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12th Annual Science & Engineering Technology Conference / DoD TECH Exposition

"Linking the DoD S&T Program to Key Mission Areas"

NORTH CHARLESTON, SC

21 – 23 June 2011

Agenda

TUESDAY, JUNE 21, 2011

Keynote Address
- The Honorable Zachary J. Lemnios, Assistant Secretary of Defense for Research & Engineering

FY 2012 President's Budget Request for DoD S&T Program
- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

DoD Basic Research Program with a Focus on Academia
- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

Rapid Fielding Directorate's Portfolio of Opportunities
- Mr. Earl Wyatt, Deputy Assistant Secretary of Defense, Rapid Fielding, OASD(R&E)

The DoD T&E/S&T Program
- Mr. George Rumford, T&E/S&T Program Manager, Defense Test Resource Management Center

Process Used to Develop the DoD Science & Technology Priorities
- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

Data to Decisions
- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

Autonomy
- Dr. Bobby Junker, Head, C4ISR Department, Office of Naval Research

Human Systems
- Dr. John F. Tangney, Director, Human & Bioengineered Systems Division, Office of Naval Research

Engineered Resilient Systems
- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

WEDNESDAY, JUNE 22, 2011

Providing Technology Enabled Capabilities
- Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)

Overview of Naval Science, Technology, and Engineering

- Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

Discussion on Navy and Marine Corps Technology Needs
Moderator: Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

- Mr. Michael Bosworth, Acting Chief Technology Officer, Naval Sea Systems Command
- Ms. Rebecca Ahne, Deputy Chief Technology Officer, Naval Aviation Enterprise
- Mr. James H. Smerchansky, Deputy Commander Systems Engineering, Interoperability, Architectures, & Technology, Marine Corps Systems Command

Overview of Air Force Science, Technology, and Engineering

- Colonel Mark Koch, USAF, Associate Deputy Assistant Secretary of the Air Force (Science, Technology & Engineering)

High Velocity Penetrating Weapon (HVPW)

- Mr. Leo Rose, U.S. Air Force Research Laboratory/RW, Program Manager

Responsive Reusable Booster for Space Access

- Mr. Bruce Thieman, Air Vehicles Directorate, U.S. Air Force Research Laboratory

Precision Airdrop

- Dr. Keith Bowman, Air Vehicles Directorate, U.S. Air Force Research Laboratory

THURSDAY, JUNE 23, 2011

How Capabilities are Developed and Delivered to the Combatant Commanders

- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

USCENTCOM

- Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM

USSOCOM

- Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM

USPACOM

- Mr. Ken Bruner, Science Advisor, USPACOM

USSOUTHCOM

- Mr. Ricky Stuart, Technology Manager, USSOUTHCOM

USTRANSCOM

- Mr. Lou Bernstein, Chief, Future Capabilities & Technology, USTRANSCOM

USSTRATCOM

- Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM

USNORTHCOM

- Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM

USEUCOM

- Mr. Stephen L. Spehn, Deputy Science Advisor, USEUCOM

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12TH ANNUAL SCIENCE & ENGINEERING TECHNOLOGY CONFERENCE / DoD TECH EXPOSITION

Linking the DoD S&T Program to the DoD S&T Priorities

CONFERENCE AGENDA

EXHIBITOR PROFILES

ATTENDEE ROSTER

DoD Technology Exposition

Event #1720
June 21 – 23, 2011
Charleston Convention Center ▶ North Charleston, SC

LOCATION

Charleston Convention Center
5055 International Boulevard
North Charleston, SC 29418

ATTIRE

Appropriate dress for the conference is business coat & tie for civilians and Class A uniform or uniform of the day for military personnel.

ID BADGES

During conference registration, each Attendee will be issued an identification badge. Please be prepared to present a valid picture ID. Badges must be worn at all conference functions.

CLASSIFIED SESSION

Registered NDIA S&ET Conference Attendees are invited by OASD(R&E) and SPAWAR to attend a Classified Session held off-site. Classified Session Attendees must hold a Secret Level Clearance Classification and must have submitted and verified their clearance acceptance with the SPAWAR security office by Friday, June 10, 2011.

PROCEEDINGS

Proceedings will be available on the web through the Defense Technical Information Center (DTIC) two weeks after the conference. All registered Attendees will receive an email notification once the proceedings are available.

ADVERTISING

Advertise in *National Defense* magazine and increase your organization's exposure. *National Defense* will be distributed to Attendees of this event, as well as other NDIA events. For more information, contact Dino Pignotti, NDIA, at (703) 247-2541 or dpignotti@ndia.org.

CONTACTS

Ms. Mary Anna Christiansen
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(703) 247-2596 or mchristiansen@ndia.org

Ms. Alden Davidson, CEM
Associate Director of Exhibits, NDIA
(703) 247-2582 or adavidson@ndia.org

INTRODUCTION

12TH Annual
S&ET Conference / DoD Tech Exposition
June 21 - 23, 2011
Charleston Convention Center
North Charleston, SC
Linking the DoD S&T Program to the DoD S&T Priorities

The 12th Annual S&ET Conference / DoD Tech Exposition will occur on June 21 - 23, 2011, at the Charleston Convention Center, North Charleston, SC. This year's conference is dedicated to the memory of Dr. A. Louis Medin, the founding Chairman of the NDIA S&ET Division.

The 2010 Quadrennial Defense Review (QDR) identified the need for the DoD to "rebalance its policy, doctrine, and capabilities to better support 6 key missions." Success in the QDR's key mission areas is dependent on the development, integration, and timely deployment of critical core capabilities. These capabilities must align to the dynamic threat environment, evolving mission architectures, and are enabled by critical investments in science and technology.

The ASD(R&E), with the support of the Services, Agencies and Joint Staff, led studies to identify the core capabilities and enabling technologies for each of the six QDR key mission areas. These studies were completed and identified near and long-term technology investments that will be required to contribute to success in these mission areas. The DoD Science & Technology (S&T) Executive Committee considered the results of these studies, along with Service S&T priorities, and the recommendations of DoD S&T Communities of Interest and DoD Technology Focus Teams, to develop a list of 7 DoD S&T Priorities. These 7 DoD S&T Priorities were documented in a memorandum signed by the Secretary of Defense on April 19, 2011. In this memorandum, the Secretary directed that implementation roadmaps be developed for each S&T Priority to coordinate the Department's "investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities."

Speakers from the DoD will present background information, a status update, and the technology challenges associated with each of the 7 S&T Priorities, plus technology investments the Services are making to achieve success in each of the 7 S&T Priority areas. Briefers will highlight opportunities for industry collaboration with Services and Agencies and identify technology areas in which industry may want to consider making independent (IR&D) investments. Speakers will be available in the "Speakers Corner" after each session. The conference will again, this year feature poster paper sessions with authors available for discussion and interaction on emerging concepts and technology. There will also be opportunities for industry and academia to present ideas to Service representatives in One-On-One Sessions. Sign-up sheets will be available at the Conference Registration Desk. The DoD Speakers will also be available to discuss new business opportunities.

S&ET Division Chair:
Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications

S&ET Division Vice Chair:
Dr. Jocelyn Seng, Research Staff, Institute for Defense Analyses, (Brigadier General, USAFR)

S&ET Division Secretary:
Mr. Michael Liggett, Director Technology Programs, Raytheon Company

S&ET Conference Co-Chairs:

- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
- Dr. Preston W. "Chip" Grounds, Director Electronics, Sensors, & Networks Research Division, Office of Naval Research
- Mr. Chris Miller, Executive Director SES, SPAWAR

CONFERENCE AGENDA

TUESDAY, JUNE 21, 2011

7:00 AM – 6:30 PM
Conference Registration
Ballroom A & B Foyer

7:00 AM – 8:00 AM
Continental Breakfast
Ballroom A & B Foyer

8:00 AM – 8:15 AM
Welcome Remarks
General Session - Ballroom A & B
▶ Major General Barry D. Bates, USA (Ret), Vice President of Operations, National Defense Industrial Association
▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair

8:15 AM – 9:15 AM
Keynote Address
General Session - Ballroom A & B
The Honorable Zachary J. Lemnios, Assistant Secretary of Defense for Research & Engineering

9:15 AM – 12:15 PM
FY 2012 President's Budget Request and Opportunities for Collaboration Session
General Session - Ballroom A & B
In this session, we will present the Fiscal Year 2012 President's Budget Request for the DoD S&T program. Specific programs that provide conference Attendees opportunities to engage in collaborative efforts with the DoD S&T community will also be highlighted. Presentations will provide information on technology areas of high interest to the DoD, time lines, and points of contact for the submission of proposals. Opportunities for both industry and academia will be covered. A wide range of programs, from the larger technology demonstrations funded by the Joint Capability Technology Demonstration program, that lead to the evaluation of military utility of advanced technology by a Combatant Commander; to the more focused technology development efforts that are funded by the Test & Evaluation/Science & Technology (T&E/S&T) program will be covered. Opportunities for proposing commercial off-the-shelf technology to meet current military needs will be addressed by "The Rapid Fielding Directorate's Portfolio of Opportunities" presentation. The session will be rounded out with brief presentations by poster paper Authors, highlighting the topics of poster papers that will be on display.
Co-Chairs:
▶ Dr. Raj K. Aggarwal, Managing Director, Advanced Research & Technology, College of Engineering, Iowa State University
▶ Mr. Michael Liggett, Director Technology Programs, Raytheon Corporation

ONE-ON-ONE SESSIONS

There will be the opportunity to meet with a USA, USN or USAF Representative in One-On-One Sessions. You may sign-up for your private, 15 minute One-On-One Session on-site at the Conference Registration Desk. Reservations will be on a first-come, first-served basis, and will be limited to one session with each Service.

ONE-ON-ONE REPRESENTATIVES

Army:
▶ Mr. Thomas Haduch, Chief, Cross Command Integration, Programs & Engineering U.S. Army Research, Development and Engineering Command
▶ Ms. Lucy Priddy, Engineer Research & Deveoplpment Center, CoE
▶ Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the U.S. Army Research & Technology
Navy:
▶ Mr. Craig Hughes, Deputy Director of Innovation, Office of Naval Research
▶ Dr. Joseph Lawrence, Director of Transition, Office of Naval Research
▶ Dr. Kam Ng, Deputy Director of Research, Office of Naval Research
▶ Mr. Bob Smith, Director, Technology Transition Initiatives, Office of Naval Research
▶ Mr. Eric Wilson, Deputy Director of Transition, Office of Naval Research
Air Force:
▶ Mr. Chris Clay, Deputy Division Chief, Science and Technology Division, Office of the Deputy Assistant Secretary of the U.S. Air Force for Science, Technology, and Engineering

SPEAKER DONATION

In lieu of Speaker Gifts, a donation has been made to the Wounded Warrior Project. For additional information, please visit:
www.woundedwarriorproject.org

SURVEY

A survey will be e-mailed to you after the event. NDIA would appreciate your time in completing the survey to help make our event even more successful in the future.

TUESDAY, JUNE 21, 2011

9:15 AM – 9:45 AM	**FY 2012 President's Budget Request for DoD S&T Program** Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
9:45 AM – 10:15 AM	**Networking Break** *Exhibit Hall - Exhibition Hall A*
10:15 AM – 10:45 AM	**DoD Basic Research Program with a Focus on Academia** Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
10:45 AM – 11:15 AM	**Rapid Fielding Directorate's Portfolio of Opportunities** Mr. Earl Wyatt, Deputy Assistant Secretary of Defense, Rapid Fielding, OASD(R&E)
11:15 AM – 11:45 AM	**The DoD T&E/S&T Program** Mr. George Rumford, T&E/S&T Program Manager, Defense Test Resource Management Center
11:45 AM – 12:15 PM	**Poster Paper Author Presentations** *General Session - Ballroom A & B*
12:15 PM – 1:15 PM	**Networking Buffet Lunch** *Exhibit Hall - Exhibition Hall A*
1:15 PM – 2:15 PM	**DARPA Session** *General Session - Ballroom A & B* **Chair:** Dr. Kenneth Potocki, former Program Manager, Johns Hopkins University, Applied Physics Laboratory **DARPA Science & Technology Program** Dr. Kaigham (Ken) J. Gabriel, Deputy Director, Defense Advanced Research Projects Agency
2:15 PM – 5:00 PM	**DoD Science & Technology Priorities Session** *General Session - Ballroom A & B* The ASD(R&E), with the support of the Services, Agencies and Joint Staff, led studies to identify the core capabilities and enabling technologies for each of the 6 QDR key mission areas. These studies were completed and identified near and long-term technology investments that will be required to contribute to success in these mission areas. The DoD Science & Technology (S&T) Executive Committee considered the results of these studies, along with Service S&T priorities, and the recommendations of DoD S&T Communities of Interest and DoD Technology Focus Teams, to develop a list of 7 DoD S&T Priorities. These 7 DoD S&T Priorities were documented in a memorandum signed by the Secretary of Defense on April 19, 2011. In this memorandum, the Secretary directed that implementation roadmaps be developed for each S&T Priority to coordinate the Department's investments in these priority areas. In this session, team leaders responsible for developing the implementation roadmaps will provide an update on the background, status, and the identification of the technology challenges associated with 4 of the 7 DoD S&T Priorities. The remaining 3 DoD S&T Priorities (Cyber Science and Technology, Counter Weapons of Mass Destruction, and Electronic Warfare/Electronic Protection) will be presented in the Classified Session on Thursday afternoon. **Co-Chairs:** ▶ Dr. Jim Wasson, Vice President, Business Development, Bennett Aerospace ▶ Dr. Al Emondi, Deputy Chief Technology Officer, SPAWAR, Atlantic
2:15 PM – 2:30 PM	**Process Used to Develop the DoD Science & Technology Priorities** Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

CONFERENCE AGENDA

TUESDAY, JUNE 21, 2011

2:30 PM – 2:45 PM	**A Message to Industry** Ms. Matice Wright, Principal Director, Manufacturing and Industrial Base Policy, OUSD(AT&L)
2:45 PM – 3:15 PM	**Data to Decisions** Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
3:15 PM – 3:45 PM	**Networking Break** *Exhibit Hall - Exhibition Hall A*
3:45 PM – 4:15 PM	**Autonomy** Dr. Bobby Junker, Head, C4ISR Department, Office of Naval Research
4:15 PM – 4:45 PM	**Human Systems** Dr. John F. Tangney, Director, Human & Bioengineered Systems Division, Office of Naval Research
4:45 PM – 5:15 PM	**Engineered Resilient Systems** Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
5:15 PM – 6:30 PM	**Networking Reception (Hosted Wine and Beer)** *Exhibit Hall - Exhibition Hall A*

WEDNESDAY, JUNE 22, 2011

7:00 AM – 5:00 PM	**Conference Registration** *Ballroom A & B Foyer*
7:00 AM – 7:55 AM	**Continental Breakfast** *Ballroom A & B Foyer*
7:55 AM – 8:00 AM	**Opening Remarks** *General Session - Ballroom A & B* Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair
8:00 AM – 5:00PM	**Services Sessions** *General Session - Ballroom A & B* The Military Departments play a major role in the planning and execution of the DoD S&T program. The Services provide the stable long-term part of the program, focused on their Services' responsibilities. The Service S&T communities are also constantly looking for opportunities to achieve revolutionary breakthroughs; however, they must also maintain a range of core competencies while also supporting the acquisition and logistics systems that produce and maintain military equipment. Each Service has a vision of future capabilities required to support the core competencies they are uniquely responsible for maintaining. In this session, Army, Navy, and Air Force Representatives will provide overviews of their S&T programs. They will also present on priority S&T programs in their portfolios that provide enabling technologies for core capabilities and support the DoD S&T Priorities.
8:00 AM – 10:00 AM	**Army Science & Technology Program Session** **Co-Chairs:** ▶ Dr. Walter F. (Rick) Morrison, Principal, Booz Allen Hamilton ▶ Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)
8:00 AM – 9:00 AM	**Providing Technology Enabled Capabilities** Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)

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CONFERENCE AGENDA

MRAP INTEGRATION FACILITY TOUR*

During the conference, there will be an optional MRAP Integration Facility Tour. The tour will take place on Wednesday, June 22 from 10:00 AM until 12:00 PM. The tour will walk through the MRAP Integration Facility with storyboards describing their processes and success stories. There are 50 vehicles in the facility for integration of electronic systems. To attend the tour, one must have already submitted a visit request. If you submitted a visit request for the Classified Session, you do not need to send another visit request. Tour attendance will be awarded on a first-come, first-served basis. To sign-up, please see the Conference Registration Desk.

- The Tour is limited to the first 50 Attendees who sign-up at the Conference Registration Desk
- Prior submittal of visit request required to participate
- Transportation will be provided

WEDNESDAY, JUNE 22, 2011

10:00 AM
Depart Charleston Convention Center; En route to MRAP Integration Facility

10:30 AM
MRAP Integration Facility Tour

11:30 AM
Depart MRAP Integration Facility; En route to Charleston Convention Center

QUESTIONS

Please contact Mr. James Polk at: james.polk@navy.mil or (843)218-5699 with questions or concerns regarding the MRAP Integration Facility Tour.

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WEDNESDAY, JUNE 22, 2011

9:00 AM – 9:45 AM

Providing Soldiers Strategic Technology Enablers
Dr. David Pittman, Director of the Geotechnical and Structures Laboratory, U.S. Army Engineer Research & Development Center, U.S. Army Corps of Engineers

9:45 AM – 10:00 AM

Question and Answer Session
Moderator: Dr. Walter F. (Rick) Morrison, Principal, Booz Allen Hamilton
- Dr. Marilyn M. Freeman, Deputy Assistant Secretary of the Army (Research & Technology)
- Dr. David Pittman, Director of the Geotechnical and Structures Laboratory, U.S. Army Engineer Research & Development Center, U.S. Army Corps of Engineers

10:00 AM – 12:00 PM
(*Optional MRAP Tour*)

MRAP Integration Facility Tour*
Off-site Location (See left column for details)

10:00 AM – 10:30 AM

Networking Break
Exhibit Hall - Exhibition Hall A

10:30 AM – 12:30 PM

The Naval Science & Technology Program Session
General Session - Ballroom A & B
Co-Chairs:
- Mr. Dennis L. Ryan, III, Science & Technology Planning Director, Johns Hopkins University, Applied Physics Laboratory
- Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research
- Mr. E. Terrence Dailey, Director for Transition, Carnegie Mellon University, Software Engineering Institute

10:30 AM – 11:15 AM

Overview of Naval Science, Technology, and Engineering
Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Researc

11:15 AM – 12:30 PM

Discussion on Navy and Marine Corps Technology Needs
Moderator: Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research
- Mr. Rob Wolborsky, Chief Technology Officer (CTO), SPAWAR
- Mr. Michael Bosworth, Acting Chief Technology Officer, Naval Sea Systems Command
- Ms. Rebecca Ahne, Deputy Chief Technology Officer, Naval Aviation Enterprise
- Mr. James H. Smerchansky, Deputy Commander Systems Engineering, Interoperability, Architectures, & Technology, Marine Corps Systems Command

12:30 PM – 1:30 PM

Networking Buffet Lunch
Exhibit Hall - Exhibition Hall A

CONFERENCE AGENDA

WEDNESDAY, JUNE 22, 2011

1:30 PM – 5:00 PM	**Air Force Science & Technology Program Session** *General Session - Ballroom A & B* **Co-Chairs:** ▶ Mr. Michael C. Dudzik, Vice President, Science & Technology, Lockheed Martin ▶ Mr. Chris Clay, Deputy Division Chief, Science & Technology Division, Office of the Deputy Assistant Secretary of the U.S. Air Force for Science, Technology, and Engineering
1:30 PM – 2:15 PM	**Overview of Air Force Science, Technology, and Engineering** Colonel Mark Koch, USAF, Associate Deputy Assistant Secretary of the Air Force (Science, Technology & Engineering)
2:15 PM – 2:45 PM	**High Velocity Penetrating Weapon (HVPW)** Mr. Ron Taylor, Munitions Directorate, U.S. Air Force Research Laboratory
2:45 PM – 3:30 PM	**Networking Break - Last Chance to Observe Exhibits and Poster Papers** *Exhibit Hall - Exhibition Hall A*
3:30 PM – 4:00 PM	**Responsive Reusable Booster for Space Access** Mr. Bruce Thieman, Air Vehicles Directorate, U.S. Air Force Research Laboratory
4:00 PM – 4:30 PM	**Precision Airdrop** Dr. Keith Bowman, Air Vehicles Directorate, U.S. Air Force Research Laboratory
4:30 PM – 5:00 PM	**IR&D Linkage to Service Core Functions** Dr. James Malas, Plans & Programs Directorate, U.S. Air Force Research Laboratory
5:00 PM	**Adjourn for the Day**

THURSDAY, JUNE 23, 2011

7:00 AM – 12:00 PM	**Conference Registration** *Ballroom A & B Foyer*
7:00 AM – 7:55 AM	**Continental Breakfast** *Ballroom A & B Foyer*
7:55 AM – 8:00 AM	**Opening Remarks** *General Session - Ballroom A & B* Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair
8:00 AM – 12:00 PM	**Capabilities Needed by the Combatant Commanders Session** *General Session - Ballroom A & B* Meeting the capability needs of the warfighter is the most important goal of the DoD Science & Technology program. Establishing strong communications between the warfighter and the researcher is essential for understanding these capability needs. Warfighters traditionally communicate their needs in terms of capability gaps. The DoD S&T community must be able to address those gaps in S&T projects and demonstrate how enabling technology can effectively fill these capability gaps. In this session, representatives of U.S. Combatant Commanders will describe what new operational capabilities would make a big difference in their ability to conduct military operations in their areas of responsibility. **Co-Chairs:** ▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications ▶ Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

THURSDAY, JUNE 23, 2011

8:00 AM – 8:20 AM	**How Capabilities are Developed and Delivered to the Combatant Commanders** Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
8:20 AM – 8:40 AM	**USCENTCOM** Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM
8:40 AM – 9:00 AM	**USSOCOM** Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM
9:00 AM – 9:20 AM	**USPACOM** Mr. Ken Bruner, Science Advisor, USPACOM
9:20 AM – 9:40 AM	**USSOUTHCOM** Mr. Ricky Stuart, Technology Manager, USSOUTHCOM
9:40 AM – 10:00 AM	**Networking Break** *Ballroom A & B Foyer*
10:00 AM – 10:20 AM	**USTRANSCOM** Mr. Lou Bernstein, Chief, Future Capabilities & Technology, USTRANSCOM
10:20 AM – 10:40 AM	**USSTRATCOM** Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM
10:40 AM – 11:00 AM	**USAFRICOM** Mr. Mike Owens, Science & Technology Advisor, USAFRICOM
11:00 AM – 11:20 AM	**USNORTHCOM** Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM
11:20 AM – 11:40 AM	**USEUCOM** Mr. Stephen L. Spehn, Deputy Science Advisor, USEUCOM
11:40 AM – 12:00 PM	**Best Poster Winner Announcement and Closing Remarks** ▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair ▶ Mr. Michael Liggett, Director Technology Programs, Raytheon Company
12:00 PM	**Conference Adjourned and Boxed Lunch Served**

Classified Session Badge Pick-Up Desk Hours

Do not forget to pick-up your Classified Session Badge! All Classified Session Attendees must have a conference badge, a classified badge and a valid photo ID to attend the session.

TUESDAY, JUNE 21, 2011	WEDNESDAY, JUNE 22, 2011	THURSDAY, JUNE 23, 2011
7:00 AM – 8:00 AM	7:00 AM – 8:00 AM	7:00 AM – 8:00 AM
9:45 AM – 10:15 AM	10:00 AM – 10:30 AM	9:30 AM – 10:10 AM
2:45 PM – 3:30 PM	3:30 PM – 4:00 PM	12:10 PM – 12:45 PM

CLASSIFIED SESSION AGENDA

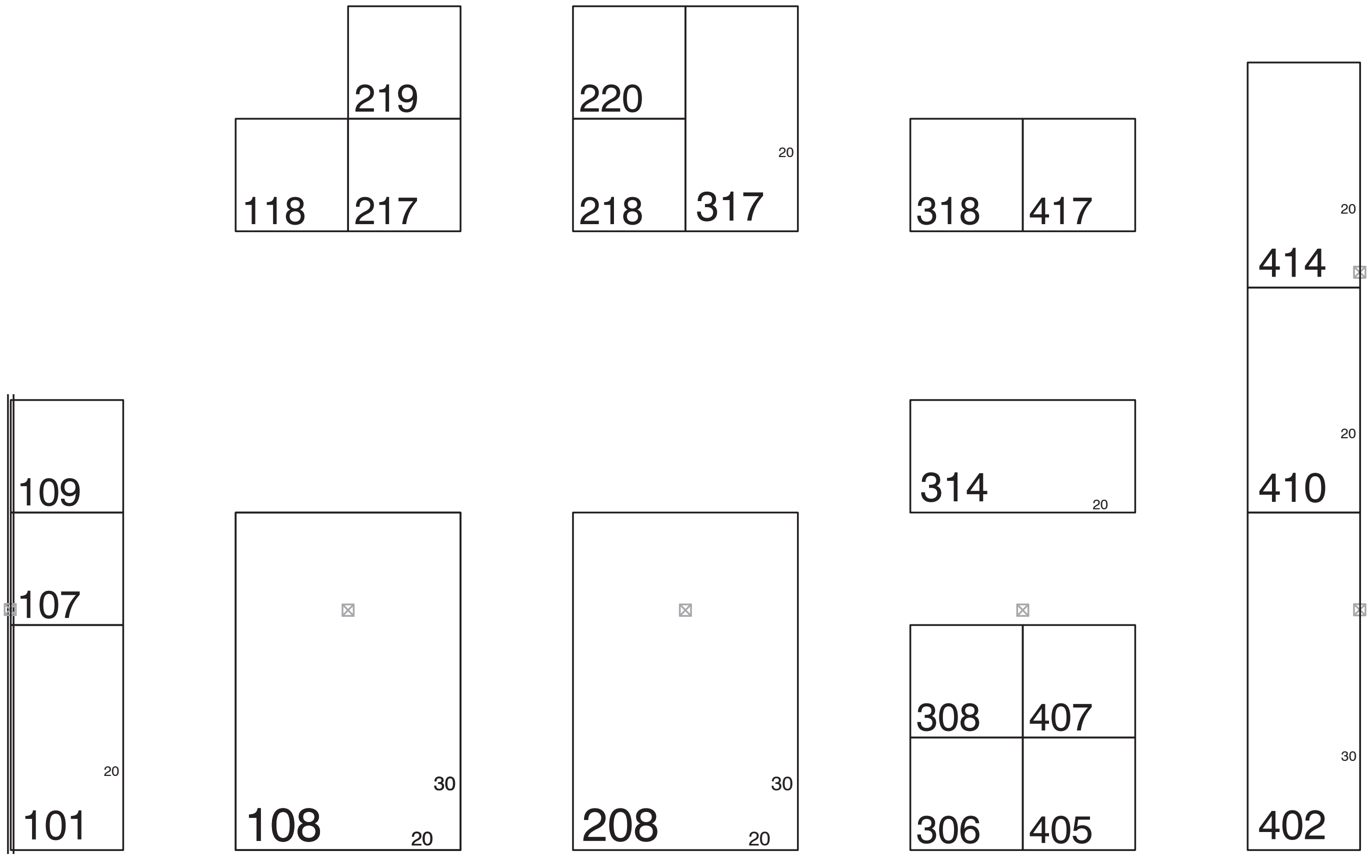
General Session - Ballroom A & B

THURSDAY, JUNE 23, 2011

1:00 PM – 5:15 PM	**Classified Session** *Off-site Location: SPAWAR's facility on Base* Registered NDIA S&ET Conference Attendees are invited by OASD(R&E) and SPAWAR to attend a Classified Session held off-site. Classified Session Attendees must hold a Secret Level Classification and must have previously submitted and verified their clearance acceptance with the SPAWAR security office by Friday, June 10, 2011. **Classified Session Attendees must have a valid ID and a Classified Issued Badge to attend this Session.** **Co-Chairs:** ▶ Dr. Al Emondi, Deputy Chief Technology Officer, SPAWAR, Atlantic ▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair
1:00 PM – 1:30 PM	**Classified Session Attendees Proceed to Off-Site Location** **Bus Transportation to the Classified Session Provided; WILL START AT 1:00 PM SHARP** *Front Drive*
1:30 PM – 2:00 PM	**Operate Effectively in Cyberspace** Dr. Steven King, Deputy Director for Cyber Security Technology, OASD(R&E)
2:00 PM – 2:30 PM	**Counter Weapons of Mass Destruction (WMD)** Dr. Carol Kuntz, Senior Advisor, Office of the Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs
2:30 PM – 3:00 PM	**Electronic Warfare/Electronic Protection** Dr. Peter Craig, Electronic Warfare Program Manager, Office of Naval Research
3:00 PM – 3:15 PM	**Networking Break (Refreshments not provided)**
3:15 PM – 3:35 PM	**USSTRATCOM** Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM
3:35 PM – 3:55 PM	**USSOCOM** Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM
3:55 PM – 4:15 PM	**USCENTCOM** Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM
4:15 PM – 4:35 PM	**USPACOM** Mr. Ken Bruner, Science Advisor, USPACOM
4:35 PM – 4:55 PM	**USNORTHCOM** Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM
4:55 PM – 5:15 PM	**USSOUTHCOM** Mr. Ricky Stuart, Technology Manager, USSOUTHCOM
5:15 PM	**Classified Session Adjourned and Return Bus Service**

National Defense Industrial Association

EXHIBIT HALL FLOOR PLAN



EXHIBITING AS	BOOTH NUMBER
Aeros Aeronautical Systems	218
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NDIA - STEM	108
Scientific Research Corporation	314
Space and Naval Warfare Systems Center Atlantic	101
Test Resource Management Center	407
Torrey Pines Logic	308
U.S. Air Force Research Lab	208
U.S. Army Corp of Engineers, ERDC	417
U.S. Army RDECOM ARDEC	410
U.S. Army RDECOM ARL	402

(As of 6/09/2011)

EXHIBITOR PROFILES

Booth # - 218
Aeros Aeronautical Systems

Aeros is the world's leading lighter-than-air, FAA-certified aircraft manufacturing company. The company's operations involve the research, development, production, operation and marketing of a complete family of Aeros-branded air vehicles used in government and commercial applications. These include non-rigid FAA Type Certified Aeros 40D Sky Dragon Airships, Advanced Tethered Aerostatic Systems and New Type Rigid Air Vehicle - Aeroscraft.

