual Technology Interchanges using the Marketplace to discuss industry IR&D efforts in Aeronautics, Autonomy, C4ISR, Human Systems (joint effort with the HS COI), Nuclear and Space.

    - Specific technology challenges are outlined and posted to the Marketplace

    - Industry is invited to provide their potential IR&D solutions through the Secure Portal

    - Submissions are reviewed by DoD (COI) subject matter experts.

    - Select projects/companies are then invited to attend a more detailed face-to-face (or Virtual) meeting.

  - Due to the efficiency of these Technology Interchanges

    - Face-to-face dialogues on the technology needs and potentially viable solutions are improved

    - New relationships and partnering opportunities have developed

COIs will be identifying their priority technology challenges and using Virtual Technology Interchanges to work them with industry

Virtual Technology Interchanges:
Specific Technology Challenges for Industry Engagement

Joint Service/Industry Human Systems COI
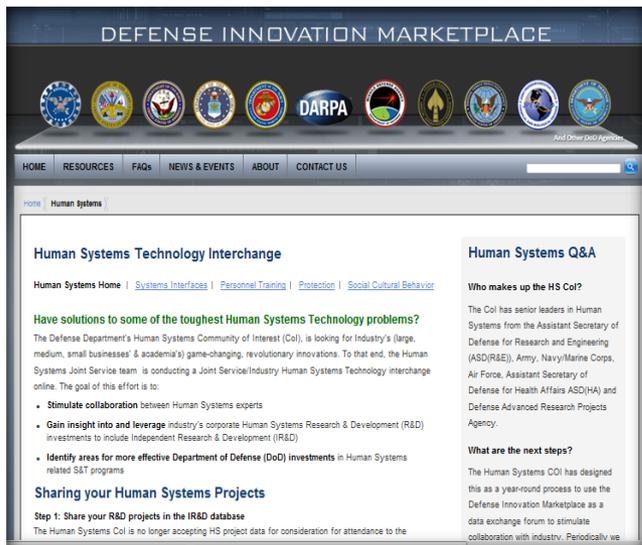
defenseinnovationmarketplace.mil/humansystems.html

Selection of Projects

Response:
- 44 Companies submitted 206 Projects online

Selection:
- 19 companies selected to brief 43 projects

Secure Video Teleconference was used when Gov't could not attend

Results/Value

- Good "discovery" mix
- Targeted discussions with industry leaders vs. long briefings
- - - - - - - - - - - - - - - -
- 6 CRADAs/ partnerships underway
- Proposals in discussion

2015 HS Tech Interchange

Timeline:

Online Materials | COI Project Selection | 2013 Tech Interchange | Online Materials | | 2015 HS Tech Interchange

Nov 12 — **May 13** — **24-28 Jun 13** — **Jan 15** — **May 15** — **June 15**

29

The Marketplace:
Industry Engagement – Virtual Technology Interchanges

- **For Industry**:
  - Human Systems Virtual Technology Interchange – June 2015

  - Webpage soon to be posted on Marketplace

  - Responses will be submitted through the IR&D Secure Portal;

  - Efforts already in the Portal can be identified to Host for review with no further action required.

- **For DoD**
  - All responses are in same format, accessible to all Subject Matter Experts to review.

  - Most relevant efforts selected for more detailed, in-person review; more effective and efficient process.

DoD-Industry Engagement IR&D Secure Portal

- ## Defense Innovation Marketplace Website

  - Industry uses the IR&D Secure Portal to submit project summaries of their efforts

  - To date, more than 18,000 project summaries have been submitted, by more than 100 companies

  - Access to these summaries is restricted to:

    - *Registered and approved DoD government employees and military personnel* with R&E/S&T or acquisition responsibilities (No contractor access)

 - Request access at http://www.defenseinnovationmarketplace.mil/government.html

www.DefenseInnovationMarketplace.mil

R&E Gateway Resources
ASD(R&E) COI Wiki

COI Collaboration Wiki – Accessible to all DoD Civilian and Military (CAC Required) – DoD Contractors can access with approval of Government Sponsor

https://www.dodtechipedia.mil/dodc/pages/viewpage.action?pageId=11797462

ASD(R&E)

DoD Research and Engineering Enterprise:
http://www.acq.osd.mil/chieftechnologist/

Defense Innovation Marketplace

www.DefenseInnovationMarketplace.mil

Twitter: @DoDInnovation