Booth # - 317
Aurora Flight Sciences

As a leader in the unmanned aircraft systems technology for over 20 years, Aurora Flight Sciences is engaged in the design, development, production, and support of unmanned aircraft. Aurora works closely with academia, the Service laboratories, DARPA, and NASA to demonstrate innovative solutions for our warfighter. As an example, the 5-day endurance Orion UAS was selected for the CENTCOM sponsored MAGIC JCTD in August 2010.

Booth # - 220
Bennett Aerospace, Inc.

Bennett Aerospace is a small business and a high-end, highly technical, engineering and development company based in Cary, North Carolina. The company's core capabilities are in: •Optics and Lasers: Holographic Visualization; Tunable Lasers; Fiber Lasers •Sensor and Instrumentation Development: Lidar Systems; Phased Array Radar •Space Hardware: Communications; Navigation; Strategic Assessments •Robotics: System Design and Build; Shipboard Robotics •Communications: System and Component Design; Terrestrial and Space •Materials and Manufacturing: Additive Manufacturing; Nano-Scale High-Strength Fiber; Advanced Materials; Nano-scale Piezoelectrics

Booth # - 107
Biometrics Identity Management Agency

The Biometrics Identity Management Agency (BIMA) leads Department of Defense activities to program, integrate, and synchronize biometric technologies and capabilities. BIMA collaborates with stakeholders and the biometric community to lead in the development of biometric capabilities that empower the warfighter.

Booth # - 109
Center for Organic Photonics and Electronics

The Georgia Tech Center for Organic Photonics and Electronics (COPE) is a leading research and educational resource center that creates flexible organic photonic and electronic materials and devices that serve the information technology, telecommunications, energy, and defense sectors.

Booth # - 306
Dassault Systemes Americas Corp.

As a world leader in 3D and Product Lifecycle Management (PLM) solutions, Dassault Systèmes develops and markets PLM application software and services that support the defense industry's industrial processes and provide a 3D vision of the entire lifecycle of products. Solutions include: Integrated product design, realistic simulation, virtual production, global collaborative innovation and 3D lifelike experience.

Booth # - 217
Defense Microelectronics Activity-DMEA

DMEA is a vital national asset as the joint DoD Center for microelectronics acquisition, adaptive operations and support--advancing future microelectronics research, development, technologies and applications to achieve the DoD's strategic and national security objectives.

Booth # - 318
DHS Science and Technology Directorate

DHS Science and Technology Directorate's mission is to provide our customers, DHS operating components, and their customers who secure our borders, ports and skies, with advanced capabilities to protect and serve the public. The S&T Directorate manages an integrated research and development program that enables technology for a safer nation.

Booth # - 414
Edgewood Chemical Biological Center

The U.S. Army Edgewood Chemical Biological Center is the nation's principal R&D resource for non-medical chemical biological defense. ECBC supports all phases of the acquisition lifecycle from basic and applied research through technology development, engineering design, equipment evaluation, product support, sustainment, field operations and demilitarization to address unique customer requirements.

Booth # - 405
Global Staffing and Consulting, LLC

GSAC, Global Staffing and Consulting, LLC, services clients in government and commercial organizations with contract, permanent and consulting professionals and executives. GSAC's areas of expertise include: Accounting, Aerospace, Audit, Capture, Compliance, Contracts, Government Relations, Engineering, Financial, Healthcare, Information Technology, Legal, Logistics, Proposals, Capture, and Procurement professionals.. Visit GSAC at www.gsacgroup.com or call 301-760-6802. Bethesda, MD & Washington, DC

Booth # - 219
L-3 Communications - Interstate Electronics Corp.

L-3's Precision Engagement Sector consists of the following divisions; Interstate Electronics Corporation, Fusing and Ordnance Systems, Unmanned Systems and Airborne Technologies, Inc. These businesses provide a broad range of products, including components, subsystems and systems, to military and commercial customers. Offerings include Unmanned Aircraft, Guidance & Navigation, Command& Control, Situational Awareness, Fuzing and Ordnance, and Systems Integration.

Booth # - 108
NDIA - STEM

NDIA's Science, Technology, Engineering and Mathematics (STEM) Workforce Division provides a forum for effective interaction between government, industry, academia, and the public at large for the strengthening of the national security STEM workforce. The Broad goals of the Division are to •Increase NDIA's participation in exciting and attracting K-12 students into STEM careers. •Maximize cooperation between federal departments, agencies, and industry on STEM workforce development initiatives. •Support the development of integrated polices around the STEM workforce. •Establish partnerships to collect and disseminate information and coordinate resources to build a robust STEM workforce of the future.

Booth # - 314
Scientific Research Corporation

The T&E/S&T Program continues to develop test technologies for transition into future test capabilities that will verify and support to optimization of the warfighting performance of our most advanced warfighting systems. These systems include advanced propulsion systems, directed energy weapons, multi-spectral sensors, net-centric systems, and unmanned systems.

Booth # - 101
Space and Naval Warfare Systems Center Atlantic

SPAWAR Systems Center Atlantic is a Department of the Navy engineering laboratory focused on rapidly developing and delivering secure, integrated and innovative solutions for our naval, joint, national and coalition warfighters. Aligned with the CNO's vision of adding cyber power to the already proven arsenal of sea and air power, SPAWAR Systems Center Atlantic provides end-users with a critical edge, elevating Information Dominance as a core warfighting capability.

Booth # - 407
Test Resource Management Center

The T&E/S&T Program continues to develop test technologies for transition into future test capabilities that will verify and support to optimization of the warfighting performance of our most advanced warfighting systems. These systems include advanced propulsion systems, directed energy weapons, multi-spectral sensors, net-centric systems, and unmanned systems.

Booth # - 308
Torrey Pines Logic

Torrey Pines Logic provides research, design, development and custom solutions using visible and IR sensors, lasers, image processing and analysis, wireless and IR-based communications, computer graphics and video.

Booth # - 208
U.S. Air Force Research Lab

AFRL displays the latest Air Force technologies in directed energy, human systems, information management, materials and manufacturing, munitions, propulsion, sensors, air vehicles, space vehicles, and basic research. AFRL executes the Air Force's entire science and technology budget. We partner with government, industry and academia to accomplish this mission.

Booth # - 417
U.S. Army Corp of Engineers, ERDC

The U.S. Army Engineer Research and Development Center (ERDC) is one of the most diverse engineering and scientific research organizations in the world. The ERDC conducts R&D in support of the Soldier, military installations, and the Corps of Engineers civil works mission, as well as for other federal agencies, state and municipal authorities, and with U.S. industry through innovative work agreements. ERDC's unique research capabilities and facilities have earned it distinction as the "Army Large Research Laboratory of the Year" for 10 of the last 19 years. As the world's premier engineering and environmental sciences organization, ERDC's cutting-edge technology is solving problems that others are not attempting to tackle in an effort to make our world safer and better.

Booth # - 402
U.S. Army RDECOM ARL

The U.S. Army Research, Development and Engineering Command (RDECOM) is the Army's technology leader and largest technology developer. RDECOM ensures the dominance of Army capabilities by creating, integrating and delivering technology-enabled solutions to our Soldiers. To meet this commitment to the Army, RDECOM develops technologies in its eight major laboratories and research, development and engineering centers. The U.S. Army Research Laboratory is the Army's corporate, or central, laboratory. Its diverse assortment of unique facilities and its workforce of government engineers and scientists comprise the largest source of world class integrated research and analysis in the Army. ARL's programs consist of basic and applied research and survivability/lethality analysis. One of the centers, the Armaments Research, Development & Engineering Center has the mission to develop and maintain a world-class workforce to execute and manage integrated life cycle engineering processes required for the research, development, production, field support and demilitarization of munitions, weapons, fire control and associated items.

Booth # - 410
U.S. Army RDECOM ARDEC

ARDEC is an internationally acknowledged hub for the advancement of armaments technology and engineering innovation. Our mission is to develop, maintain, execute and manage integrated life cycle engineering processes required for the research, development, production, field support and demilitarization of munitions, weapons, fire control and associated items.

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Thank You for Attending!
We'll See You in 2012!

SAVE THE DATE

13th Annual S&ET Conference DoD / Tech Exposition
April 17 - 19, 2012
Charleston Convention Center, North Charleston, SC

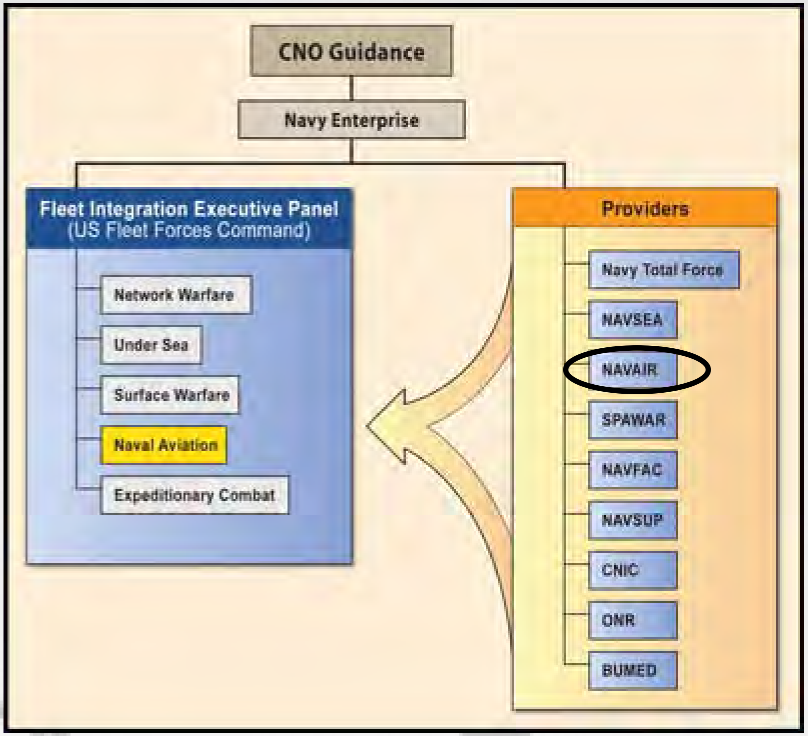
http://www.ndia.org/meetings/2720

Naval Aviation Enterprise Chief Technology Officer (CTO) Organization

Ms. Rebecca Ahne, NAE Deputy CTO

Naval Aviation Enterprise

The Naval Aviation Enterprise (NAE) is a warfighting partnership in which interdependent Naval Aviation issues affecting multiple stakeholders are resolved on an enterprise-wide basis. Between the Navy and Marine Corps, our Enterprise includes over 183,000 people, 3,700 aircraft, 11 aircraft carriers and executes a budget in excess of $40 billion. Focusing these resources to provide our country with the necessary warfighting readiness expected to meet national policy and priorities is a shared responsibility of each member of the Enterprise.



NAE CTO also serves as the CTO for
- Naval Air Systems Command (NAVAIR) and PEOs
- Naval Air Warfare Centers (NAWC)

Naval Aviation Platforms/Programs

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NAVAL AIR SYSTEMS
COMMAND
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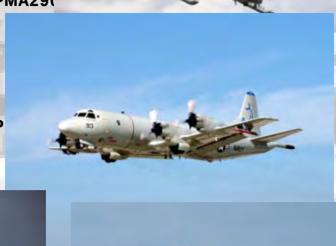

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FLEET SUPPOR
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COORDINATION ON
REQUIREMENTS AND RESOURCES

NAE Science & Technology Objectives

- Provides guidance for the NAE to facilitate the alignment of available science and technology development investments with the technology requirements of Naval aviation.

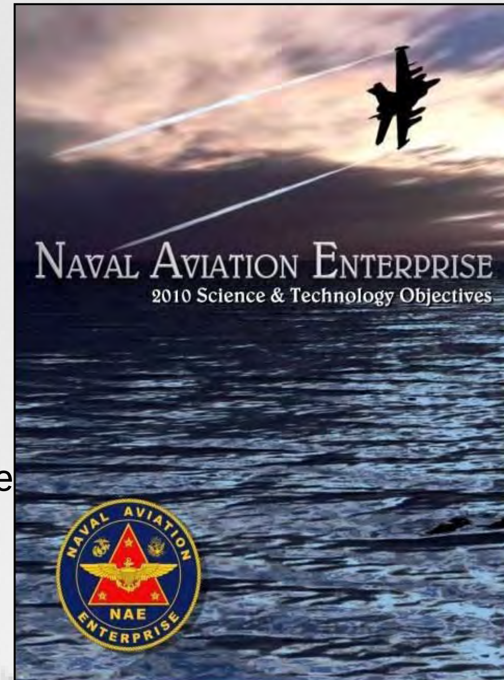
- Represents the <u>goals</u> of the NAE S&T program
  - Used as the baseline for identifying, prioritizing, aligning and synchronizing S&T investment efforts throughout the Enterprise.

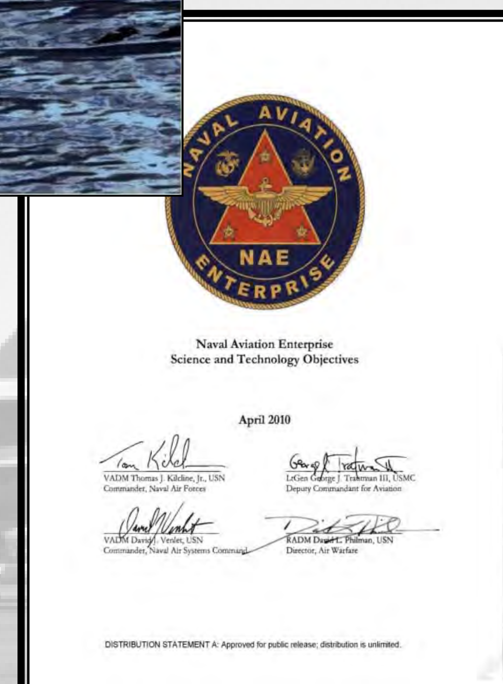
- Represents a broad strategy that provides focused direction for the future while retaining sufficient flexibility to allow the S&T community to meet emerging challenges.

- Identifies 11 Capability Gaps supported by 34 NAE S&T Objectives (STOs)
  - USMC Aviation STOs included

- Document signed by
  - Commander, Naval Air Forces
  - Deputy Commandant for Aviation
  - Commander, Naval Air Systems Command
  - Director, Air Warfare

- Updated biennially; next edition available April 2012





Naval Aviation Enterprise
Science and Technology Objectives

April 2010

VADM Thomas J. Kilcline, Jr., USN
Commander, Naval Air Forces

LtGen George J. Trautman III, USMC
Deputy Commandant for Aviation

VADM David J. Venlet, USN
Commander, Naval Air Systems Command

RADM David L. Philman, USN
Director, Air Warfare

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

Available online at: http://www.public.navy.mil/airfor/nae/Documents/2010%20STO.pdf

S&T Objective Road Mapping

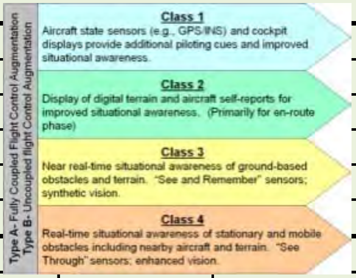
- 4 Levels of Road mapping
  - Acquisition* – Defines capability needs specific to each platform and maps/aligns with POM cycles
  - Platform S&T – Identifies where S&T can contribute to the needs identified on the Acquisition roadmap, identifies and maps current workload/projects to those needs
  - S&T Objectives – Defines the critical capability gaps for each S&T Objective, decomposes capabilities needs into technology investment areas, identifies & maps current workload/projects, and identifies where future work may be required to achieve required capability
  - Laboratory Core Capabilities – Defines those technologies considered core to the NAWC laboratory research and engineering workforce and facilities, maps current workload/projects and identifies where future work is required

* Acquisition Road maps are being developed by Program Offices

Deploy and Employ Forces (DEF) STO 3

- **STO Number: DEF STO 3**
- **Title: Improved Vertical Delivery – Systems enhancements**
- **Statement of Need:** Vertical delivery systems enhancements that improve ability to operate in the intended environment are required to increase tactical effectiveness, safety and survivability. Includes aerial delivery and internal/external cargo handling systems.
- **Why Required:** Military success is often dependent on a commander's ability to effectively maneuver and mass forces, to support and reinforce deployed or embarked units, and to quickly react to changes in the tactical situation. Additionally, Naval forces rely heavily on efficient, effective vertical lift for resupply and sustainment.

METRICS	Baseline	0-5 Years	5-10 Years	15+ Years
INCREASE SITUATIONAL AWARENESS				
SA Enablers (Sensors)				
Data Fusion				
Displays				
Redistribution of Downwash				
EMBARK/DEBARK				
Reduce time to Embark (Full Payload)		10%	20%	30%
Reduce time to Debark (Full Payload)		10%	20%	30%
SPEED (External Loads)				
Increase speed for Ext Loads				
Helicopter		10%	25%	50%
Tiltrotor		10%	25%	50%
Unmanned Vertical Replenishment			Demostrated	Deployed
DEVELOP SAFETY SYSTEMS				
Airframe/Crew Airbags				
Improve Crashworthiness Seats/Structure				
IMPROVE SURVIVABILITY				
Susceptibility				
Vulnerability				
Active Protection Systems				



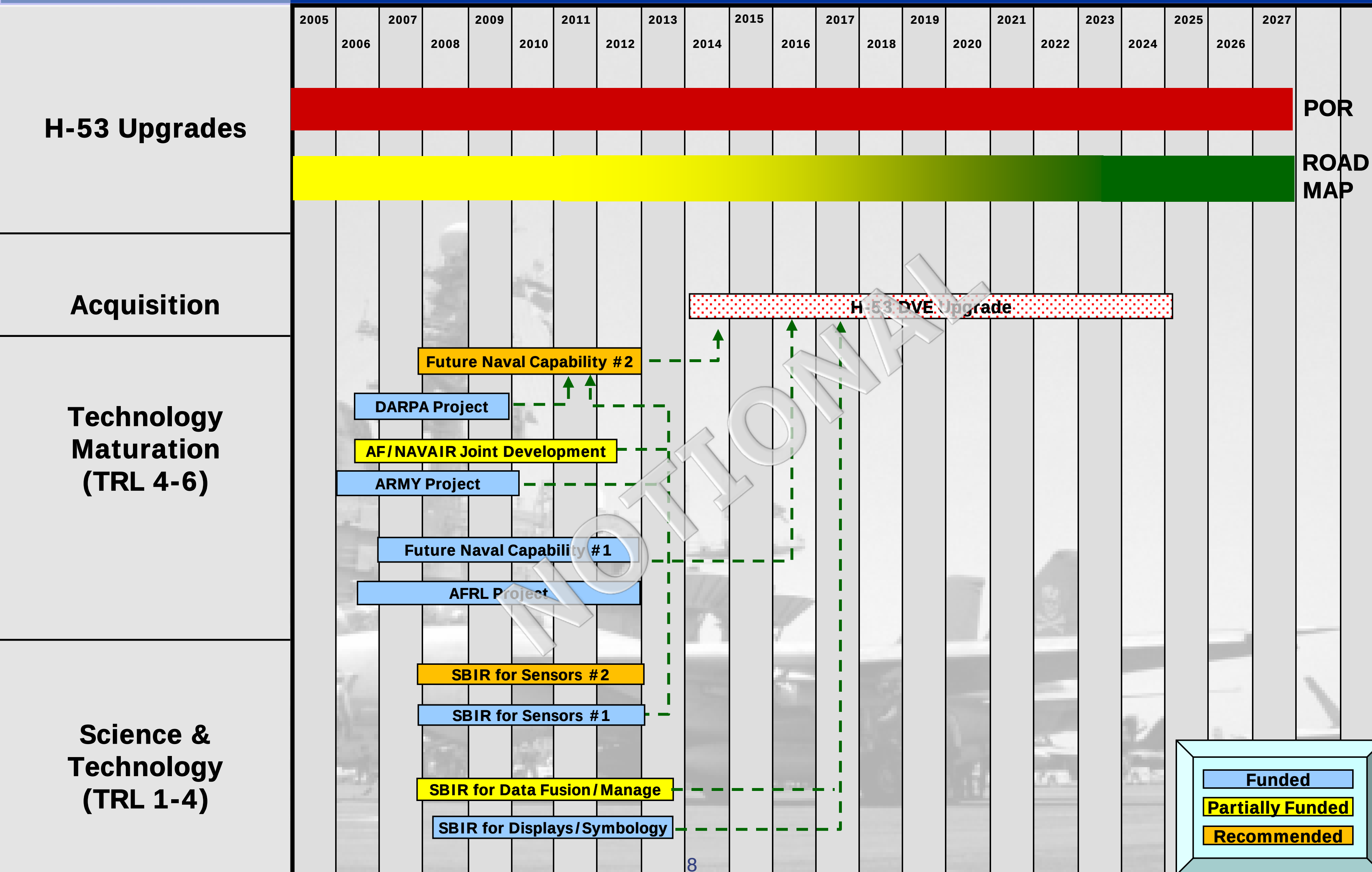
NOTIONAL

DEF STO 3 - Taxonomy

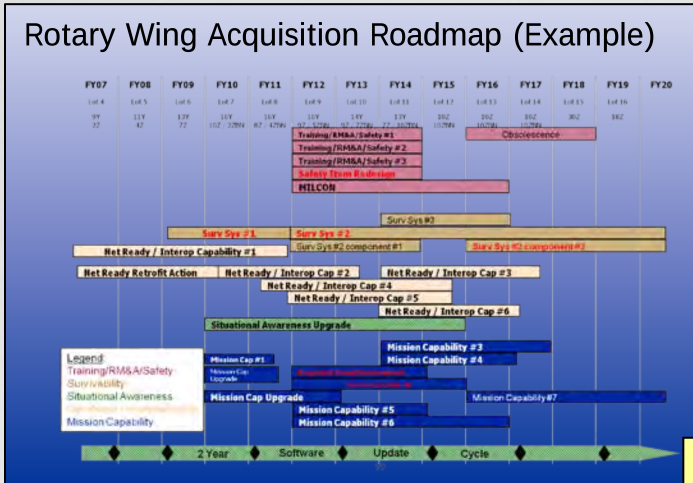
Improve Active Protection Systems

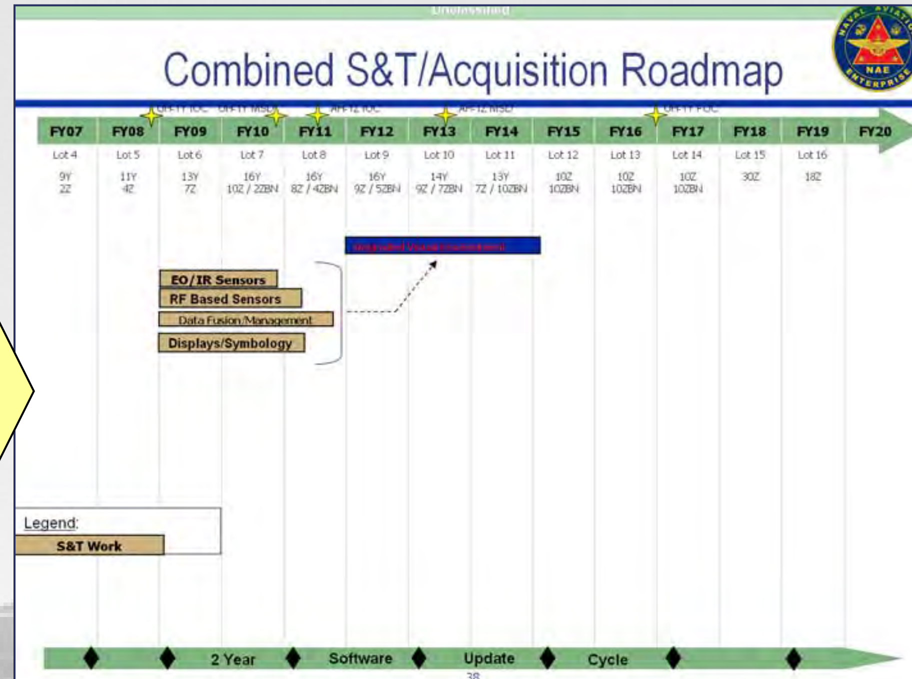
	Task Name
1	DEF STO 3 - SYSTEMS ENHANCEMENTS
2	
3	⊟ IMPROVE SITUATIONAL AWARENESS (Brownout/Whiteout/Fog/Rain)
4	⊞ Redistribution of Rotorwash/Flow Field Modification
11	⊞ Develop "See Thru" Technologies
37	⊞ Develop Tactile Cueing Systems
39	⊞ Develop Terrain/Obstacle/Traffic Warning Systems
42	⊞ Develop Improved Flight Controls
49	
50	⊟ IMPROVE EMBARK/DEBARK TIMES
51	Reduce Embark Time
52	Reduce Debark Time
53	
54	⊟ IMPROVE EXTERNAL LOAD CARRYING CAPABILITY
55	Increase Speed for external loads
56	⊞ Develop Autonomous or Unmanned Vertical Replinishment Capability
58	
59	⊟ IMPROVE SAFETY
60	⊞ Develop Crashworthy Systems
69	⊞ Develop Floatation & Stability Systems
71	
72	⊟ IMPROVE SURVIVABILITY
73	⊞ Suceptability
77	⊞ Reduce Vulnerability
84	⊞ Improve Active Protection Systems

DEF STO 3: See "Thru" Solution for Degraded Visual Environment



GOAL: Combined S&T/Acquisition





Summary

- NAE Chief Technology Officer (CTO) is responsible for providing oversight and strategic management of the NAE S&T investment portfolio

- NAE CTO monitors health of S&T portfolio and progress toward delivery of capability through the use of S&T Objective Roadmaps

- Goal is to integrate/link S&T Objective Roadmaps into Acquisition Roadmaps
  - Allows insight into our programs and provides a strategic framework for all stakeholders

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NAVAL AVIATION
1911 2011
CENTENNIAL
Centennial of Naval Aviation
1911-2011
Thank you for your support
and celebration of the
United States Sea Services!

DoD's Engineered Resilient Systems (ERS) S&T Priority

PoC: Dr. Robert Neches

Director, Advanced Engineering Initiatives
ODASD - SE

Robert.Neches@osd.mil

Presenter: Dr. Randy Avent

Presentation to NDIA/DoD Annual S&T Conference
20-23 June 2011

A Quote from the former Secretary of Defense, Dr. Robert Gates

The Honorable Dr. Robert M. Gates, 22nd Secretary of Defense, interview at The American Enterprise Institute, carried on CSPAN, 24 May 2011

...our record of predicting where we will use military force since Vietnam is perfect. We have never once gotten it right.

There isn't a single instance ... where we knew and planned for such a conflict six months in advance, or knew that we would be involved as early as six months ahead of time.

So my mantra actually has been for the last several years in the department that, as we train and as we equip, we need to have in mind the greatest possible flexibility and versatility for the broadest range of conflict....

Engineered Resilient Systems Problem Statement

Uncertain futures & threats outpace our ability to create & field affordable, effective systems

***Change happens* – we need to design for it.**
But, today, instead...

- **Adaptability, trustability and affordability are not sufficiently considered** when making tradeoffs
  - ...and are also not maintained when modifications occur during design, manufacturing, and fielding
- **Effective design is hobbled:** engineers hear too little about warfighters' / stakeholders' needs; and too little information about design feasibilities and opportunities gets fed back
- **Cost/schedule slip is highly likely when problems arise, requirements change, or adaption is needed:** Too few alternative designs are considered in depth, nor are they kept active very long
- **Uncertainties compound when planning horizons grow:** long design-test-build-field-adapt lead-times exacerbate uncertain futures problems, overload designs, and lock out new technologies

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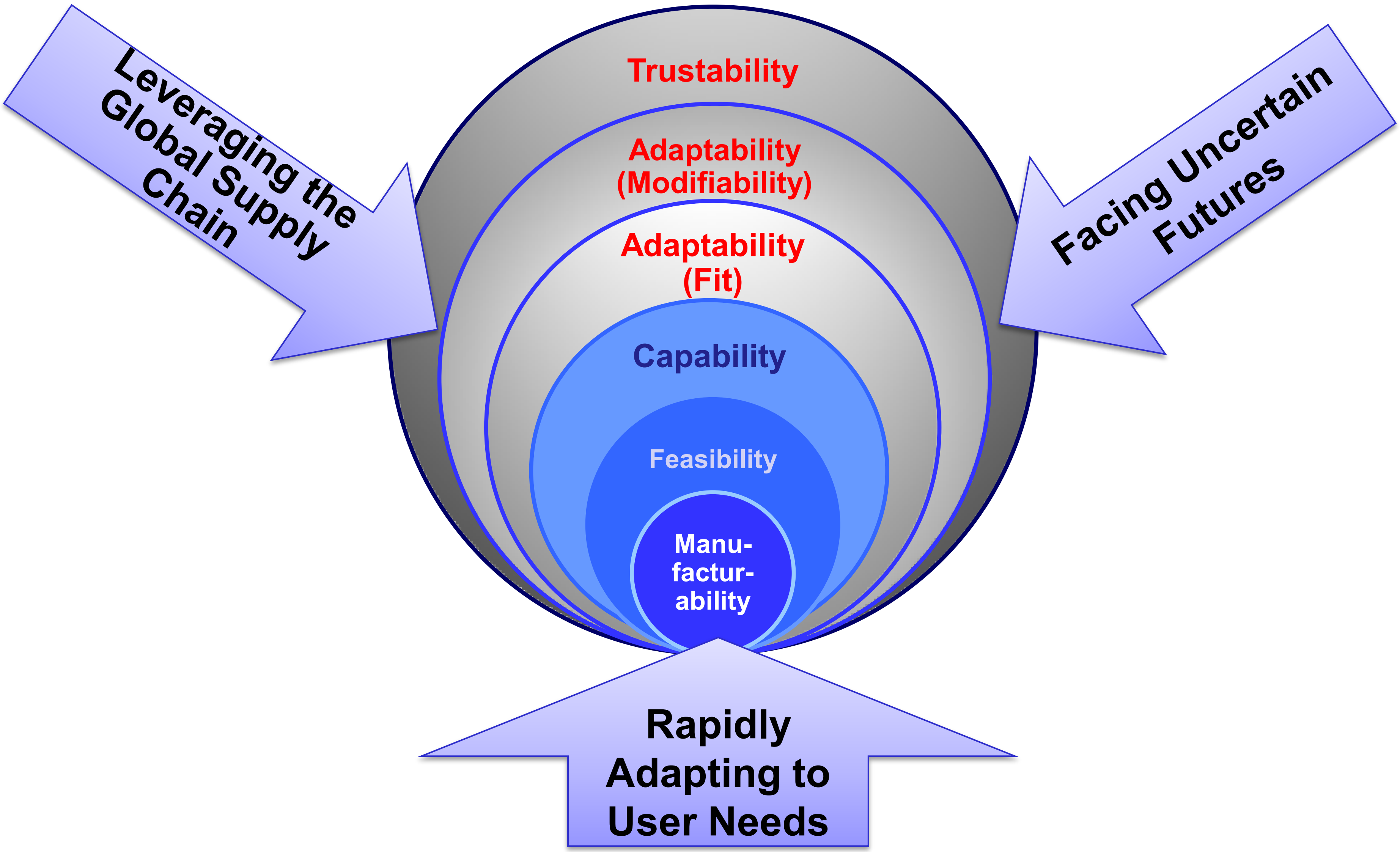
21st Century Dynamics Require New Design Constraints



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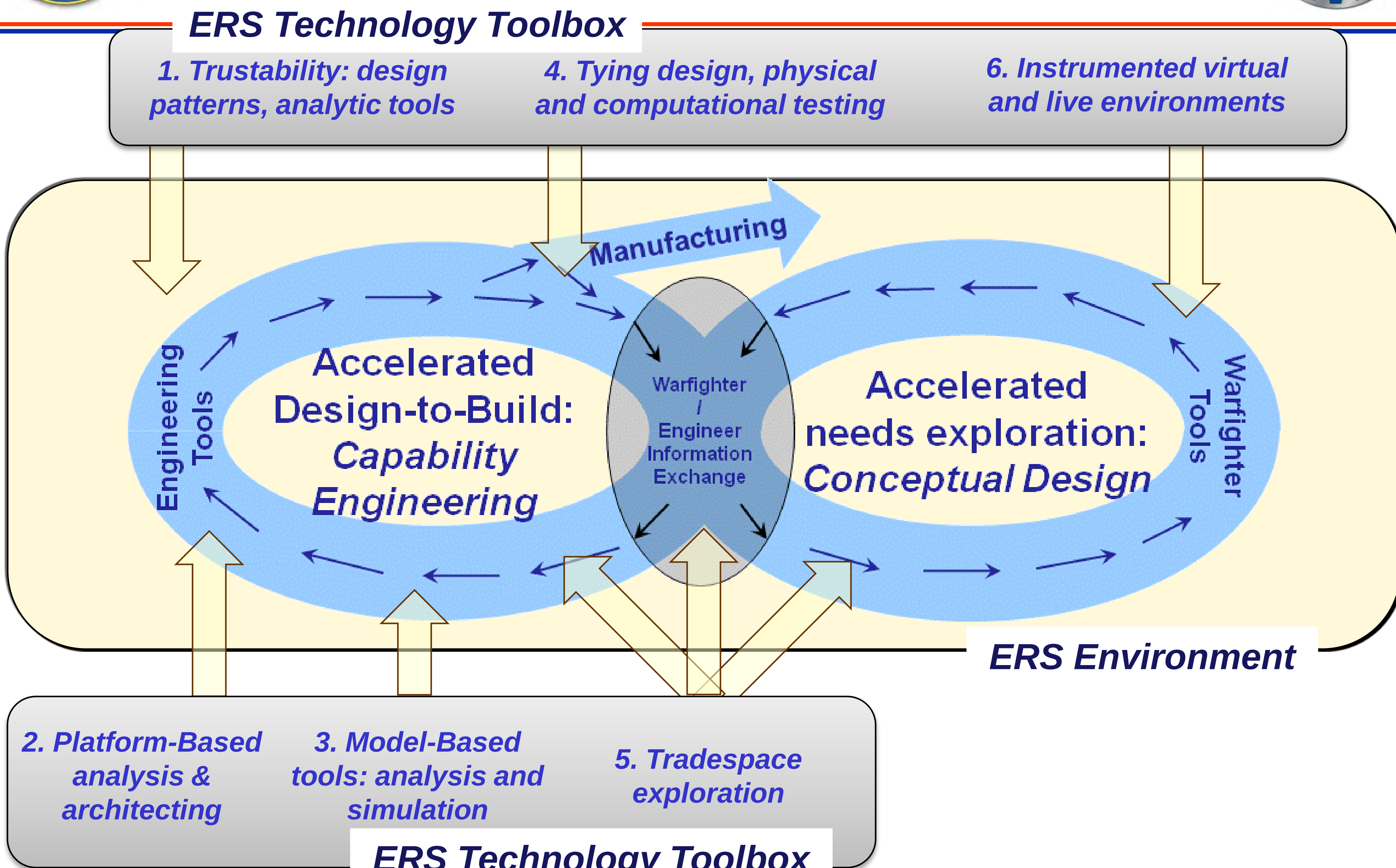
ERS: Tools and Technologies to Facilitate Adaptability & Trustability



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Goals / End States

Engineering of Defense Systems Capable of Supporting Rapidly Changing Warfighter Needs

R&D in ERS enables agile and cost effective design, development, testing, manufacturing, and fielding of trusted, assured, easily modified defense systems

ERS delivers science, engineering concepts, processes, and design tools to:

- Continuously coordinate design, testing, and production with warfighter review to facilitate earliest possible safe field use of needed capabilities
- Generate an efficient set of design points spanning the design space
- Ensure that tradeoffs among alternative designs are better understood, and that tradeoffs bearing on time, cost, trust and adaptability get appropriate consideration
- Facilitate adaptability via both reconfigurable product families and design diversity
- Consider a wide range of conditions and ConOps during design and testing
- Protect against unintentional or malicious compromise of weapon systems through the supply chain
- Reduce the time needed to reconfigure, substitute or otherwise adapt systems to rapidly changing conditions or operational concepts
- Provide a distributed collaborative engineering environment with seamless two-way transfer of data between tools enabling design, engineering, production/manufacturing, and operational evaluation

Enabling Technologies for Making Informed Decisions about Systems Designed for Trustability and Adaptability – with Timely and Affordable Results

Synthetic Environments for Assessment
(Mission Centric Design Support)

Early Warning Systems for Downstream Issues:
- Tradespaces
- Testing sufficiency
- Computational Test and Validation of Process Plans (e.g., Manufacturability, Supply Chain Risk,...)

Cross-level consistency / interoperability of models (scale, physics)

Efficient, sufficiently veridical Physical & Engineering (product, environmental) Models
(System Centric Design Support)

(Distributed Infrastructure Support)
Configurable Collaborative Engineering Environments and Processes
Human-provided Guidance and Coordination Mechanisms

Emerging Technical Opportunities

1. **Trustability: design patterns and tools**
   Adapt/extend reliability-inspired methods
   - Integrating reliability and cost approaches
   - Reasoning about risk and uncertainty
   - New sensitivity localization algorithms

2. **Platform-Based analysis & architecting:**
   New analysis tools for designing platforms, rapidly adapting systems
   - Identifying high-impact variables, and likelihoods of emergent interactions
   - Algorithms for measuring adaptability
   - Risk-based cost-benefit analysis tools for platforms and designs, "uncertainty bars"

3. **Model-based tools: analysis & simulation**
   New products / product line options
   - On-demand composition of models and simulation/analysis workflows
   - Maintaining consistency across hybrid models (not unintelligible monolithic models)
   - Using semantic features to create and repair mappings between modeling systems

4. **Tying design, physical/computer tests**
   Linked temporal & physical models
   - Simulations combining live and virtual elements
   - Acquisition and cross-integration of physics-based vs. statistical models
   - Critical new models: e.g., deformable and moving objects

5. **Tradespace exploration:**
   Collaborative options exploration
   - Guiding automated searchs
   - Advanced algorithms and massive computing for exploring alternative options
   - Envisionment of multi-dimensional tradespaces

6. **Instrumented live and virtual environments for ConOps Exploration**
   - Game and scenario writing tools
   - Discussion, annotation, collaboration in augmented reality environments
   - Visualization and explanation tools to assist in prioritizing tradeoffs, explaining decisions

Basic Science Issues

- **Scale and Complexity mean that humans cannot do the job unassisted**
  - Algorithms for selective search of intractably large spaces are needed to manage the combinatorial explosion
  - Human-guided search, and social networking techniques will also play a role
- **New challenges for large distributed architectures**
  - Efficient execution and coordination of large processing that is widely distributed and highly stochastic but partly parallel
- **New technology of interchange between discrete event, process and mathematical models will be needed to further manage tractability**
  - Models will need to be learned and refined from instrumenting physical tests and live systems
- **New human interface tools and approaches for decision support**
  - How do we help people understand the extent of coverage of mission possibilities?
  - How do we help people understand impact of requested design features/properties/capabilities and their interactions on affordability, delivery time, cost, and mission range?
- **New mathematical and statistical approaches to testing complexity and model validation**
  - Uncertainty representation and analysis (risk and confidence intervals)
  - Game theoretic approaches to finding design tradeoff win-wins
- **Physics and engineering disciplines**
  - Understanding the actual phenomena we want to capture in multi-scale, multi-physics models
  - Validating multi-scale, multi-physics models

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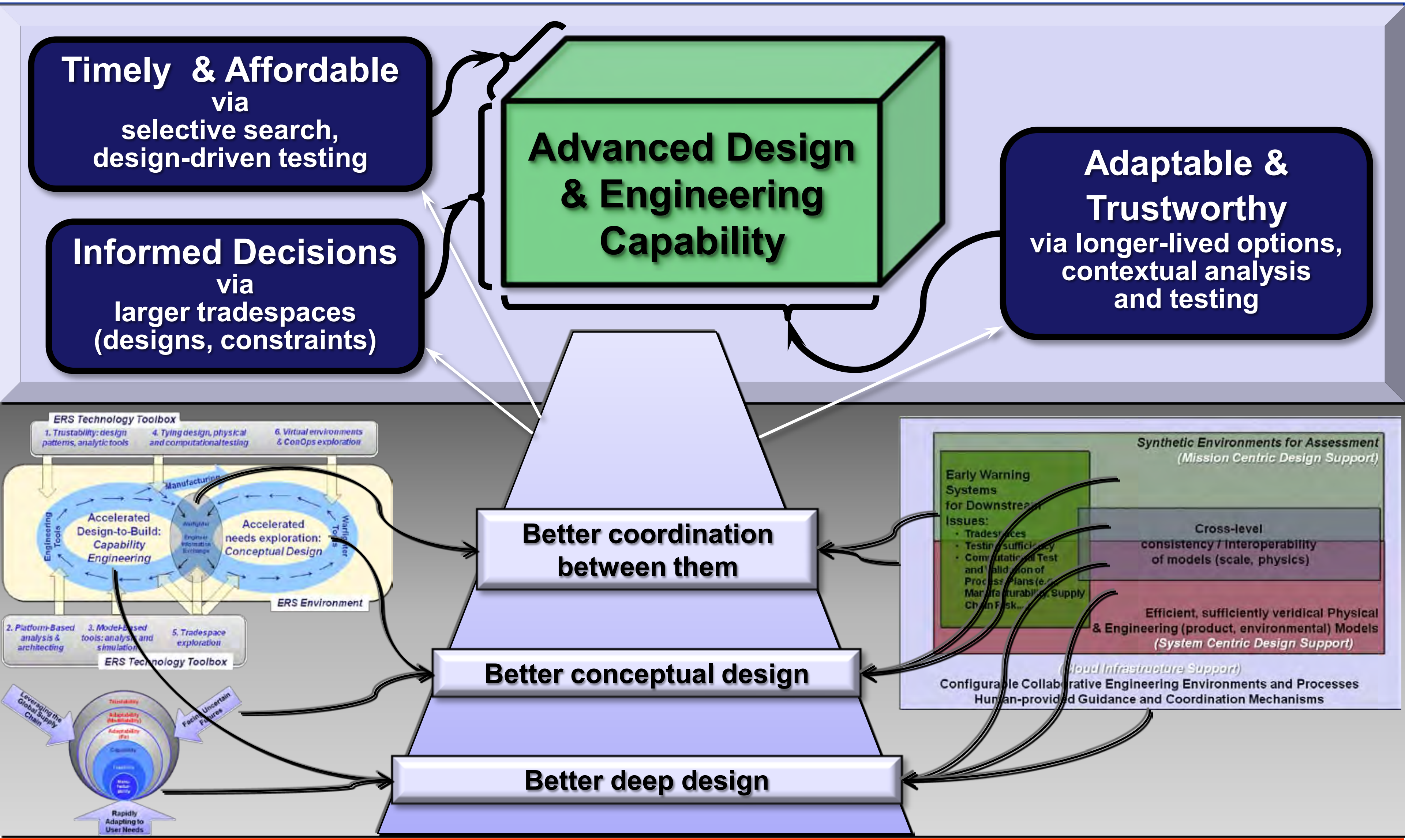
Novel Elements of Approach

- **Focus on re-design: retrofit/upgrade/adapt faster and cheaper**
- **Selectively explore feasible variations, reconfigurations, extensions**
- **Three lines of defense against change and uncertainty:**
  - Mission-oriented design for adaptability, with testing against broad range of missions and environments, prepares for the "known unknowns"
  - Diversity from *longer retention* of *multiple* designs avoids fragility of monoculture
    - Increases chances of having options that will address any "unknown unknowns"
    - Forcing the entire process to be open to alternatives, architects the engineering process to facilitate as rapid and agile a response as possible -- even in the worst case
  - Reduced engineering times enable tighter (therefore less uncertain) planning horizons
- **Focus on design and testing *in context, with stakeholders***
  - Model more of the operating environment
  - Explore and evaluate current and future scenarios, jointly with associated CONOPS
  - Design and evaluate for *mission capability* rather than disjoint technical parameters

The Path to Achieving, "Agile and cost effective design, development, testing, manufacturing, and fielding of trusted, assured, easily modified defense systems"



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Key ERS Goals, Concepts and Notional Roadmaps

Informed Decisionmaking

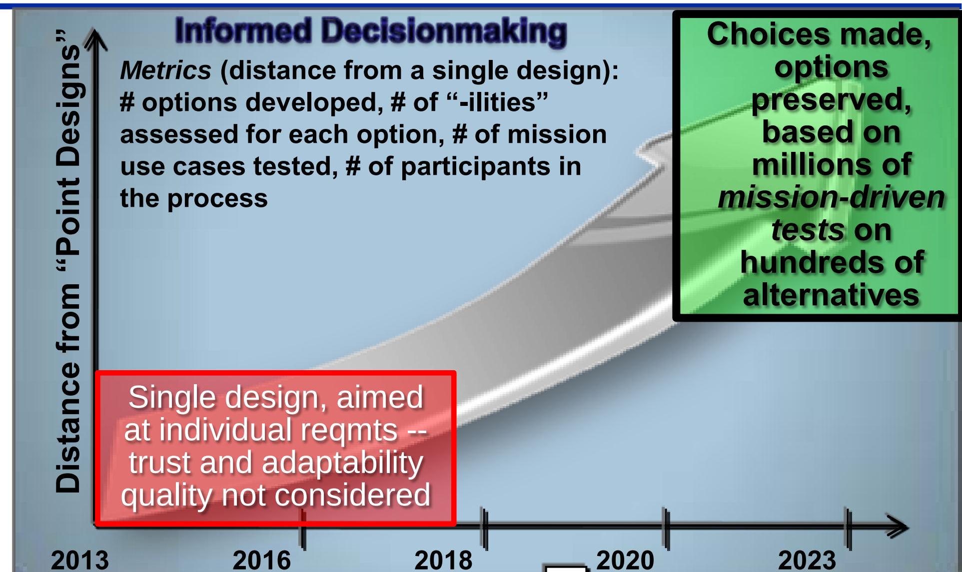
- Increasing the availability of engineering choices and the ability to assess consequences of of those choices

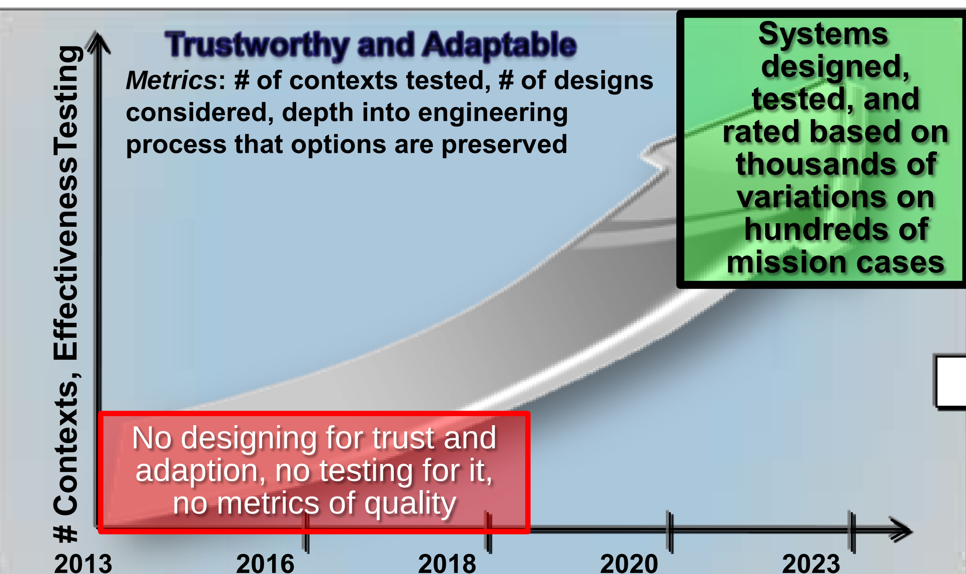
Trustworthy and Adaptable Design

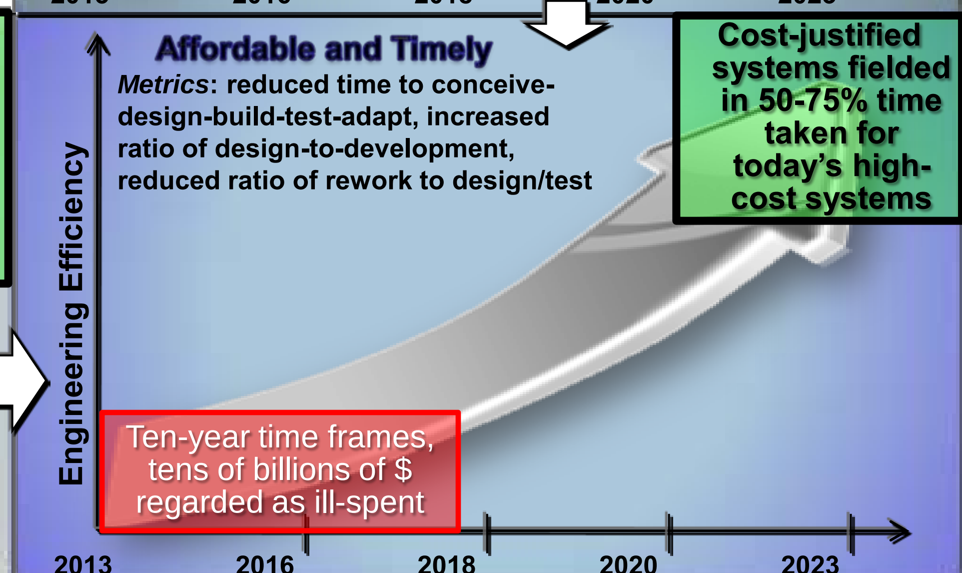
- Encouraging design for reliability, testing designs across many contexts (including degraded functioning), keeping options open, and learning from inspecting alternatives

Affordable and Timely

- As fast as possible for the problem addressed – minimizing unnecessary effort both reduces time and the cost of standing armies of engineers







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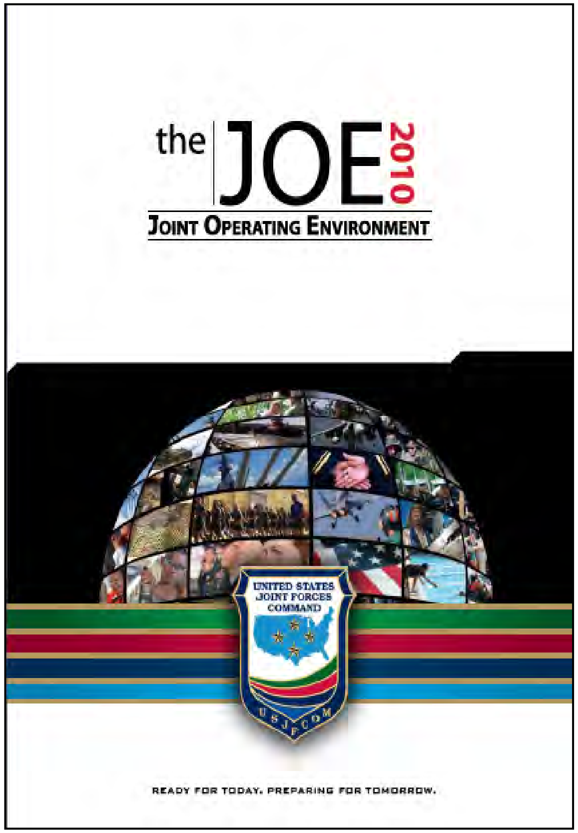
DoD Basic Research Program with a Focus on Academia

Dr. Randy K. Avent

21 June 2011

Key Challenges and Trends



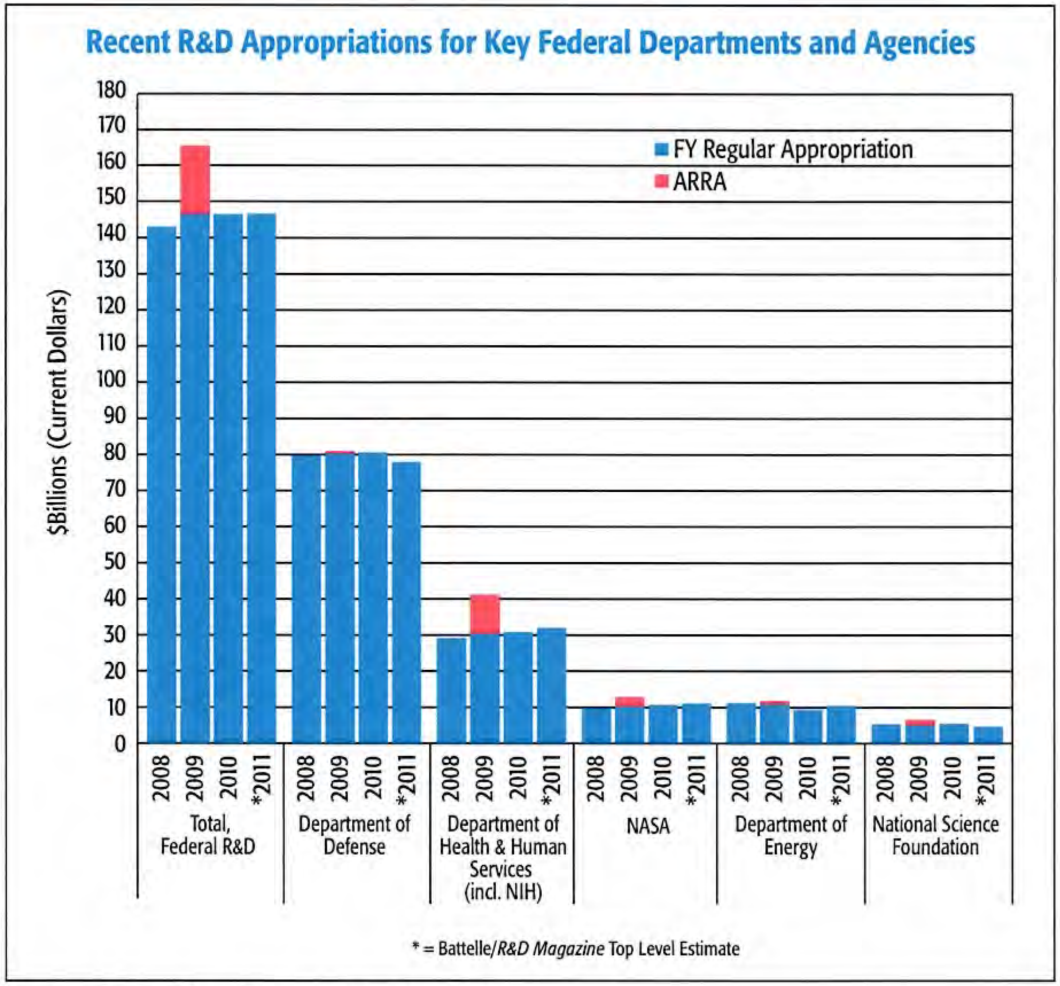
- **Demographics**
  - Aging population in developed world
  - Growing youth population in developing world
- **Globalization**
  - World wide access to knowledge
- **Economics**
  - New wealth in Brazil, Russia, India & China
  - Large debts and deficits in developed nations
- **Energy**
  - High on every nation's priority list
- **Climate change & natural disasters**
- **Challenges to existing state structures**
  - Radical ideologies
  - Internet communities

A robust S&T program is necessary to address today's complex and changing defense environment

Outline

- Introduction
- By the numbers
- Science initiatives
- Summary

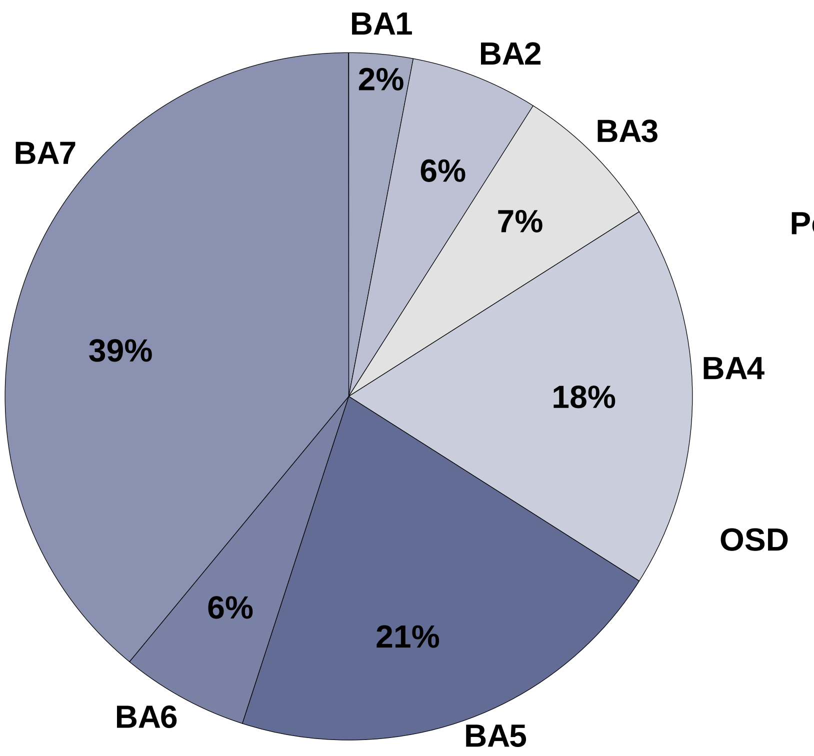
Federal Research Spending



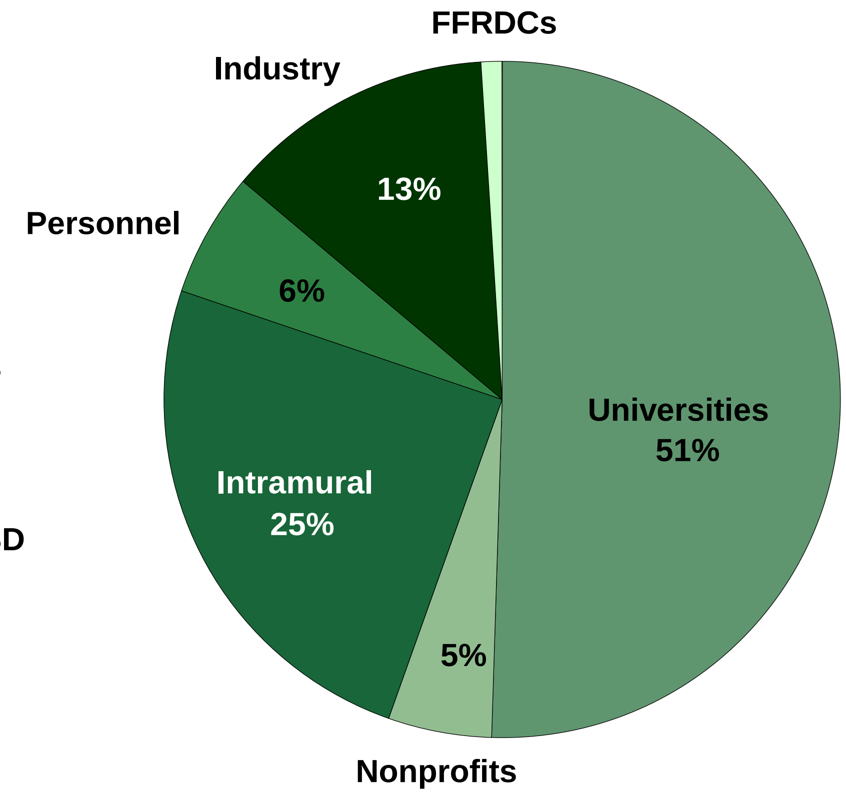
Source: Battelle/*R&D Magazine* with data from OSTP, AAAS

Basic Research Portfolios

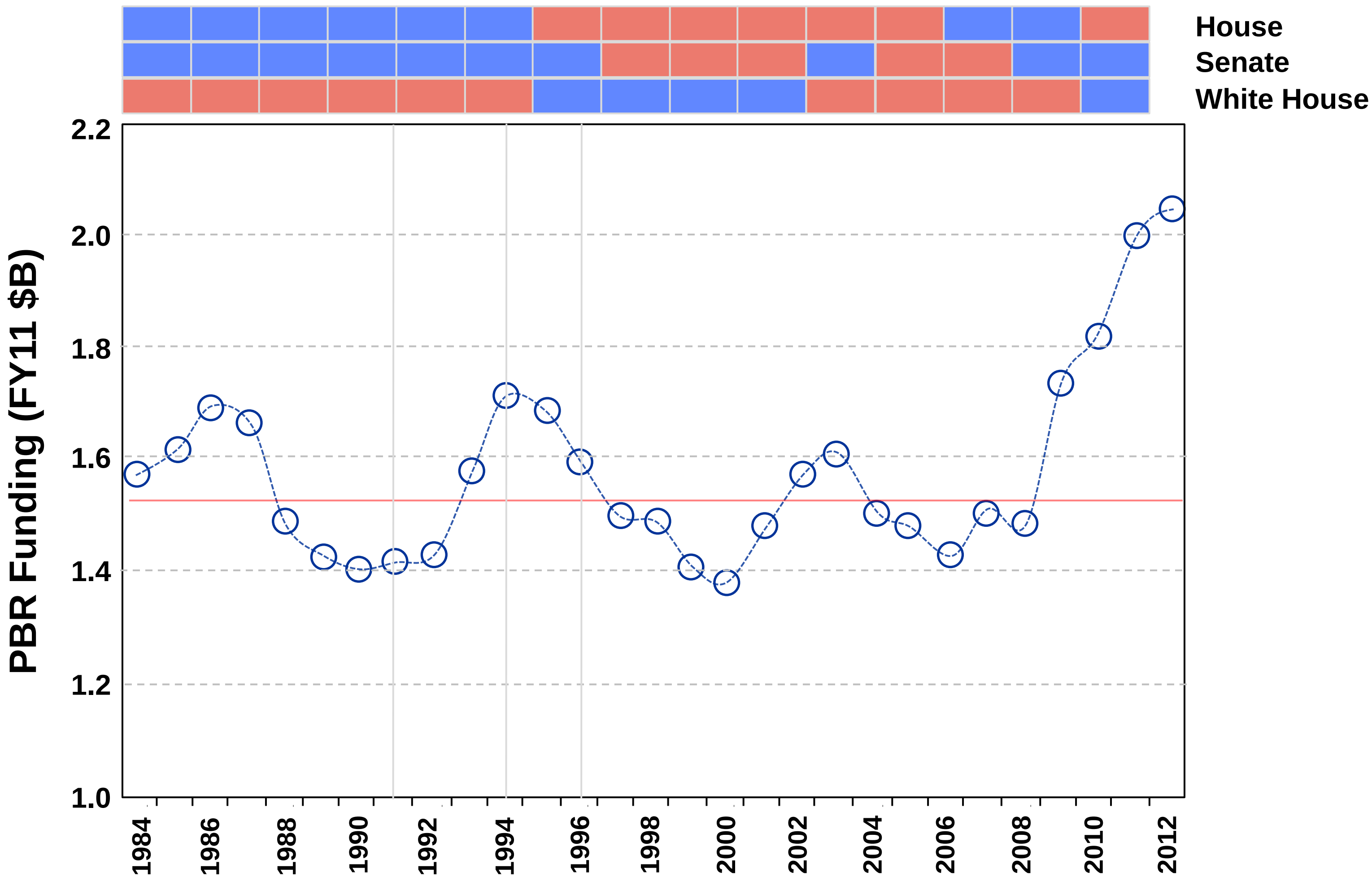
- Defense Investments



- Defense Recipients



Basic Research Funding



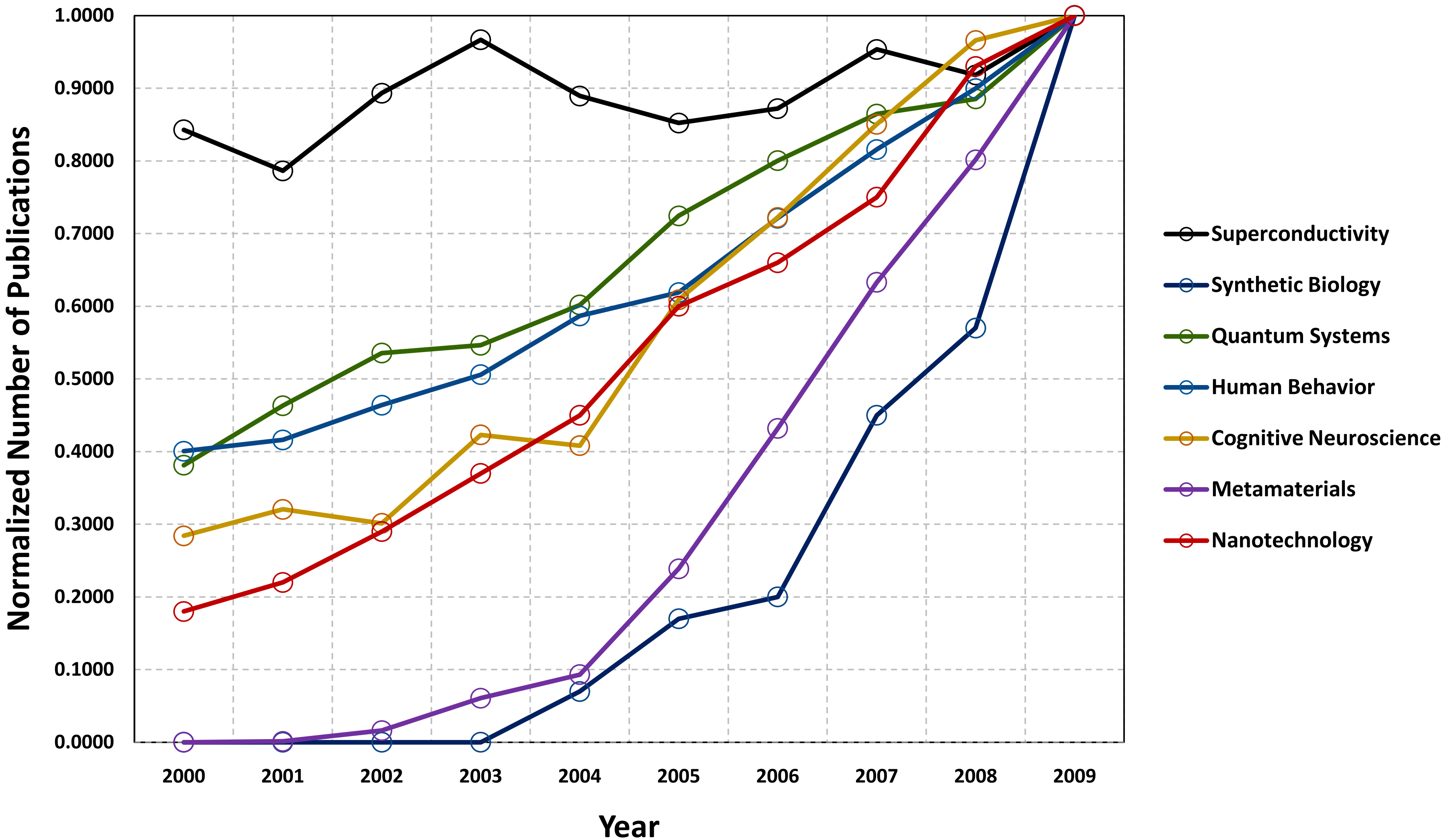
Outline

- Introduction
- By the numbers
- **Science initiatives**
- Summary

Basic Research Definitions

Basic Research should pursue fundamental understanding to provide a foundation for future work

Priority Basic Research Areas



Nanoscience and Nanotechnology

- **Discover and exploit unique phenomena at nanometer dimensions to enable novel applications**

- **Enabled capabilities**
  - Electronics and Sensing: Multispectral focal plane arrays
  - Power and Energy: Fuel-cells, portable electronics, thermoelectrics
  - Coatings: Photactive, self-cleaning films
- **Select breakthroughs**
  - Nano-particle coating & functionalization
  - Catalysts for energy-harvesting
  - Graphene and carbon nanotubes
- **Key research challenges**
  - Low defect density graphene over large areas
  - Production and reproducibility of chirality nanotubes and bilayers of graphene

Synthetic Biology/Panomics

- **The promise of engineered biology for a multitude of applications**

- **Enabled capabilities**
  – Bio-production including bio-fuels, food production
  – Bio-sensors
  – Tissue regeneration, broad-source vaccinations
  – Clean water as a bio-based capability

- **Key research challenges**
  – Modeling and simulation to address complexity of pathways
  – Automation of trials
  – Selection of appropriate host cell compatible with synthetic genome
  – Regulation and societal acceptance

Quantum Information Science

- **Manipulate and control nature down to the precision of a single quantum**

- **Enabled capabilities**
  - Quantum computing, Quantum communication
  - Quantum simulation
  - Quantum sensing, metrology and imaging
- **Select breakthroughs**
  - Quantum factorization algorithm
  - Quantum gas microscope
- **Key research challenges**
  - Maintaining quantum coherence over time
  - Discovering new algorithms that fully exploit QIS for additional new capabilities
  - New techniques to control quantum systems
  - New materials, fabrication for long coherence time

Metamaterials and Plasmonics

- **Engineered design of basic properties and transport of energy/information in materials and structures**

- **Enabled capabilities**
  - Nanoscale subsurface spectroscopy
  - Plasmon-enhanced detectors and imagers, Phased arrays
  - Novel coatings; Microvascular autonomic composites
- **Select breakthroughs**
  - Sub-wavelength elements, plasmonics, photonic crystals, metamaterials
  - Self-sensing and self-healing materials
  - Biologically-inspired structures
- **Key research challenges**
  - Efficiently convert optical radiation into localized energy
  - Enhanced local photophysical processes; 3-D photonic structures
  - Integrated plasmonics with nanostructured semiconductor devices

Cognitive Neuroscience

- **More deeply understand and more fully exploit the fundamental mechanisms of the brain**

- **Enabled capabilities**
  - Deeper understanding of human information processing, learning and decision making
  - Ameliorate/prevent PTSD and TBI
- **Select breakthroughs**
  - Advances in brain imaging, e.g., fMRI, Diffusion Tensor Imaging, digital EEG
  - Advances in correlation of brain-structure to function
  - Massively parallel computation enabling brain signal analysis
- **Key research challenges**
  - Solving the inverse problem of predicting human behavior from brain signals
  - Translating clinical measurements & analyses to uninjured personnel
  - Developing models incorporating individual brain variability

Computational Models of Human Behavior

- **A fundamental understanding and predictive capability of human behavior dynamics from individuals to societies**

- **Enabled capabilities**
  - Predictive models supporting strategic, operational and tactical decision making
  - Real-time cultural situational awareness; Immersive training
- **Select breakthroughs**
  - Early success of simple models
  - Success of social network analysis
  - Prediction of crowd tipping points
- **Key research challenges**
  - Conflicting theories
  - Data management and fusion
  - Mathematical complexity; validation of models

Summary

- **Future operations capabilities depend on the basic research achievements of today**
- **Five goals for DDR&E to strengthen the defense basic research program:**
  - **Provide scientific leadership** for the DoD basic research enterprise
  - **Attract the Nation's best S&Es** to contribute to and lead DoD research
  - **Ensure the coherence and balance** of the DoD basic research portfolio
  - **Foster connections** between DoD performers and the DoD community
  - **Maximize the discovery potential** of the defense research business environment
- **Achieving these goals results in a coherent, forward-thinking basic research program supported by the Nation's top researchers and paving the way for tomorrow's revolutionary breakthroughs**

Data-to-Decisions

Dr. Randy K. Avent

21 June 2011

Data-to-Decision Systems

Tactical Operations

- Low Latency
- Narrow Field-of-View
- Limited Fusion
- Automatic Target Recognition
- Data: ~MB-GB

Operations Intelligence

- Medium Latency
- Wide Field-of-View
- Hard Sensor Fusion
- Assisted Target Recognition
- Data: ~GB-TB

Strategic Intelligence

- Long Latency
- Synoptic Field-of-View
- Hard/Soft Sensor Fusion
- Multiple Hypotheses
- Data: ~PB-EB

The complexity and adaptability of threats has surpassed our ability to find them in large data volumes within mission timelines

D2D Technology Assessment

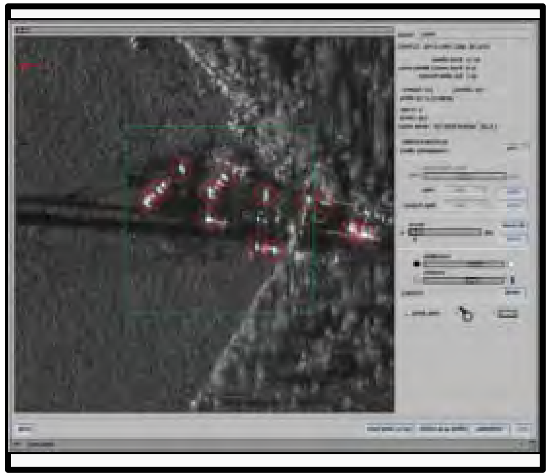
- **Moderately Mature**
- **Driven by IT Industry**

- **Immature**
- **Driven by Defense**

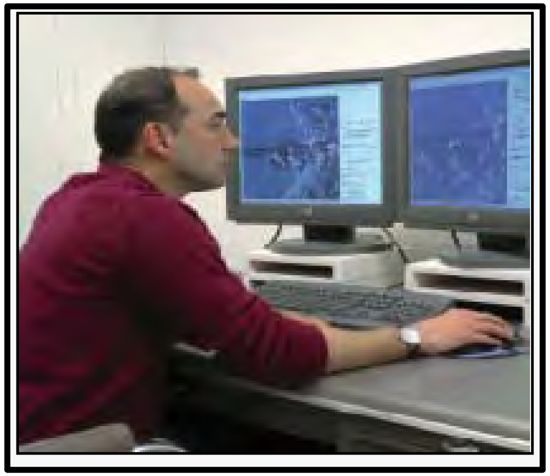
- **Moderately Mature**
- **Driven by IT Industry**

Data Management Layer

Analytics Layer



User Interface Layer



Current assessment is that unstructured data analytics is the most challenging and critical component of D2D

Outline

- Introduction
- Technology Thrusts
- Summary

Data Management Layer

- **Problem Statement: Increasing data volumes and modalities have diminished our ability to communicate, store, retrieve and process sources within mission critical timelines**

- **3-to-5 year timeframe objective**
  - Computational infrastructure to support capturing, processing, marking, retrieval, and management of millions of information objects per second
  - Network architecture with embedded information management on existing networks to support both real-time and discovery mission data requirements

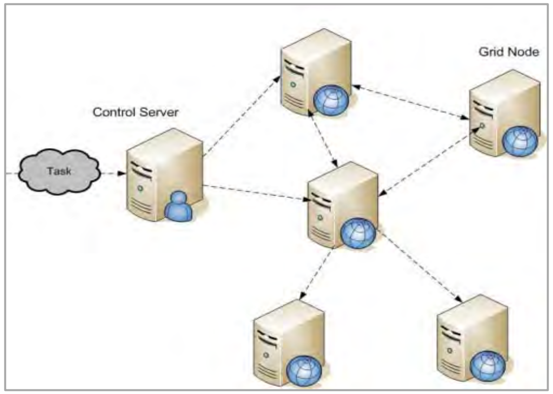
- **7-to-10 year timeframe objective**
  - Anticipatory autonomous control of sensors and compute resources to simultaneously support hundreds of consumer requests for analysis products

Hardware Infrastructure

- Embedded System

- On-board storage
- Tightly coupled data and algorithms
- Low-latency, low-bandwidth operations

- Grid Cluster



- Centralized storage
- Data moved to compute nodes
- Tightly coupled algorithms
- Parallel file system limits large data use

- Cloud Computing

- Distributed storage
- Applications moved to compute nodes
- Order-independence through map/reduce

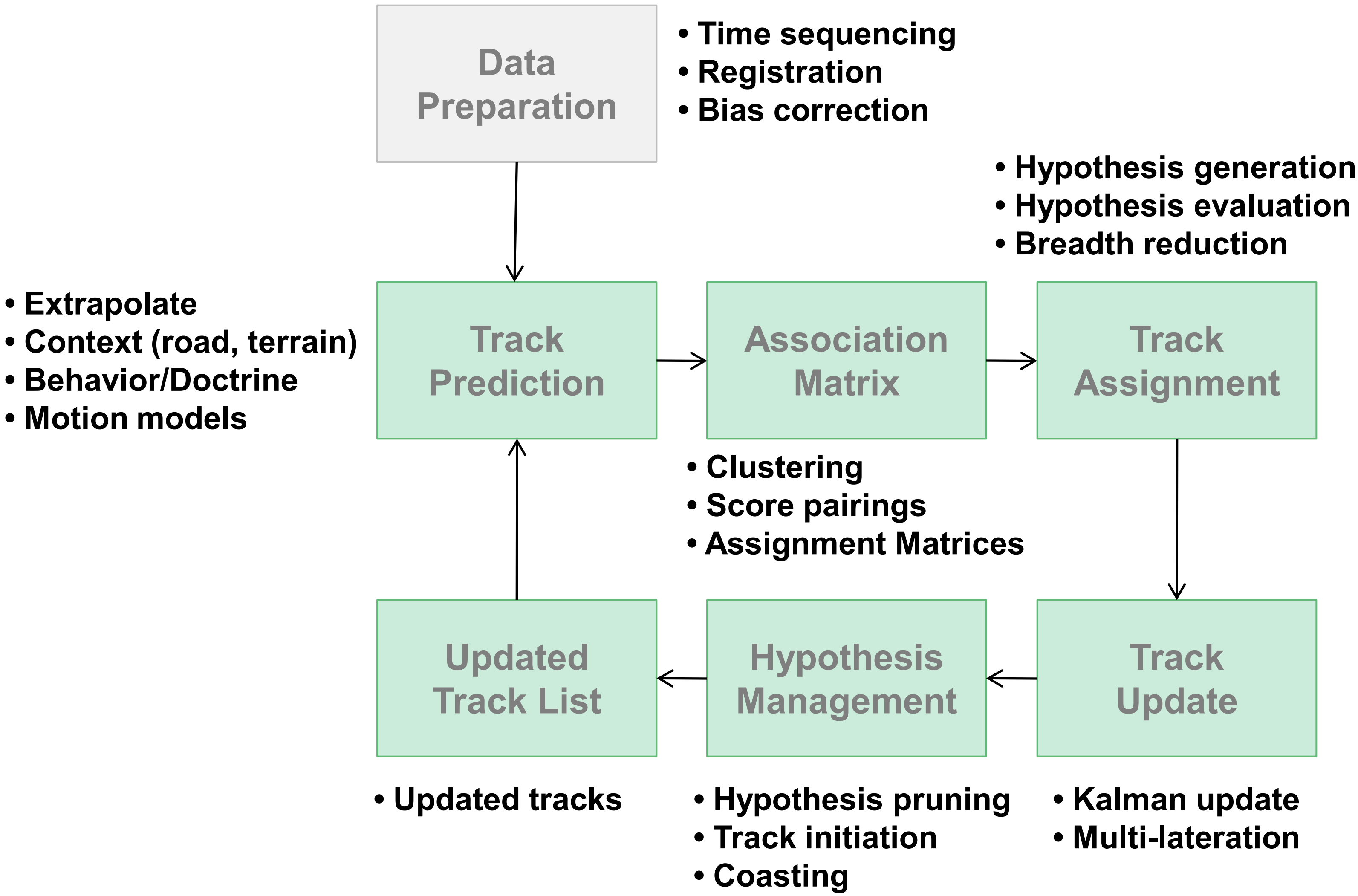
Analytic Layer

- **Problem Statement: Existing automation tools do not aid users in finding today's complex and adaptable threats within mission timelines**

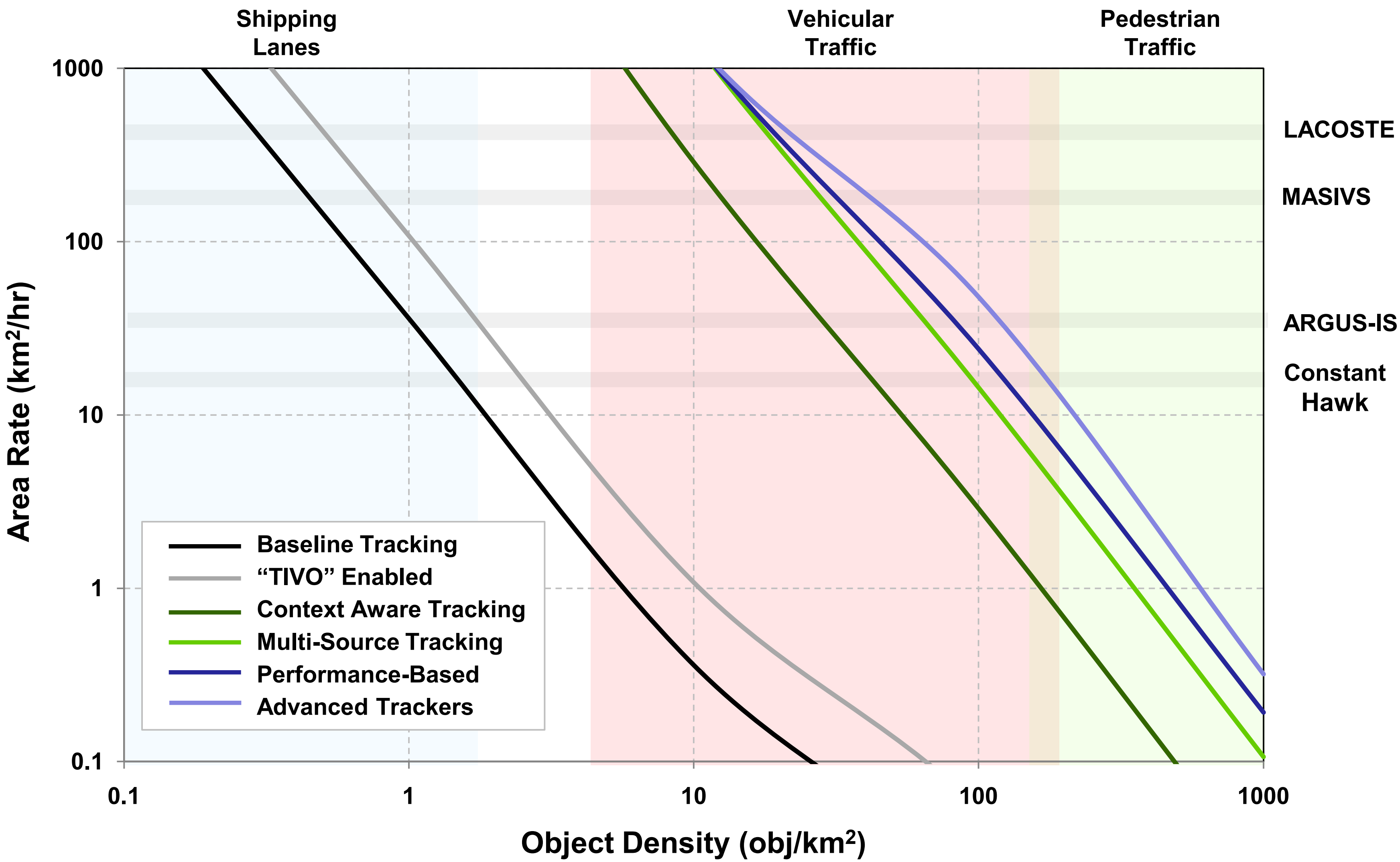
- **3-to-5 year timeframe objective**
  - Robust classification to accurately detect, geo-register and identify surface objects despite difficult environments, configurations and emplacements
  - Robust automation tools to identify relationships, patterns of life and activities of ground vehicles
  - Robust tools to capture, store and retrieve HUMINT-based information to identify and leverage popular support against insurgents

- **7-to-10 year timeframe objective**
  - Robust classification to accurately detect, geo-register and identify all surface objects despite difficult environments, configurations and emplacements
  - Robust automation tools to identify relationships, patterns of life and activities of dismounts
  - Robust tools to search, mine and exploit open-source data to identify all aspects of insurgent networks

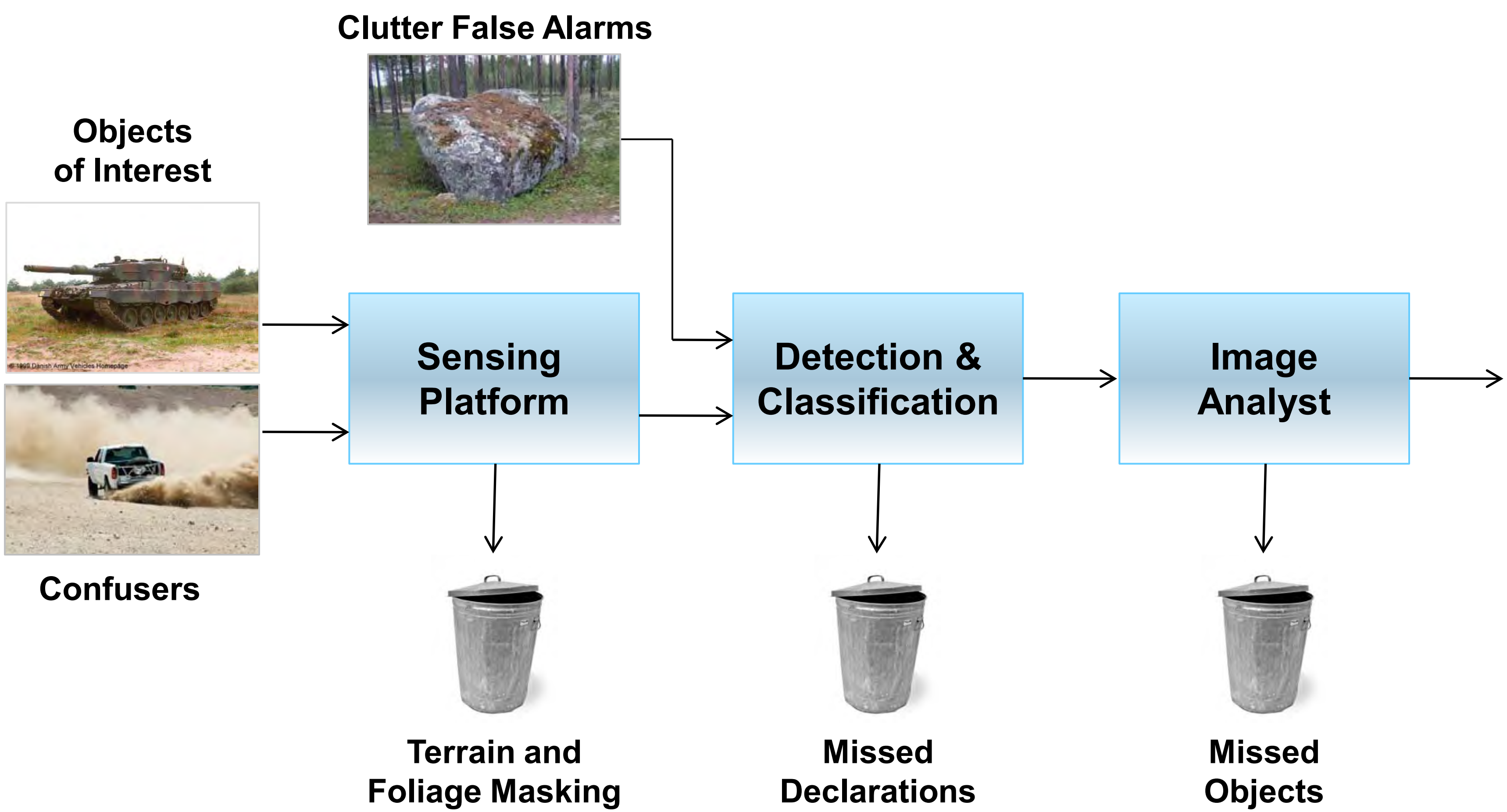
Generalized Tracking



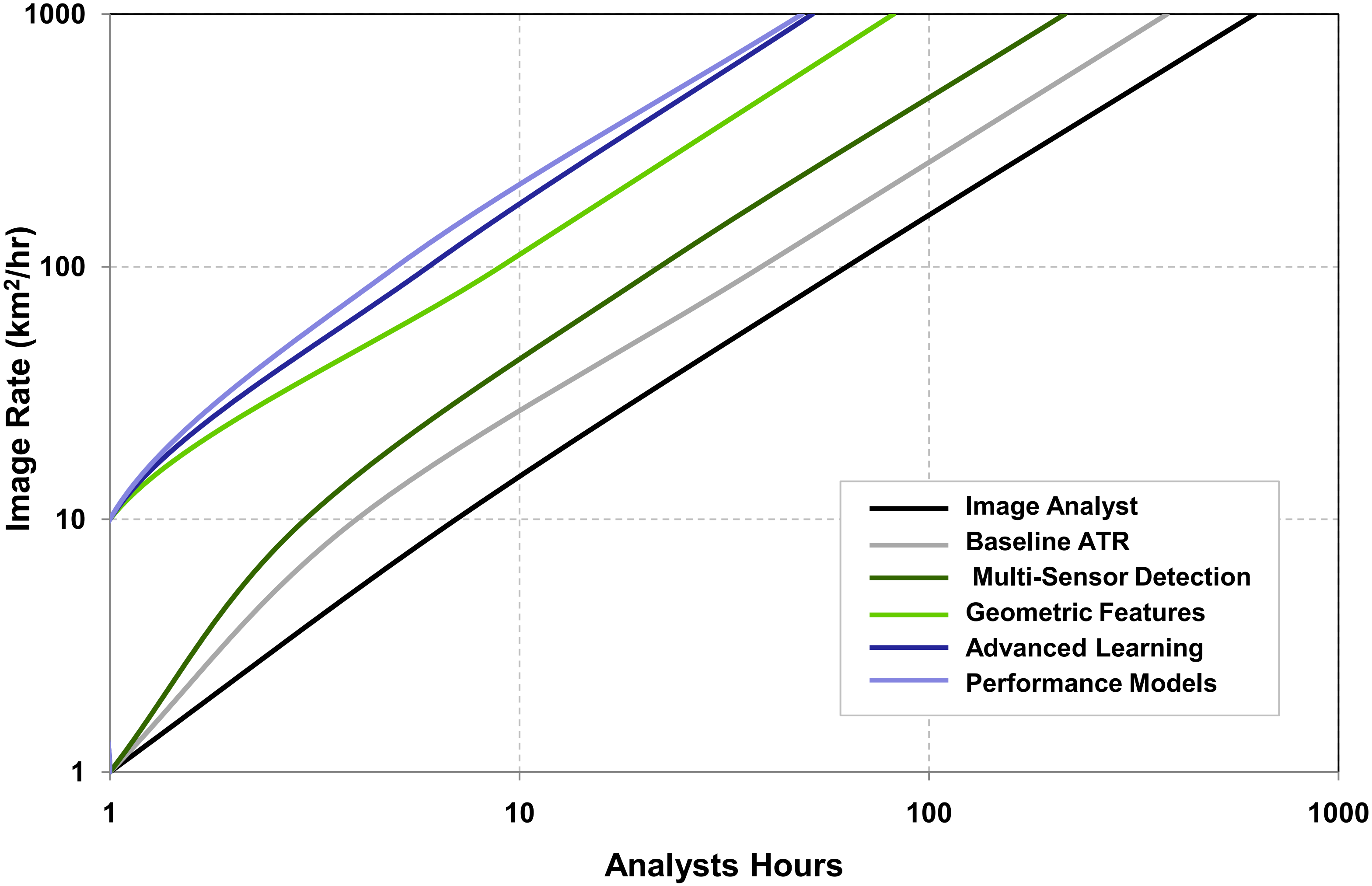
Tracking Analysis



Imagery Processing Chain



Detection/Classification Analysis



Text Analysis

	Advanced Machine Translation	HSCB Analysis	Document Exploitation (DOCEX)*	A&V from Text (Link/Temporal /Spatial)
Text Preparation (OCR, Speech, MT, Zoning)	TRL 3-6	TRL 3-6	TRL 3-6	TRL 3-6
Entity/Event Resolution & Consolidation	N/A	TRL 3-6	TRL 3-6	TRL 1-3
Advanced Entity/Relation/Event Extraction	N/A	TRL 1-3	TRL 3-6	TRL 1-3
Time/Location Stamping	N/A	TRL 3-6	TRL 1-3	TRL 1-3
Subjectivity/Sentiment Extraction	N/A	TRL 1-3	TRL 3-6	TRL 3-6
Text Mining	N/A	TRL 3-6	TRL 1-3	TRL 1-3
Portability (Genre/Domain/Language)	TRL 1-3	TRL 1-3	TRL 1-3	TRL 1-3
Multilingual Extraction	TRL 1-3	TRL 1-3	TRL 1-3	TRL 3-6

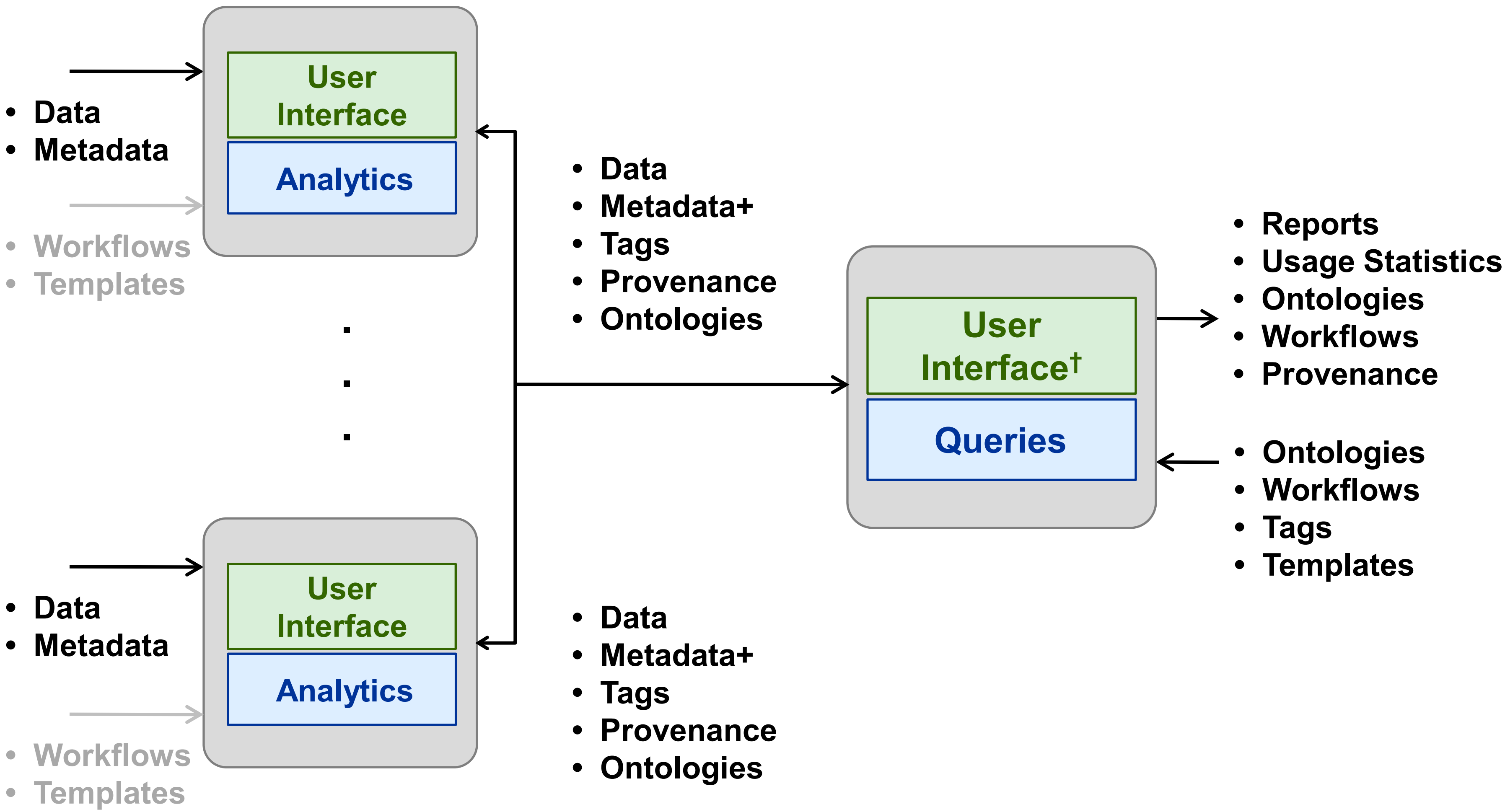
* This refers *to operational* Document Exploitation *(*DOCEX); when Special Ops Forces (SOF) finds hard copy documents at a site and we need to process for intel info

Acronyms & Abbreviations
A&V = Analysis & Visualization
HSCB = Human Social Cultural Behavioral
MT = Machine Translation
OCR = Optical Character Recognition

N/A TRL 6-9 TRL 3-6 TRL 1-3

User Interface Layer

- Analysts (Single Source)
- Aggregators (All-Source)



†End User Programmable

User Interaction Layer

- **Problem Statement: Existing interface tools do not support the user's need to collaborate, visualize, adapt and manage knowledge gained from sensing assets**

- **3-to-5 year timeframe objective**
  - User tools that aid data discovery, link communities, support aggregation and provide natural user interfaces

- **7-to-10 year timeframe objective**
  - Never-ending learning systems that maintain and reason over millions of facts to identify new knowledge
  - Workflow tools that capture and teach analysts' best practices

Summary

- The Data-to-Decisions program develops technology for the rapid development of flexible new Decision Support Systems
- Program consists of a series of relevant challenge problems that advance the underlying technology in data management, analytics and user interfaces
- Execution is through a consortium that addresses the challenge problems in a coherent and integrated team approach
- Major research initiatives focus on developing extendable analytic approaches and advanced user-interface modules

Fiscal Year 2012
President's Budget Request
for the
DoD Science & Technology Program
June 21, 2011

Mr. Bob Baker
Deputy Director, Plans & Programs,
Assistant Secretary of Defense (Research & Engineering)

Outline

- *Guidance from the Chain of Command*
- *FY2012 S&T President's Budget Request*
- *Historical Context*
- *Strategic Planning & Budget Changes*

Connecting Researchers to the Warfighter

President Obama, State of the Union, January 25, 2011

*"The first step in winning the future is encouraging American innovation. Our free enterprise system is what drives innovation. But because it's not always profitable for companies to invest in **basic research**, throughout our history, our government has provided cutting-edge **scientists** and inventors with the support they need.*

*Two years ago, I said that we needed to reach a level of **research and development ,** we haven't seen since the Space Race. And in a few weeks I'll be sending a budget to Congress that helps us meet that goal. We'll **invest in biomedical research, information technology, and especially clean energy technology** -- an investment that will strengthen our security, protect our planet, and create countless new jobs for our people.*

*Maintaining our **leadership in research and technology** is crucial to America's success. But if we want to win the future - - if we want innovation to produce jobs in America and not overseas – then we also have to win the race to educate our kids.*

*Over the next 10 years, with so many baby boomers retiring from our classrooms, we want to prepare 100,000 new teachers in the **fields of science and technology and engineering and math.**"*

Investment in Basic and Applied Research is a commitment to the future warfighter

Thoughts from the Secretary of Defense

Secretary Gates, Budget Rollout Hearing 14 Feb 2011

"These budget decisions took place in the context of a nearly two year effort by the DoD to reform the way the Pentagon does business – to change how and what we buy…We have protected programs that support military people, readiness, and modernization…We still live in a very dangerous and often unstable world. Our military must remain strong and agile enough to face a diverse range of threats – from non-state actors attempting to acquire and use weapons of mass destruction and sophisticated missiles, to the more traditional threats of other states… "

"Directed DoD to fund 2% real growth in Basic Research and to maintain stable funding in the rest of S&T for FY12-FY16. In real terms, the FY12 S&T budget request is almost 29% greater than the request in FY 2000." ***OSD/PA News Release, 2/14/11***

Continuing the Reform Agenda

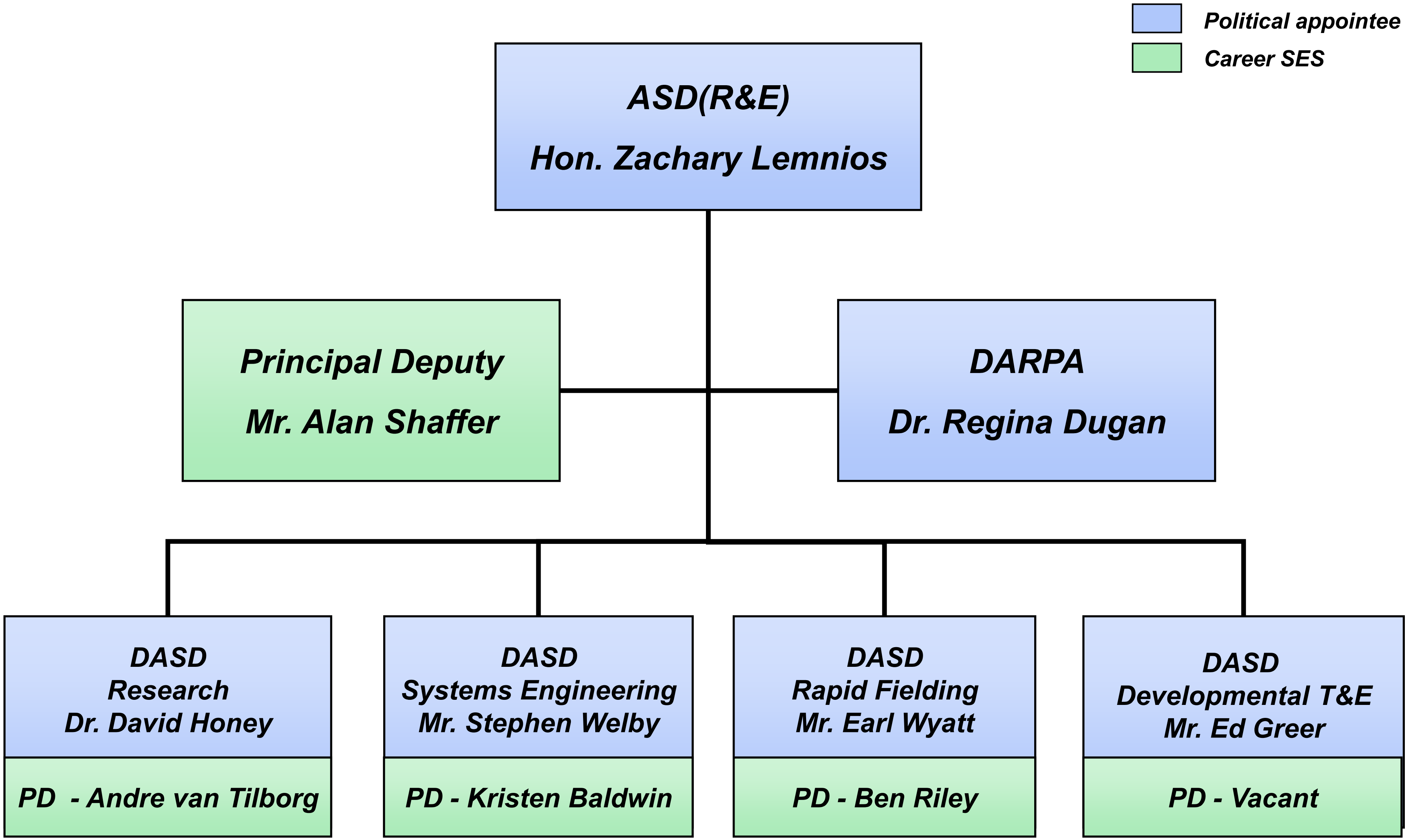
"Budget represents a reasonable, responsible, and sustainable level of funding" - Secretary Gates, Budget Rollout Brief (2/14/2011)

- **Taking Care of People**
- **Rebalancing Military Capabilities**
- **Reforming What and How We Buy**
- **Supporting our Troops in the Field**

ASD(R&E) Imperatives

- **Accelerate delivery of technical capabilities to win the current fight.**
  - Solve the most difficult near term problems and transition compelling concepts to the warfighter.
- **Prepare for an uncertain future.**
  - Shape the Department's science and technology investments to open options that counter (and create) strategic surprise.
- **Reduce the cost, acquisition time and risk of our major defense acquisition programs.**
  - Provide systems engineering leadership, deep system analysis, and technical assessments across the Department.
- **Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.**

ASD(R&E) – Organization



Outline

- ***Guidance from the Chain of Command***
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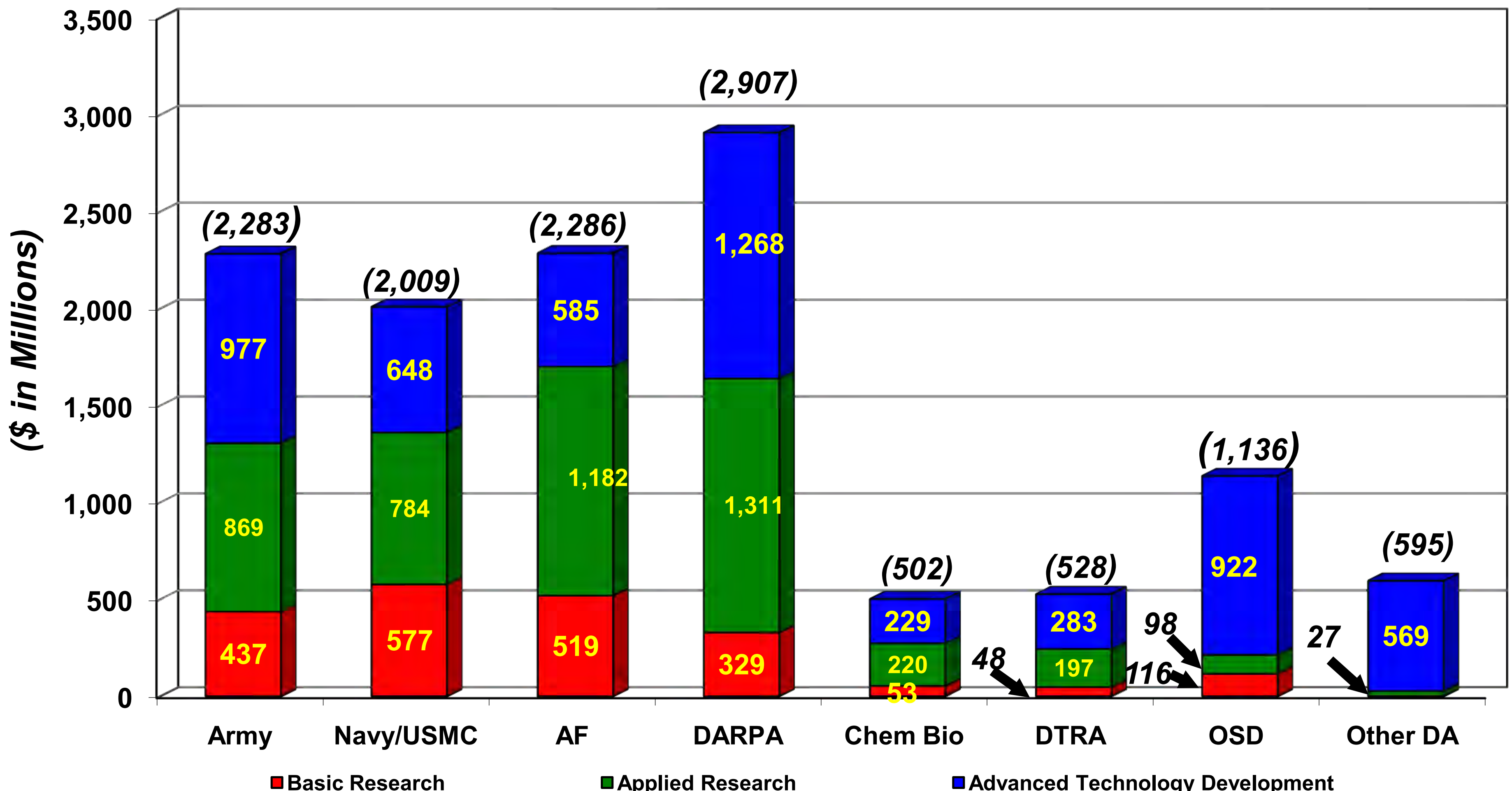
FY12 DoD S&T Budget Request

Total FY12 S&T request = $12.25B

Total FY11 S&T Request = $11.82B

Army = 1,945 Navy = 1,961 AF = 2,191 DARPA = 3,026 ChemBio = 396 DTRA = 555 OSD = 1,356 Other DA = 389



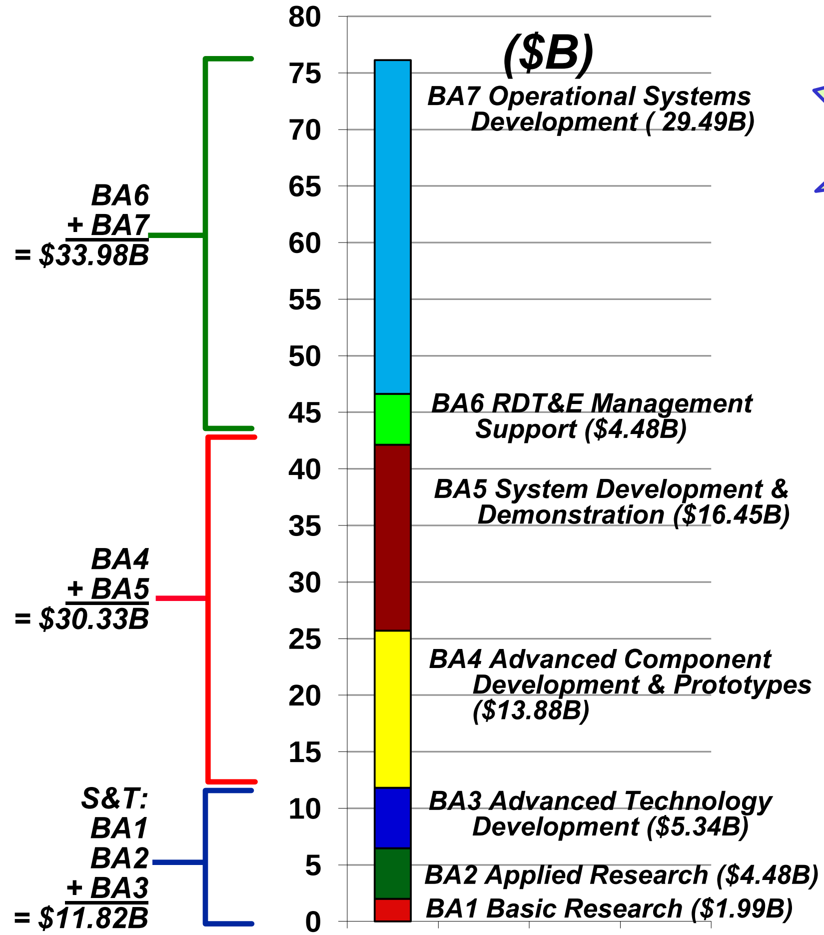
FY12 President's Budget Request

BP12	BA	FY11	FY12	FY13	FY14	FY15	FY16
		PBR 11	PB12 CIS	PB12 CIS	PB12 CIS	PB12 CIS	PB12 CIS
DoD	**BA 1**	**1,998,797**	**2,078,470**	**2,137,917**	**2,221,206**	**2,305,688**	**2,404,212**
DoD	**BA 2**	**4,475,822**	**4,687,273**	**4,680,455**	**4,712,527**	**4,758,137**	**4,854,129**
DoD	**BA 3**	**5,344,430**	**5,481,225**	**5,765,877**	**5,874,758**	**6,028,726**	**6,126,183**
	DoD S&T	**11,819,049**	**12,246,968**	**12,584,249**	**12,808,491**	**13,092,551**	**13,384,524**
Army	BA 1	406,873	436,920	440,492	456,268	470,582	487,449
	BA 2	841,364	869,332	860,648	856,203	840,534	832,660
	BA 3	696,592	976,812	949,153	983,936	966,542	983,685
	Army S&T	**1,944,829**	**2,283,064**	**2,250,293**	**2,296,407**	**2,277,658**	**2,303,794**
Navy	BA 1	556,425	577,372	599,398	622,310	646,079	670,756
	BA 2	678,680	783,794	782,973	772,408	809,831	821,744
	BA 3	725,599	648,217	606,260	641,203	629,779	641,636
	Navy S&T	**1,960,704**	**2,009,383**	**1,988,631**	**2,035,921**	**2,085,689**	**2,134,136**
AIR FORCE	BA 1	500,473	518,859	538,233	558,331	579,179	600,805
	BA 2	1,181,420	1,181,874	1,187,232	1,203,560	1,227,057	1,250,541
	BA 3	509,305	585,404	562,607	579,470	590,288	600,329
	Air Force S&T	**2,191,198**	**2,286,137**	**2,288,072**	**2,341,361**	**2,396,524**	**2,451,675**
Def-Agencies	BA 1	535,026	545,319	559,794	584,297	609,848	645,202
	BA 2	1,774,358	1,852,273	1,849,602	1,880,356	1,880,715	1,949,184
	BA 3	3,412,934	3,270,792	3,647,857	3,670,149	3,842,117	3,900,533
	Def-Agencies S&T	**5,722,318**	**5,668,384**	**6,057,253**	**6,134,802**	**6,332,680**	**6,494,919**

FY11 and FY12 RDT&E Budget Request Comparison

- in Then Year Dollars -

FY11 RDT&E request = $76.13B
(Budget Activities 1-7)

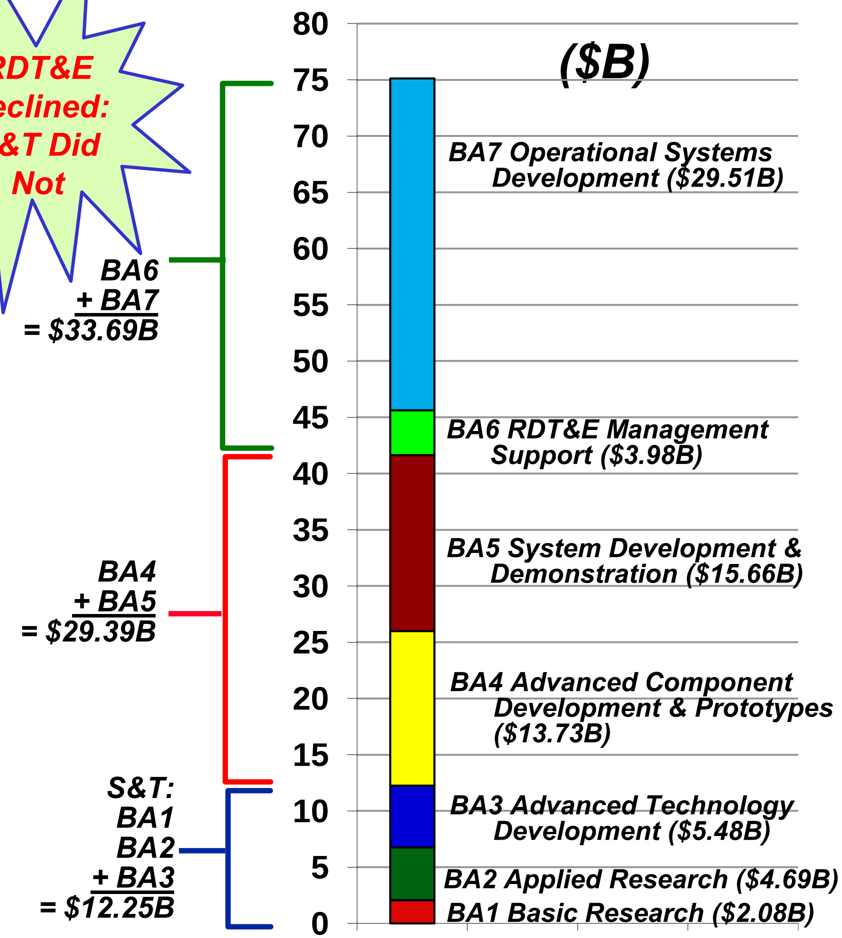


Technology Base (BA1 + BA2) = $6.47B

PBR11 S&T is 15.5% of RDT&E

RDT&E Declined: S&T Did Not

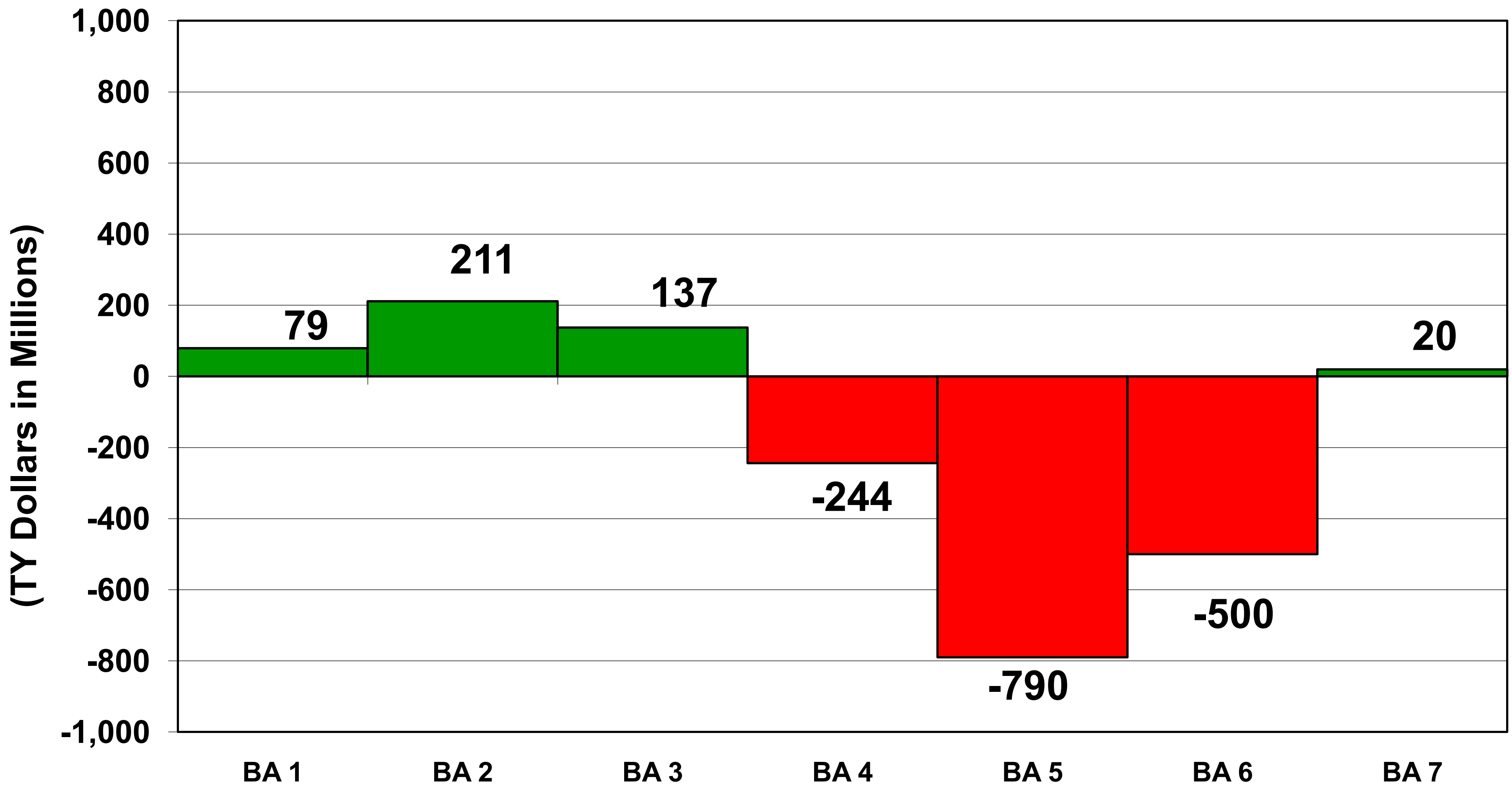
FY12 RDT&E request = $75.33B
(Budget Activities 1-7)



Technology Base (BA1 + BA2) = $6.77B

PBR12 S&T is 16.2% of RDT&E

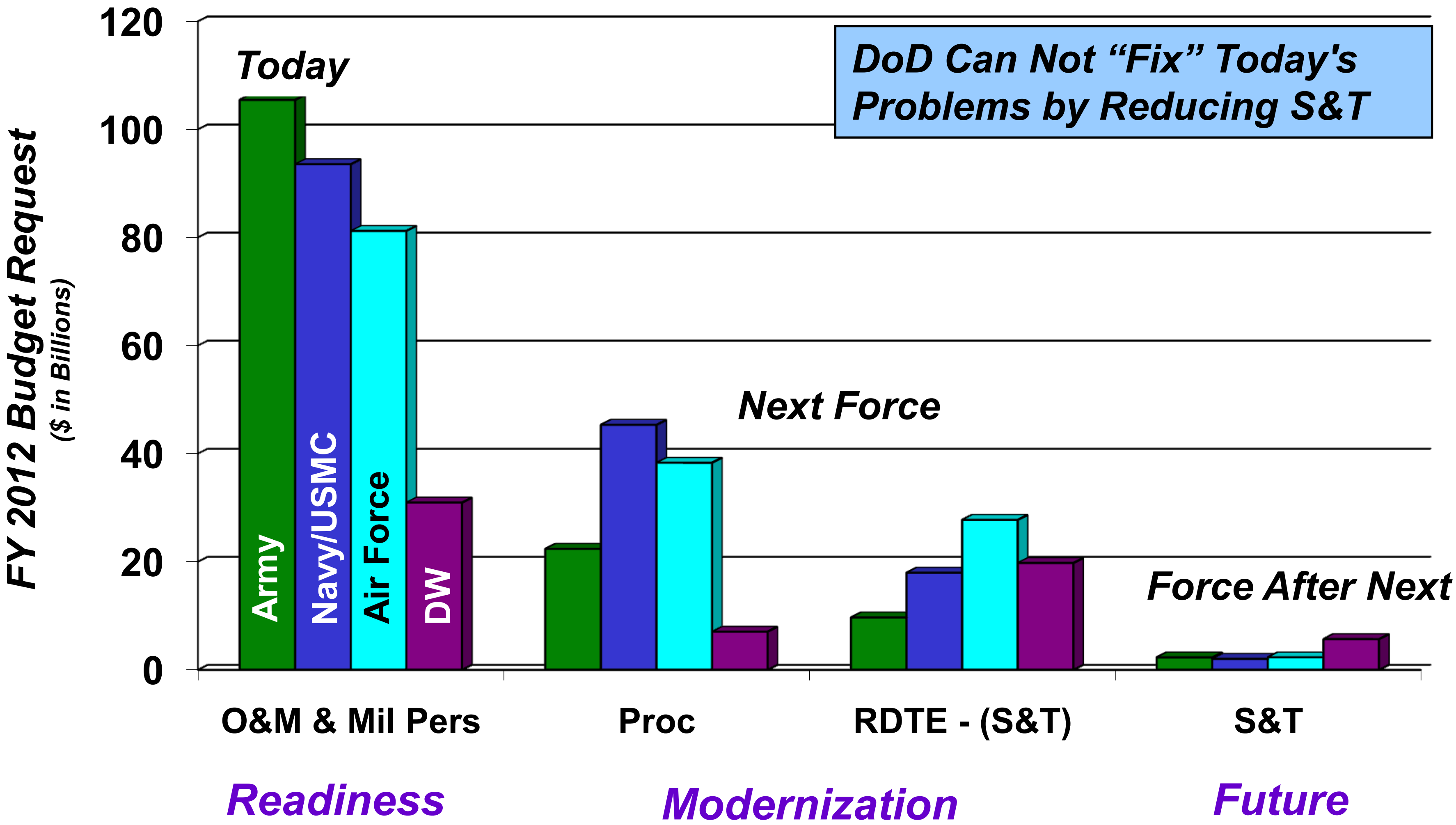
RDT&E Budget Request Overview
- FY11 and FY12 Comparison -



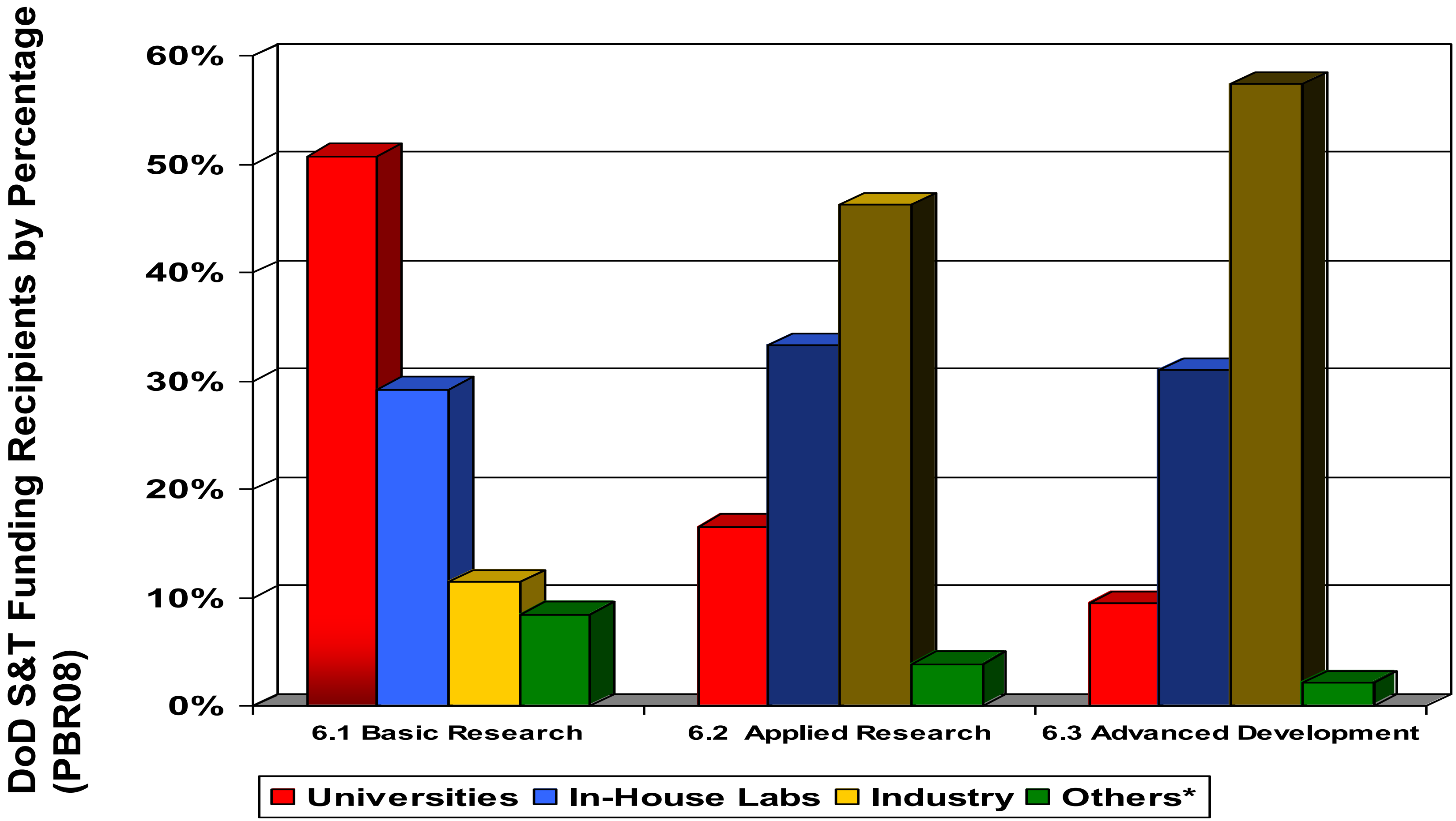
FY12 DoD R&E Budget Request Comparison

	PBR 2010	PBR 2011 *(CY FY11 $)*	PBR 2012 *(CY FY11 $)*	Real Change from PBR11 to PBR12 (CY FY11 $)
Basic Research (BA 1)	1,798	1,999	2,078 (2,043)	+2.2%
Applied Research (BA 2)	4,247	4,476	4,687 *(4,608)*	+2.9%
Advanced Technology Development (BA 3)	5,605	5,344	5,481 *(5,388)*	0.8%
DoD S&T	**11,649**	**11,819**	**12,247 *(12,039)***	**1.9%**
Advanced Component Development and Prototypes (BA 4)	14,306	13,877	13,733 *(13,401)*	-3.4%
DoD R&E (BAs 1 – 4)	**25,956**	**25,696**	**25,880 *(25,440)***	**-1.0%**
DoD Topline	**533,813**	**549,093**	**566,341 *(556,710)***	**+1.4%**

FY12 Technology Investment Compared to Other DoD Categories



Recipients of DoD S&T Funds



***Includes non-profit institutions, State & local govt., & foreign institutions**

Source: National Science Foundation Report (PBR08)

Outline

- ***Guidance from the Chain of Command***
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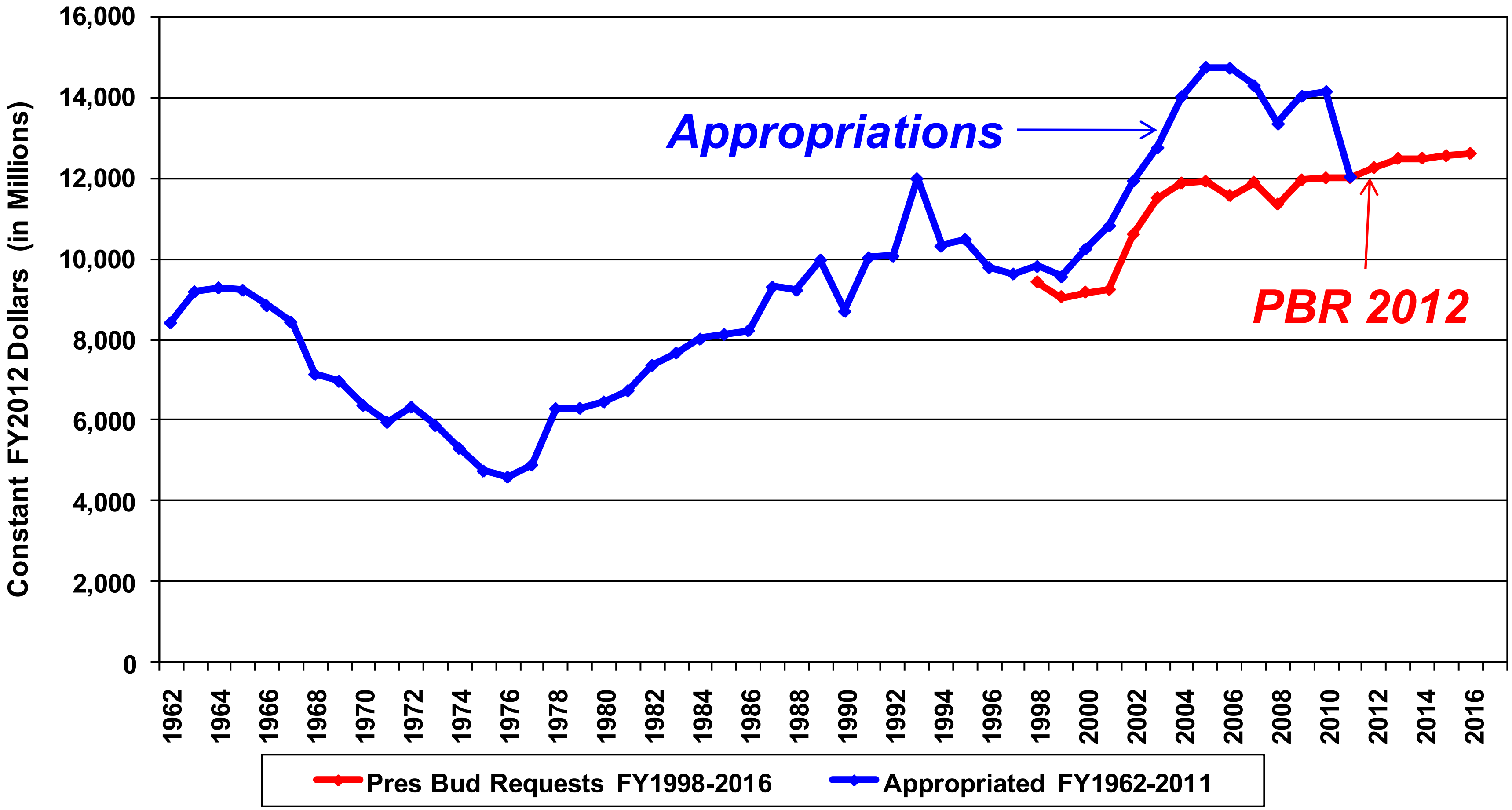
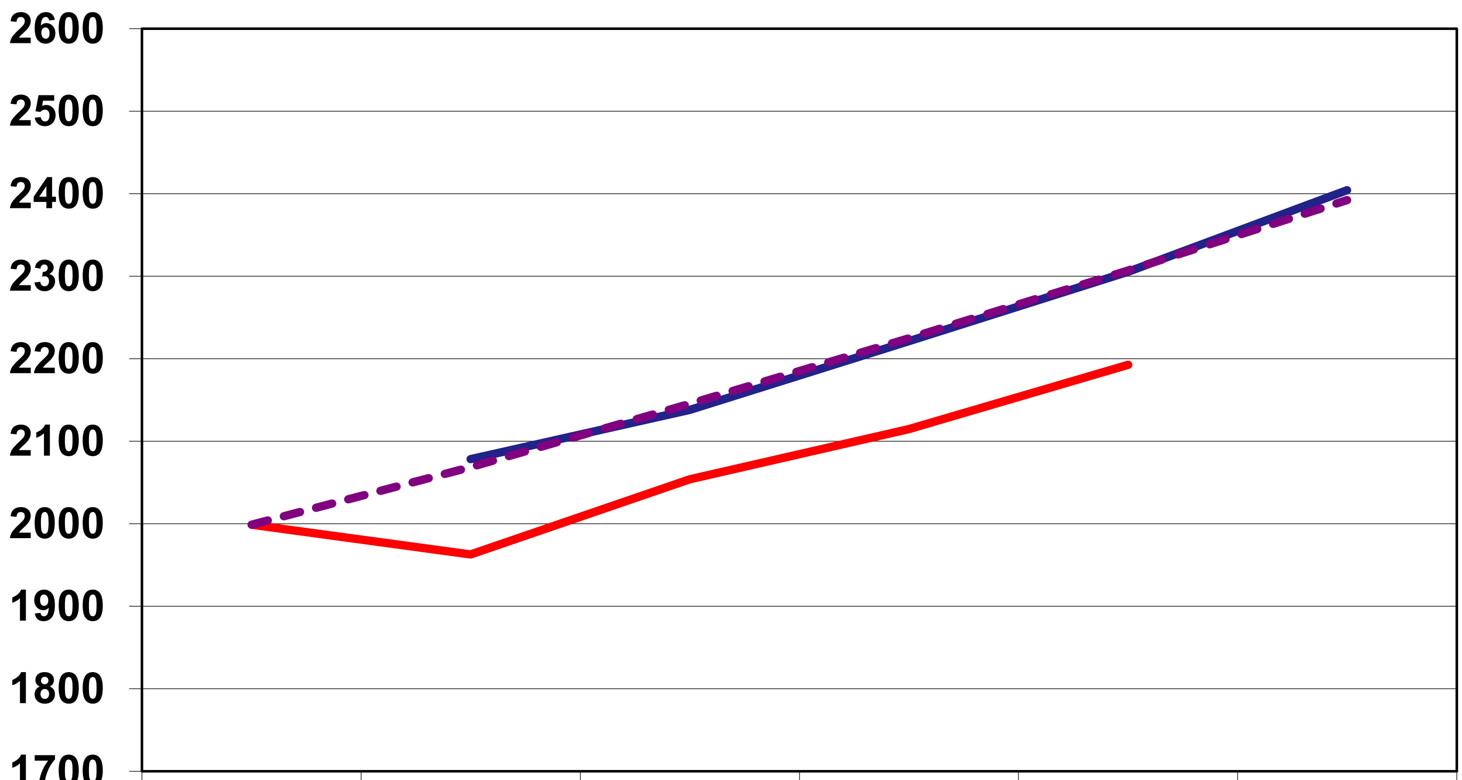
DoD S&T FUNDING: FY1962-2016
(Constant FY12 Dollars)



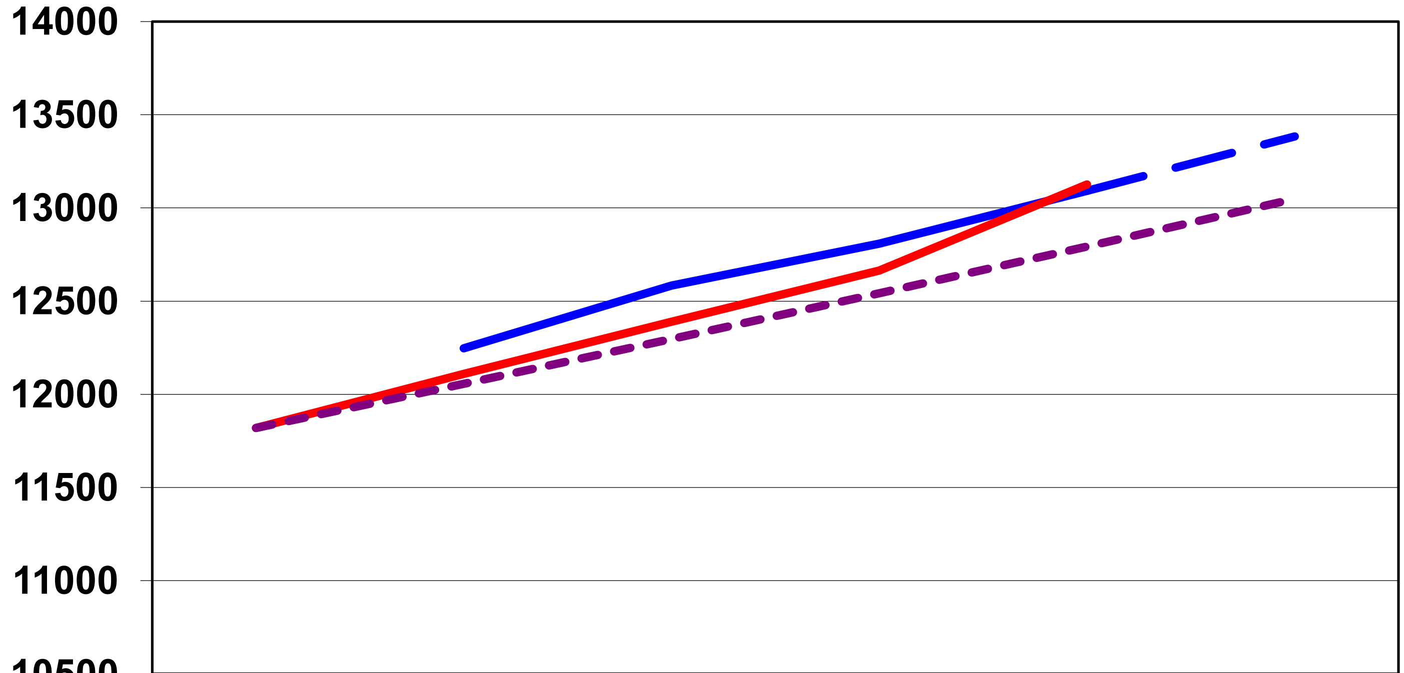
DoD Basic Research

(TY Dollars in Millions)



	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016
PBR-12		2,078	2,138	2,221	2,306	2,404
PBR-11	1,999	1,963	2,054	2,115	2,193	
2% RPG	1,999	2,069	2,145	2,225	2,307	2,392
∆ - PBR11 versus PBR12		116	84	106	113	

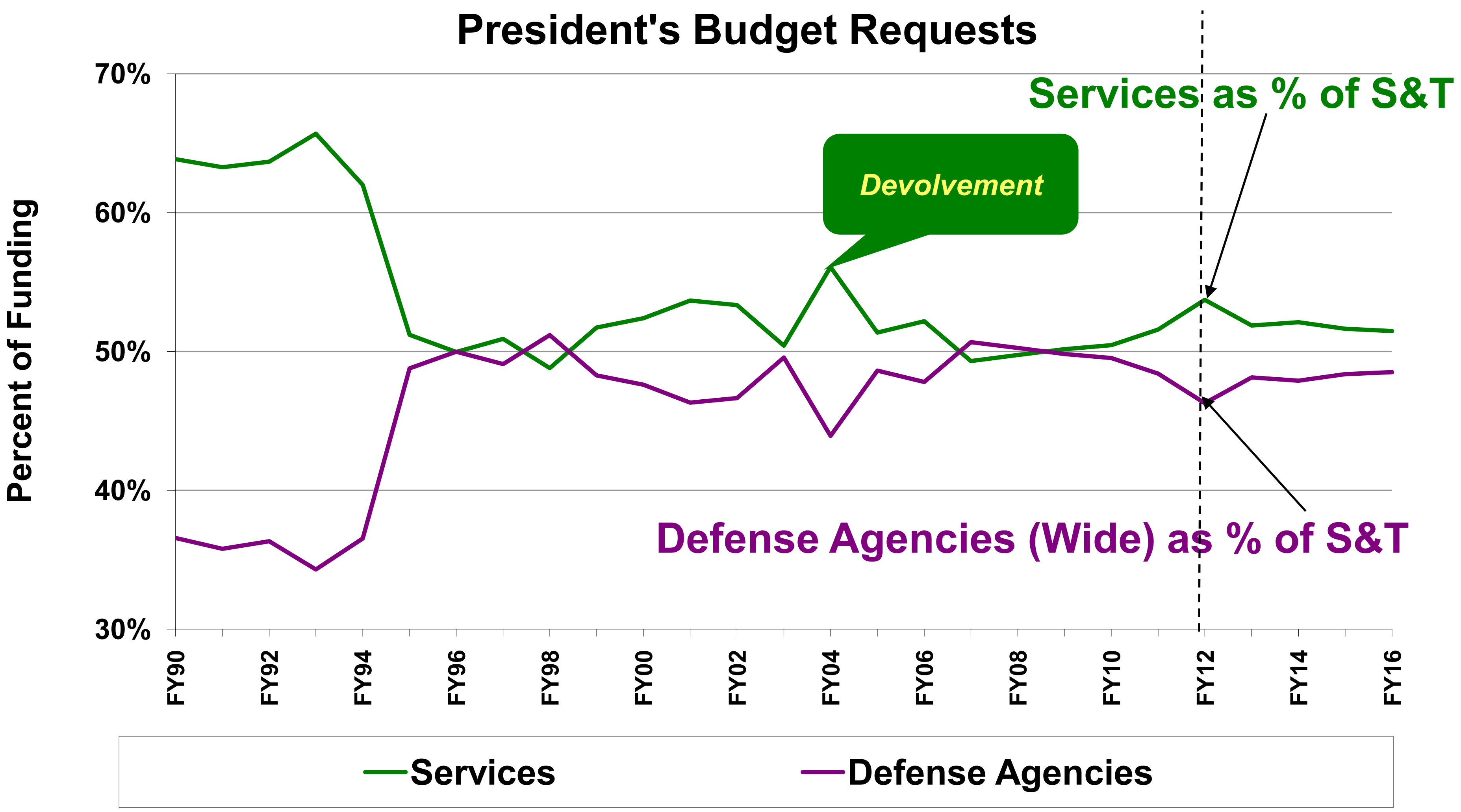
DoD Science & Technology
(TY Dollars in Millions)



	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016
PBR-12		12,247	12,584	12,808	13,093	13,385
PBR-11	11,819	12,109	12,390	12,663	13,125	
0% RPG	11,819	12,055	12,297	12,542	12,793	13,049
Δ - PBR12 versus PBR11		138	194	145	-33	

S&T Breakout

- Services and Defense Agencies (Wide) as % of Total S&T -



Outline

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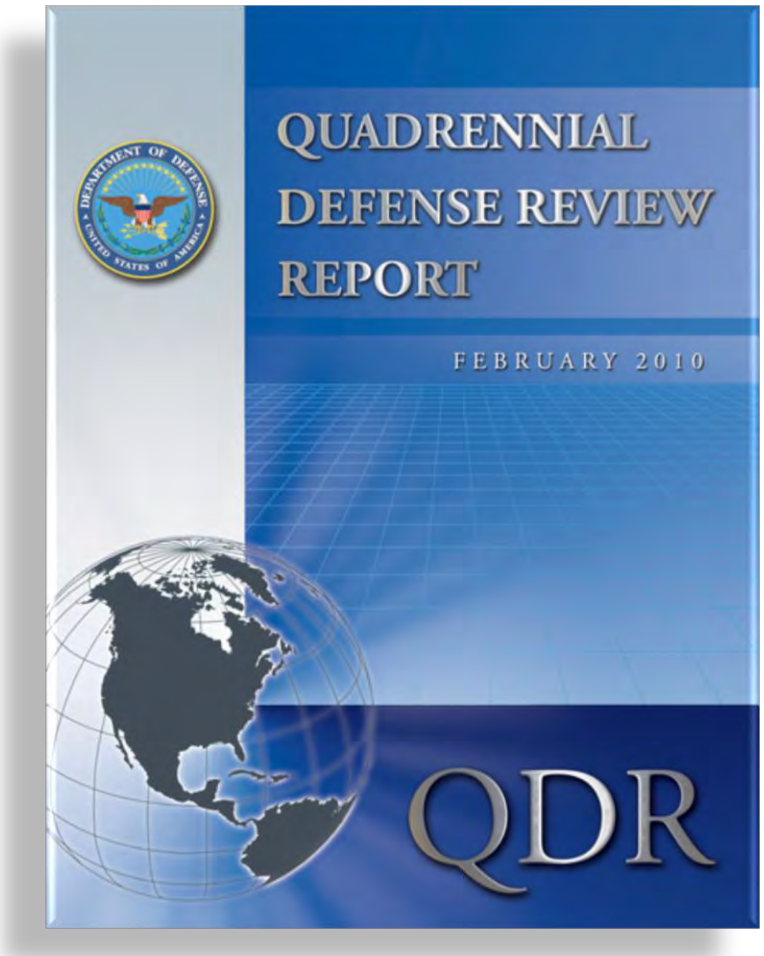
Quadrennial Defense Review Key Mission Areas (KMAs)



1. *Defend the United States and Support Civil Authorities at Home*
2. *Succeed in Counterinsurgency, Stability, and Counterterrorist Operations*
3. *Build the Security Capacity of Partner States*
4. *Deter and Defeat Aggression in Anti-Access Environments*
5. *Prevent Proliferation and Counter Weapons of Mass Destruction*
6. *Operate Effectively in Cyberspace.*

QDR 2006 vs. QDR 2010

QDR 2006 Strategic Outcomes

1. ***Defend the Homeland in Depth***
2. ***Defeat Terrorist Networks***
3. ***Shape the Choices of Countries at Strategic Crossroads***
4. ***Prevent the Acquisition or use of Weapons of Mass Destruction***

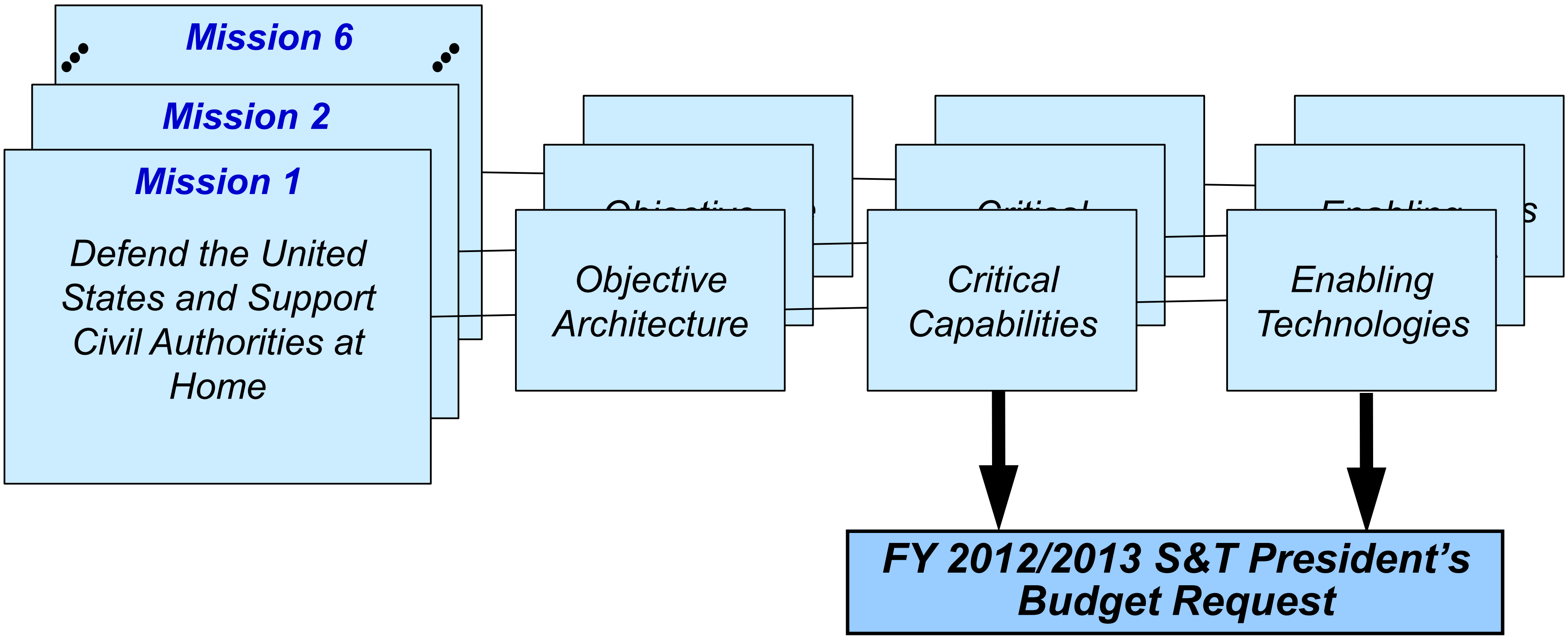
QDR 2010 Key Mission Areas

1. ***Defend the United States and Support Civil Authorities at Home***
2. ***Succeed in Counterinsurgency, Stability, and Counterterrorism Operations***
3. ***Build the Security Capacity of Partner States***
4. ***Deter and Defeat Aggression in Anti-Access Environments***
5. ***Prevent Proliferation and Counter Weapons of Mass Destruction***
6. ***Operate Effectively in Cyberspace***

QDR 2010 Builds on QDR 2006

- Anti-Access and Cyberspace are New -

QDR Key Mission Area Studies Approach



Priority S&T Investment Areas for FY 2013-2017

- **Data-to-Decisions**
  - Science and applications to reduce the cycle time and manpower requirements for analyses and use of large data sets.
- **Engineered Resilient Systems**
  - Engineering concepts, science, and design tools to protect against malicious compromise of weapon systems, and to develop agile manufacturing for trusted and assured defense systems.
- **Cyber Science and Technology**
  - Science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- **Electronic warfare / Electronic protection**
  - New concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
- **Counter Weapons of Mass Destruction (WMD)**
  - Advances in DoD’s ability to locate, secure, monitor, tag, track, interdict, eliminate, and attribute WMD weapons and materials.
- **Autonomy**
  - Science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks in all environments.
- **Human Systems**
  - Science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.

Big Moves DoD Wide

FY2012

	Program	Funding (Increase from FY11PBR-FY12PBR)	Agency
	Taking Care of People		
1	Defense Health	~ $ 125 M	DHP; Services
	Force Protection		
2	Chemical Bio-Defense Program	~ $ 100 M	NCB
3	Cyber S&T	~ $ 76 M	DARPA
4	Force Protection	~ $ 49 M	Navy & Army
5	RF Systems	~ $ 45 M	Navy
	Prepare for Uncertain Future		
6	Info & Communications Technology	~ $ 120 M	DARPA; AF
7	Weapons Technology	~ $ 62 M	Services
8	Undersea Warfare	~ $ 30 M	Navy
	TOTALS	~ $ 607 M	

Big S&T Moves, Last Three Budgets

FY2010 (~$1.8B across the FYDP)	***FY2011 (~$1.6B across the FYDP)***
Medical S&T (Wounded Warrior) (~$2.5B total; ~$1B in S&T, remainder DHP)	7% increase in FY11 Basic (6.1) and Applied Research (6.2) from FY10 base (~$544M)
Large Data Handling (ISR Cap) ~ $100M)	Deployable Force Protection (~$238M)
Cyber Protection (~ $100 M)	Cyber Security Research (~$200M)
Anti-Tamper (~$33M)	Night Vision Technology-Advanced Focal Plane Array ($94M)
High Temperature Materials (~$70M)	High Energy Laser Advanced Technology ($512M)
Stand-off Detection of Fissile Materials (~$300)	
High Performance Computing (~$100M)	
Minerva (Sociology Research) (~$100M)	

FY2012 (~$0.6B; $3.0 B across the FYDP)

Protection of Defense Health ($125 M)
Information and Communication Technology ($120 M)
Force Protection Technology ($49 M)
Chemical and Biological Defense Technology ($100 M)
Cyber Security ($76 M)
Advanced Undersea Warfare Applied Research ($30 M)

Key
Joint Programs
Multiple Executors
Army
Navy
Air Force

Summary

- Overall S&T up 1.9% (in real terms) from FY11 PBR
  - Grew at a faster rate than DoD top line (1.4%)
  - All three categories (6.1, 6.2. 6.3) had real growth
  - RDT&E is down, but S&T is up
- Met SECDEF Guidance
- Big Moves Included:
  - Protection of Defense Health Program
  - Information and Communications Technology
  - Cyber S&T
  - Force Protection
  - Chemical and Biological Research
  - Weapons Technology

How Capabilities are Developed and Delivered to the Combatant Commanders
June 23, 2011

Mr. Bob Baker
Deputy Director, Plans & Programs
Assistant Secretary of Defense (Research & Engineering)

Service vs. COCOM Responsibilities

Military Services / Departments

Organize, Train & Equip

+

Combatant Commanders

Operationally Employ

How Capabilities are Developed and Delivered to the Combatant Commanders

Adaptive Response to Urgent Needs

- Rapid Acquisition / Procurement / Rapid Fielding

Transition to Procurement & Sustainment

- Joint Training / Global Force Allocation

Readiness & Suitability Confirmation

- Test & Evaluation
- Military assessment of utility

Functional Validation; Tailored Form/Fit/Function

- Demonstration

Technical Concept Design & Development

- Prototyping

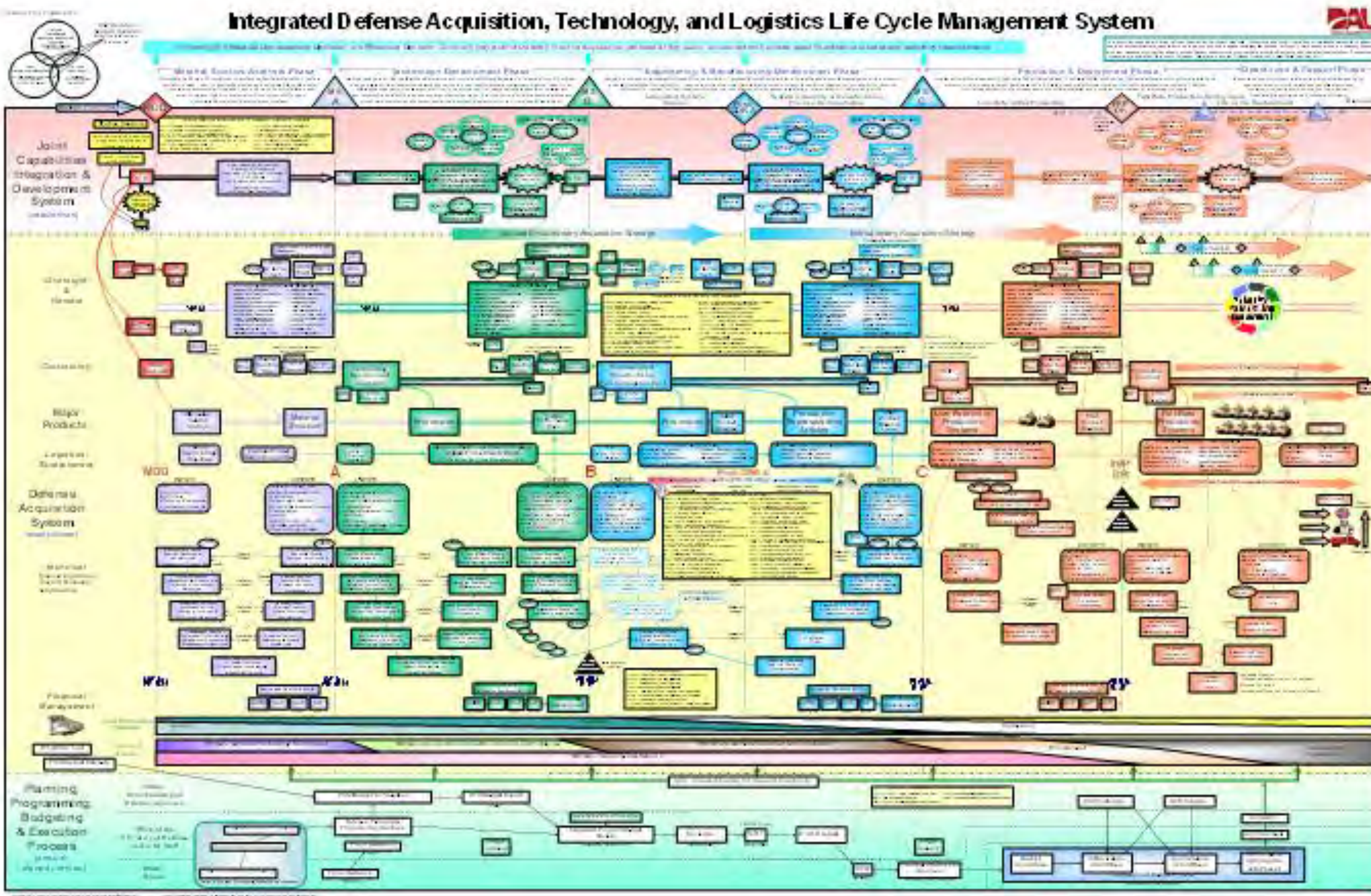
Alternatives Development & Assessment

- Experimentation
- Red Teaming Analysis

Conceptualization

- Needs identification / lessons learned / assessment
- Tech push exploitation

Defense Acquisition Process



ASD(R&E)Key Demonstration & Fielding Programs

Funds: Research, Development, Test & Evaluation | Procurement | O&M

TRL 1 - 3 | TRL 4 | TRL 5 | TRL 6 | TRL 7 | TRL 8 | TRL 9

Pre-Concept | Mtrl. Solution Analysis | A | Technology Development | B | Engineering & Manufacturing Development | C | Production & Deployment | Sustainment & Maintenance

Tech Demos for Irregular Warfare

Rapid Reaction Fund (RRF)

PE 0603826D8Z

TRL: Technology Readiness Level
OCO: Overseas Contingency Operations

New Breakthrough Capabilities to Operations

Biometrics & Forensics S&T

PE 0603665D8Z

Operational Experiments & Tech Integration for COCOMs & Interagency

Emerging Capabilities (EC)

PE 0603699D8Z

COCOM, Joint, Coalition & Interagency Capability Needs

Joint Capabilities Technology Demonstrations (JCTDs)

PE 0603648D8Z

"Gap-Filling" Technologies for OCO

Quick Reaction Funds (QRF)

PE 0603826D8Z

Assess Mature Technology from Coalition Industry

Foreign Comparative Testing (FCT)

PE 0605130D8Z

Rapid Reaction Fund (RRF)

- **Description**
  - Identify & develop near-term capabilities to support irregular warfare needs within 6-18 months
- **Focus Areas**
  - Unmanned autonomous systems and behaviors
  - Evaluation of emerging commercial technologies for blue/red applications
  - Addressing and responding to enhanced enemy capabilities
  - ISR RDT&E architecture and integration venues
  - Countering violent extremism
  - Force Protection against advanced asymmetric threats
- **Participants**: COCOMs, Intel Community, Interagency, Services & Defense Agencies

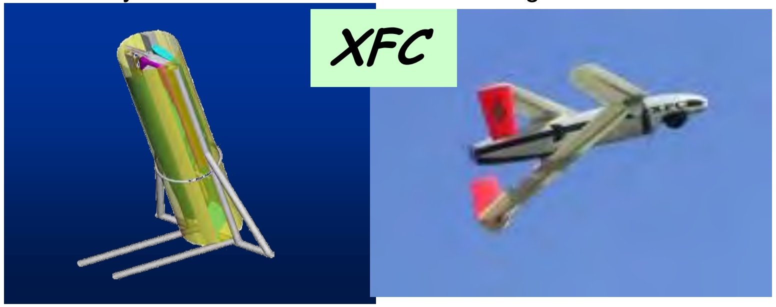
Sea Stalker

Demonstrate an operational autonomous ISR capability that can be launched from submarines and surface platforms

Folded Wing Ready for Non-Pyrotechnic Launch

Fuel Cell Powered for Long Endurance ISR

XFC



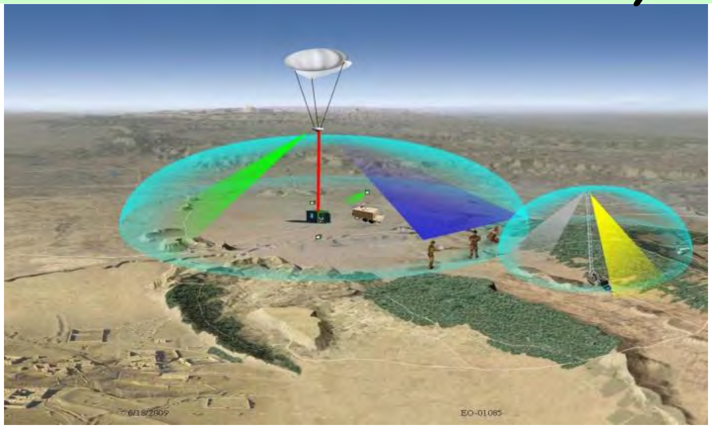
Development of a hydrogen fuel cell powered asymmetrical unmanned aerial system for persistent surveillance

Joint Capability Technology Demonstrations (JCTDs)

- **Description**
  - Provide technology capability solutions through rapid prototyping to solve urgent joint, coalition, and inter-agency gaps
  - Validated by Joint Staff and independent Military Utility Assessment
- **Focus Areas**
  - Most pressing military needs as identified by COCOM's capability gaps, including Joint Urgent Operational Needs (JUONs) & Integrated Priority Lists (IPLs)
  - Multiple new start opportunities annually to address emerging capability gaps within the budget period

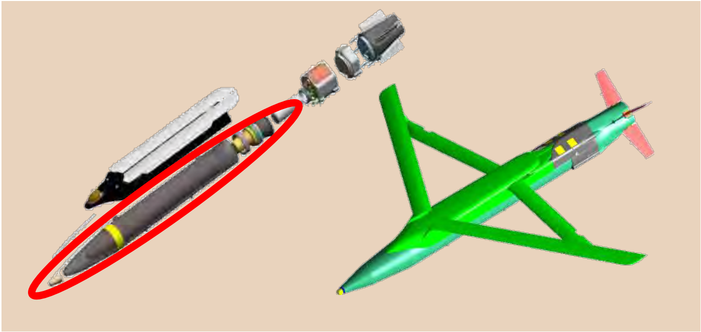
Participants: COCOMs, Coalition Partners, Services & Defense Agencies, Industry

Persistent Ground Surveillance Systems



Supports urgent need for persistent surveillance at forward operation bases in Afghanistan

Focused Lethality Munition



Demonstrate low collateral damage weapon - warhead with specialized fill to reduce frag & increase blast effects

Quick Reaction Fund (QRF)

- **Description**
  - Funds high priority, short duration technology demos during execution year responding to new adversary threats
  - Identify and develop near term capabilities to support conventional forces warfare urgent needs
  - Efforts completed within 12 months
- **Focus Areas**
  - Anti-Access Area Denial (FY 2012)
- **Participants**
  - Project Sponsors & Execution: Services & Defense Agencies
  - Efforts coordinated with Combatant Commanders / Joint Staff

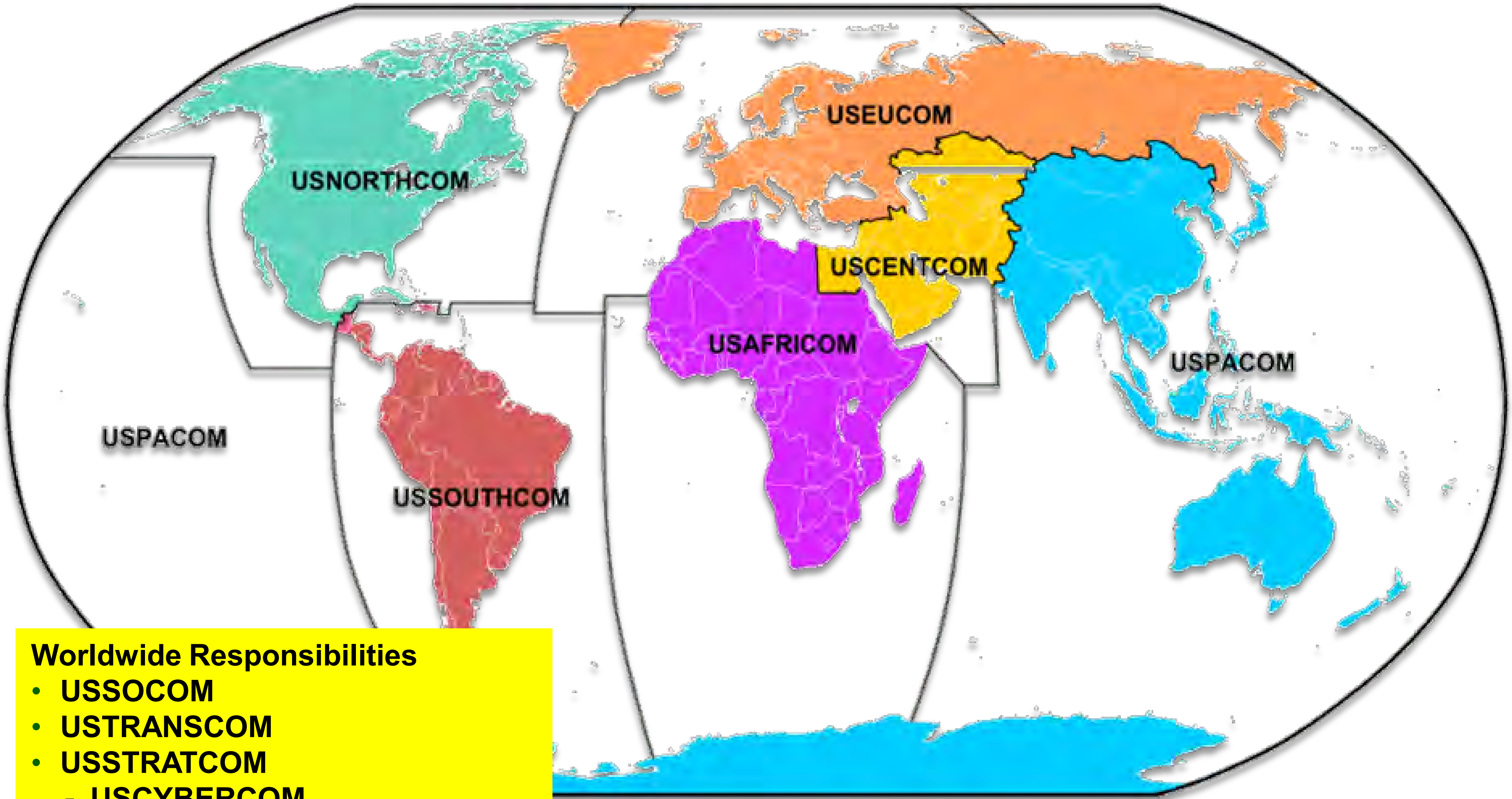
Gunslinger

Modular, vehicle based, on-the-move hostile fire detection and counter-fire capability

Deployable Satellite Communication System

Inflatable satellite antenna, designed to provide high-bandwidth SATCOM capability in a smaller, lighter package than conventional systems

Areas of Responsibility



Worldwide Responsibilities
- USSOCOM
- USTRANSCOM
- USSTRATCOM
  - USCYBERCOM

Process Used to Develop the DoD Science &Technology Priorities
June 21, 2011

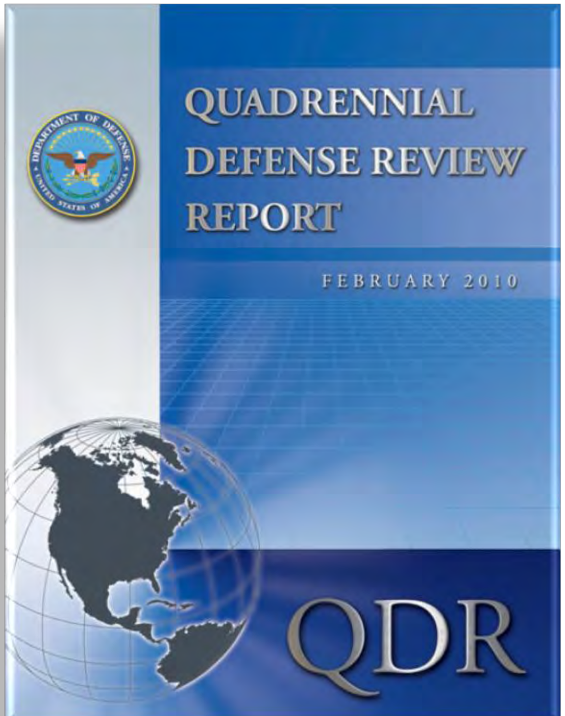
Mr. Bob Baker
Deputy Director, Plans & Programs
Assistant Secretary of Defense (Research & Engineering)

Process Began With the 2010 QDR

❑ **The 2010 QDR identified 6 Key Mission Areas (KMAs) that DoD should build capability capacity to be successful in the future global security environment**

- ***Defend the United States and Support Civil Authorities at Home***
- ***Succeed in Counterinsurgency, Stability, and Counterterrorist Operations***
- ***Build the Security Capacity of Partner States***
- ***Deter and Defeat Aggression in Anti-Access Environments***
- ***Prevent Proliferation and Counter Weapons of Mass Destruction***
- ***Operate Effectively in Cyberspace.***

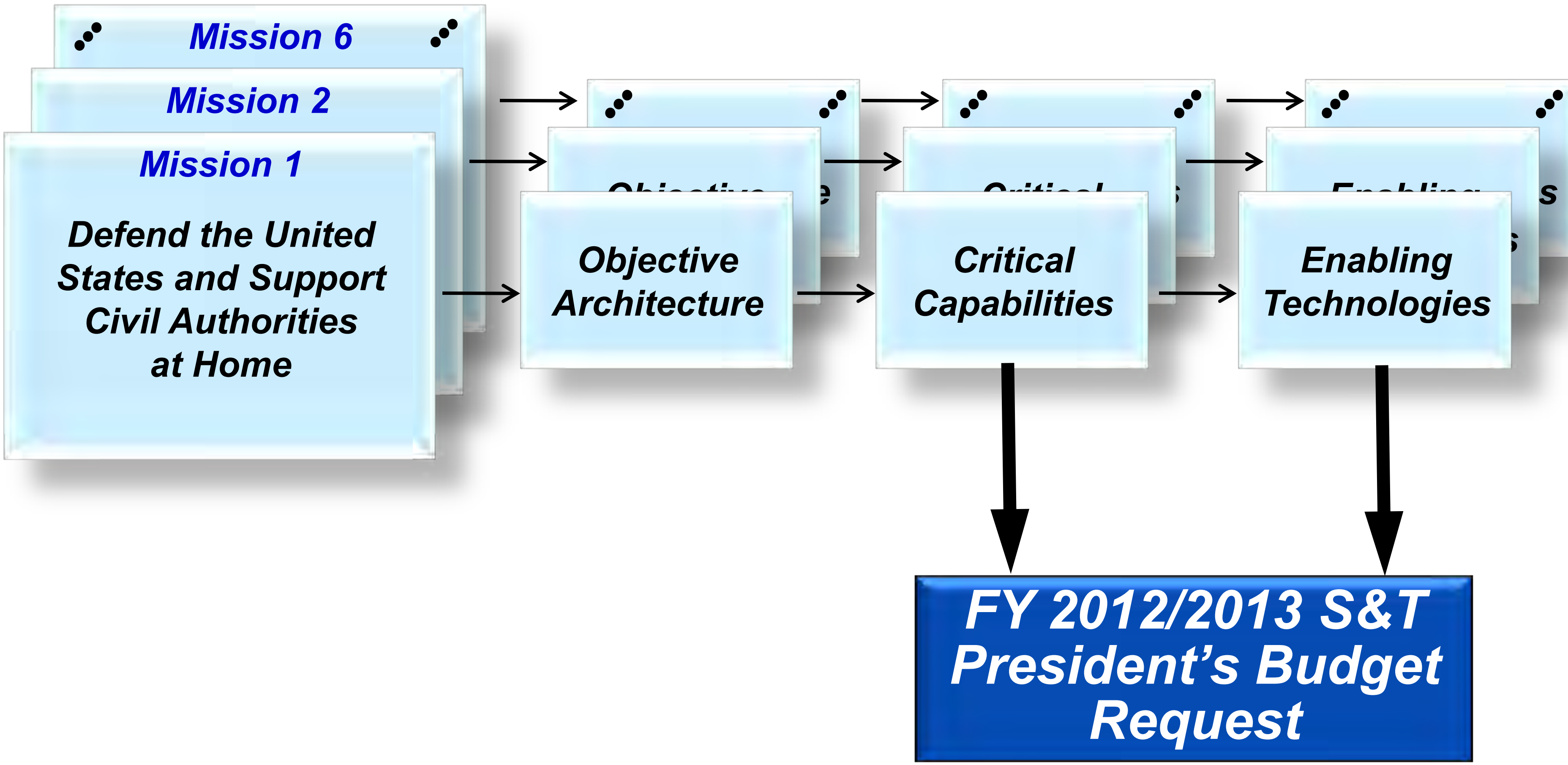
QDR Key Mission Areas and Department Planning and Programming Guidance (DPPG) Tasking



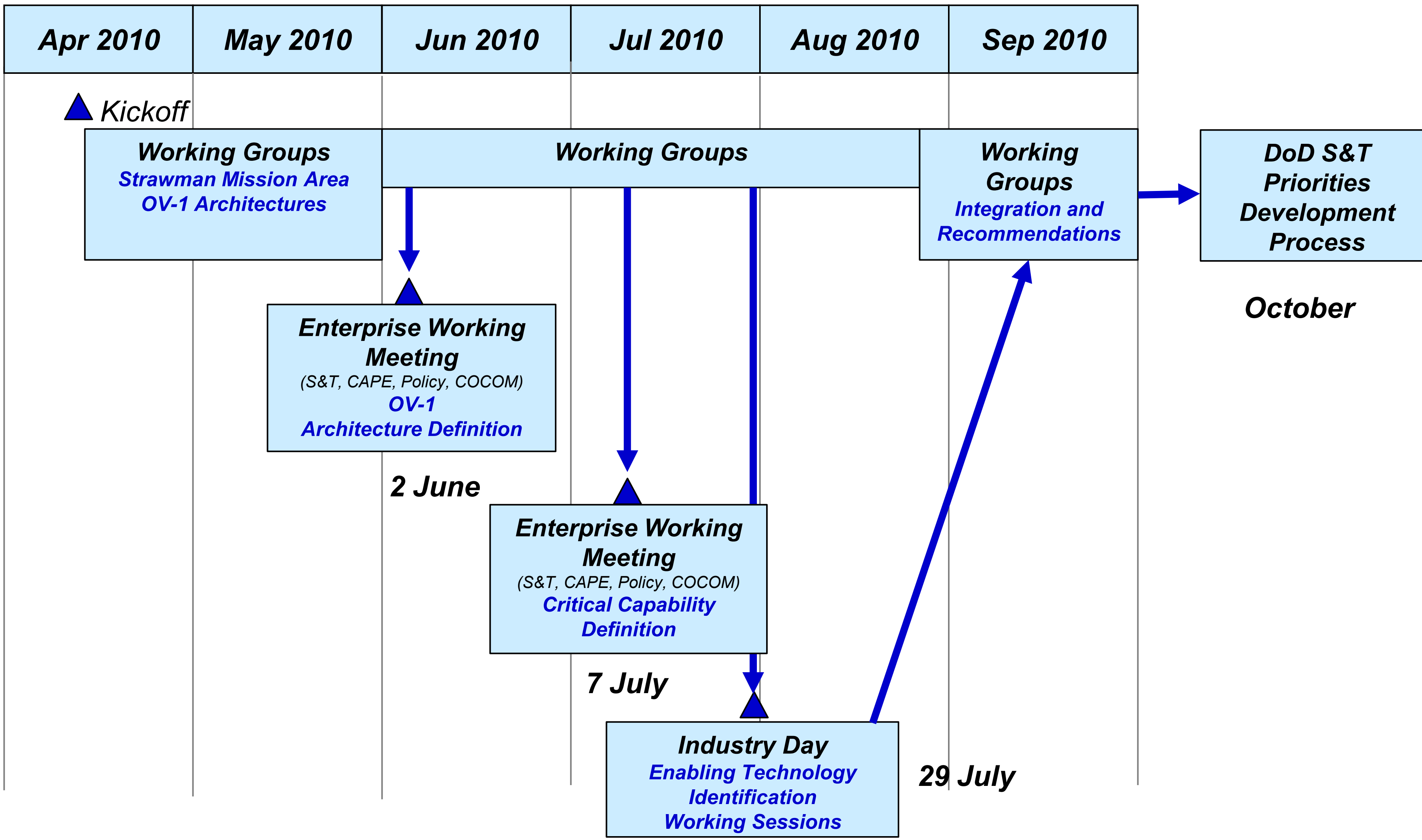
Key Mission Areas
Defend U.S. and Support Civil Authorities at Home
Succeed in COIN/Stability/CT Ops
Build Partner Security Capacity
Deter and Defeat Aggression in Anti-Access Environments
Prevent Proliferation and Counter WMD
Operate Effectively in Cyberspace

***DPPG Task*: "The DDR&E, with the support of the Secretaries of the Military Departments, Directors of the Defense Agencies, and CJCS will lead an effort across the Department to identify the core capabilities and enabling technologies for each of the six QDR key mission areas."**

QDR KMA Study Approach



QDR KMA Study Timeline



Single-Service Led S&T Priorities

- **Army**
  - Immersive Training
- **Navy**
  - Undersea Warfare
- **Air Force**
  - Long Range Strike
  - Affordable Space Access

Note: The QDR KMAs are additive to core military missions and competencies assigned to the armed forces

Initial S&T Priorities - 54 Total
- Reduced to 7 -

- **QDR KMA DPPG Study:**
  - Data to Decisions
  - Systems 2020
  - Immersive Training
  - Autonomy for Standoff, Speed & Scale
  - Human Terrain Preparation
  - CBRN Standoff Detection, Locate, Monitor & Track
  - Cyber Mission Assurance/Dominance -Includes Trust & Attribution
  - Rapidly Tailored Effects
  - EM Spectrum Management
  - Knowledge and Information Management / Architecture
  - Ubiquitous Observation
  - Access and Sharing of DoD Information/Databases
  - Alternatives to GPS for providing PNT
  - Contextual Exploitation
- **TFTs and COIs:**
  - High Speed / Hypersonics

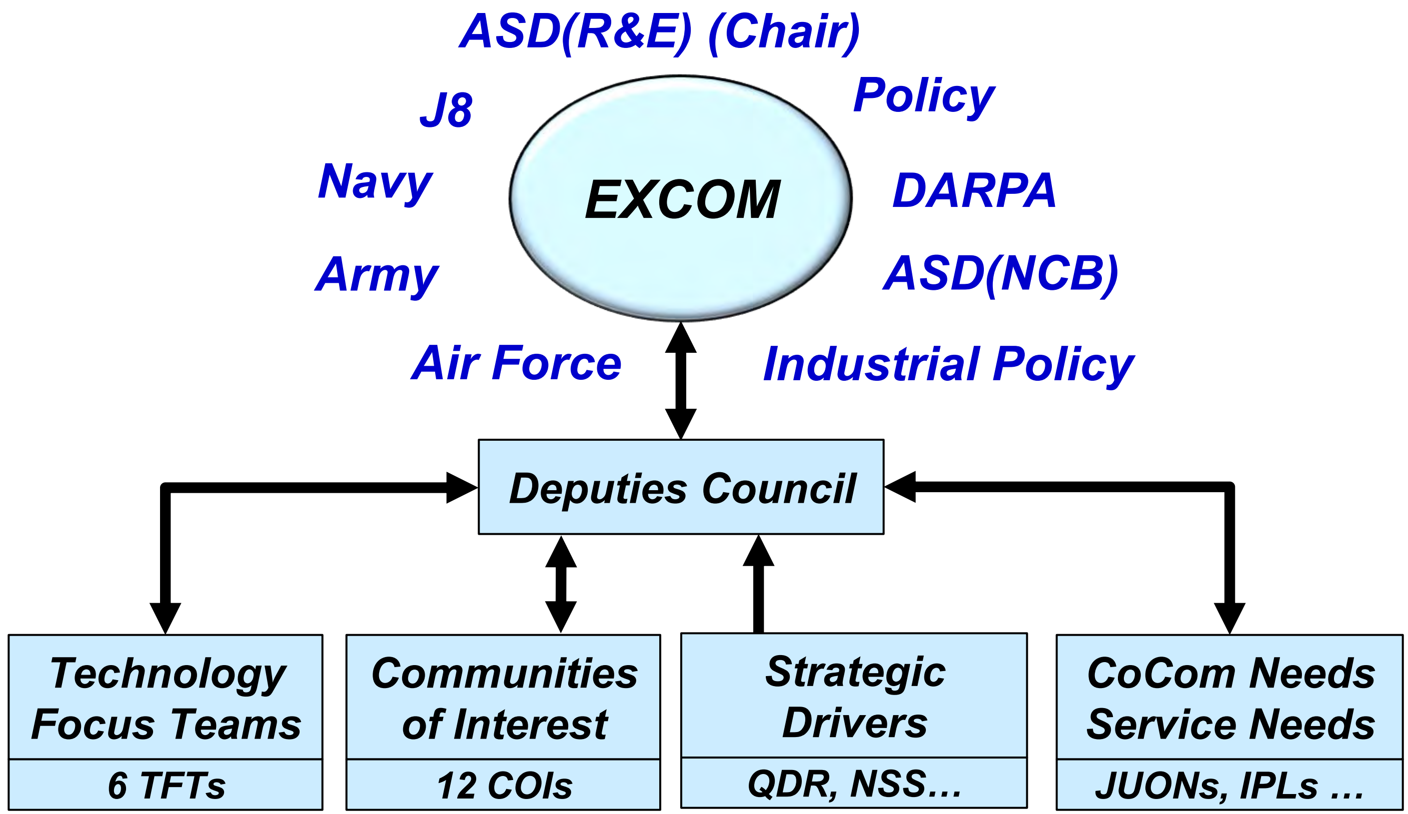
Initial S&T Priorities - 54 Total - Reduced to 7 (contd.) -

- **TFTs and COIs (contd.)**
  - Highly Adaptive Turbine Engines
  - Multi Role Vertical Lift
  - Reasoning Machines
  - Teaming Large Numbers of Autonomous Hetero. Systems
  - Developing Materials Underpinning Electronics Technologies
  - Force Protection
  - Mobility
  - Integrated Computational Materials Science and Engineering (ICMSE)
  - Complex Engineered Materials
  - Improved Kinetic Weapons
- **Service and Agency Priorities**
  - Autonomy
  - Power & Energy
  - Total Ownership Cost
  - Directed Energy
  - Educational Outreach/STEM

Initial S&T Priorities - 54 Total - Reduced to 7 (contd.) -

- **Service and Agency Priorities (contd.)**
  - Irregular Warfare/Counter IED
  - Undersea Warfare
  - Electronic Warfare/Electronic Protection
  - Improved Situation Awareness, Persistent ISR
  - Climate Change and the Arctic
  - Long-Range Strike
  - Medical PTSD/TBI, Blast/Trauma
  - Enhanced Cognitive Performance
  - Software Assurance
  - Rare Earth Element Technologies
  - Small Engines/Alternate Propulsion
  - Military-Unique Fixed-Wing and Rotary-Wing Technologies
  - Human System
  - Affordable Space Access
  - Precision lethality
  - Counter-WMD Technologies (9 total that were consolidated to 1)

Implementation Forum: S&T Executive Committee



- *Leadership Commitment*
- *High-Priority Objectives*
- *Tightly-Focused Agendas*
- *Structured Decision Packages*

S&T Executive Committee (EXCOM)

Lt Gen Larry Spencer
J8

Ms. Kathleen Hicks
DUSD(SPF)

Mr. Zach Lemnios
ASD(R&E)

Mr. Andrew Weber
ASD(NCB)

Mr. Brett Lambert
DASD(MIBP)

Dr. Regina Dugan
DARPA

Dr. Steven Walker
DASAF(STE)

Dr. Marilyn Freeman
SAAL-ZT

RADM Nevin Carr
CNR

Process for Developing S&T Priorities

S&T Investment Drivers

Warfighters
- *IPLs/STIPLs*
- *RDA Task Force*

Strategic Guidance
- *QDR KMA Studies*
- *DPPG Studies*
- *OSTP Priorities*

Technology Push
- *TFT Priorities*
- *COI Priorities*

Service Priorities
- *Immersive Training*
- *Undersea Warfare*
- *Affordable Space Access*

Comprehensive List of Needs

-
-
-
-
-
-
-
- ***(54 Total)***
-
-
-
-
-
-
-
-
-

Identify Cross-cutting & Single Service Priorities

S&T EXCOM Review

High Level Review of Existing Priorities

(7 Identified)

SECDEF S&T Priorities Memo Apr 19. 2011

FY 2013 S&T Priorities Timeline

Nov 8-12	Nov 15-19	Nov 22-26	Nov 29-Dec 3	Dec 6-10	Dec 13-17

Service Priorities
QDR KMA Study
DPPG Studies
OSTP Priorities
TFT/COI Priorities

3 Nov

S&T Deputies Council Meeting
- Gather Inputs and organize data

10 Nov

S&T Deputies Council Meeting
- Priorities spreadsheet discussion

S&T Deputies Council Working Group

17 Nov

S&T Deputies Council Meeting
- Discuss which priorities make it into DDR&E Guidance Memo
- QDR KMA Study Team 1 Brief)

23 Nov

S&T Deputies Council Meeting
- Reviewed voting on top 6-8 S&T Priorities

30 Nov

S&T Deputies Council Meeting
- POC briefings on S&T Priorities

8 Dec

S&T Deputies Council Meeting
- Review DDR&E Guidance Memo
-- Dry run S&T Priorities Briefing

15 Dec

S&T EXCOM
- S&T Priorities Briefing

Roadmap Development

Secretary of Defense S&T Priorities Memo – Apr 19, 2011

The Assistant Secretary of Defense for Research and Engineering, with the Department's S&T Executive Committee and other stakeholders, will oversee the development of implementation roadmaps for each priority area. These roadmaps will coordinate Component investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities.

SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

APR 19 2011

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS
ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Science and Technology (S&T) Priorities for Fiscal Years 2013-17 Planning

The Department's S&T leadership, led by the Assistant Secretary of Defense for Research and Engineering, in close coordination with leadership from the Under Secretary of Defense for Policy, the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense, the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, and the Joint Staff, has identified seven strategic investment priorities. These S&T priorities derive from a comprehensive analysis of recommendations resulting from the Quadrennial Defense Review mission architecture studies directed in the FY12-16 Defense Planning Programming Guidance.

The priority S&T investment areas in the FY13-17 Program Objective Memorandum are:

(1) **Data to Decisions** – science and applications to reduce the cycle time and manpower requirements for analysis and use of large data sets.
(2) **Engineered Resilient Systems** – engineering concepts, science, and design tools to protect against malicious compromise of weapon systems and to develop agile manufacturing for trusted and assured defense systems.
(3) **Cyber Science and Technology** – science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
(4) **Electronic Warfare / Electronic Protection** – new concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
(5) **Counter Weapons of Mass Destruction (WMD)** – advances in DoD's ability to locate, secure, monitor, tag, track, interdict, eliminate and attribute WMD weapons and materials.
(6) **Autonomy** – science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks, in all environments.
(7) **Human Systems** – science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.

OSD 02073-11

S&T Priorities

- ***Data-to-Decisions***
- ***Engineered Resilient Systems***
- ***Cyber Science and Technology***
- ***Electronic Warfare / Electronic Protection***
- ***Counter Weapons of Mass Destruction***
- ***Autonomy***
- ***Human Systems***

"The Assistant Secretary of Defense for Research and Engineering, with the Department's S&T Executive Committee and other stakeholders, will oversee the development of implementation roadmaps for each priority. These roadmaps will coordinate Component investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities."

Priority S&T Investment Areas for FY 2013-2017

- **Data-to-Decisions**
  - Science and applications to reduce the cycle time and manpower requirements for analyses and use of large data sets.
- **Engineered Resilient Systems**
  - Engineering concepts, science, and design tools to protect against malicious compromise of weapon systems, and to develop agile manufacturing for trusted and assured defense systems.
- **Cyber Science and Technology**
  - Science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- **Electronic warfare / Electronic protection**
  - New concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
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- **Autonomy**
  - Science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks in all environments.
- **Human Systems**
  - Science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.

USTRANSCOM
Operational and Technology Challenges Brief
to
Science & Engineering Technology Conference/DOD Tech Expo

Mr. Lou Bernstein

Approved for Public Release

Purpose

- Role/Mission
- Logistics Transformation Imperative
- Top Operational/Technology Challenges
- RDT&E Program Overview/Project Highlights

USTRANSCOM Transformation

DPO
Distribution Process Owner

2011– Global Distribution Synchronizer

2007 – DPO lead for DOD Supply Chain RFID/AIT implementation

2005 – Full Time US Transportation Command Commander

2003 – Distribution Process Owner Established

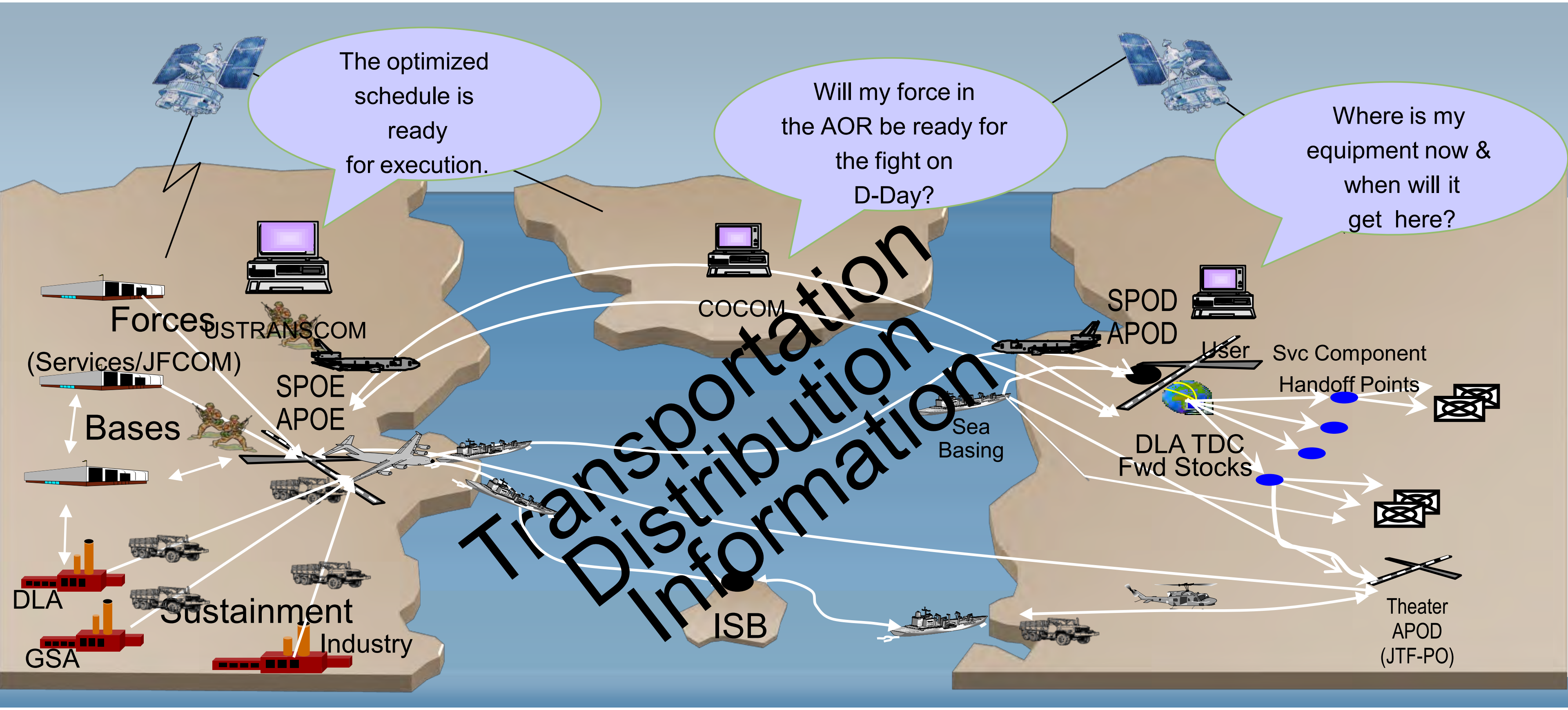
1993 – US Transportation Command Charter (Peacetime/Wartime Strategic Mobility)

1990 – DESERT SHIELD/STORM

1987 – US Transportation Command Established

1986 – Goldwater/Nichols Act

USTRANSCOM's End-to-End Mission



Leveraging S&T to Transform Logistics Support to the Warfighter and Ensure the Development of Affordable Solutions

Operating in a Global Environment…

Challenges

Roads/Rail

Ports

No Fuel

Runways

Diplomatic Clearances

No MHE/CHE

Limited Navaids

Poor Construction

Access!!

High Threat

Combatant Commander Plans…

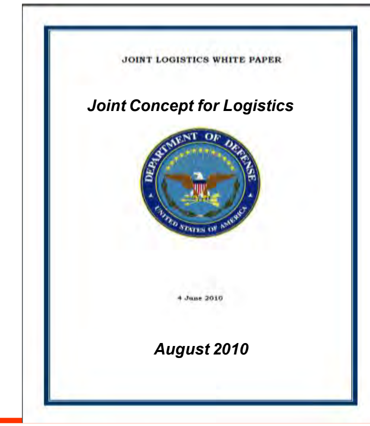
- Rely on Austere Infrastructure
- Demand Rapid Force Projection
- Require Early Diplomatic Coordination
- Incorporate Civil-Military Support
- Pose Force Protection Threat

…that places a premium on Collaboration

DOD's Logistics Strategic Vision

- **DOD Logistics Goals**
  - *Effective logistics support to current ops*
  - Effective management of contractors on the battlefield
  - Integrate life cycle management principles
  - *Integrate supply chain to point of consumption*
- ***Deliver integrated joint logistics capabilities***
- ***Network/Optimize the Joint Logistics Enterprise***
- ***Ensure Rapid, Precise Response***

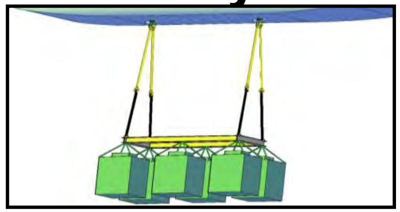
Note: *USTRANSCOM RDT&E program affects italicized areas*



Top Operational/Technical Challenges

- **Improve Point of Need Delivery**

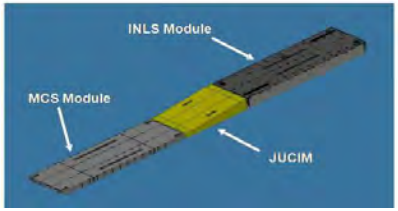
High Speed Container Delivery



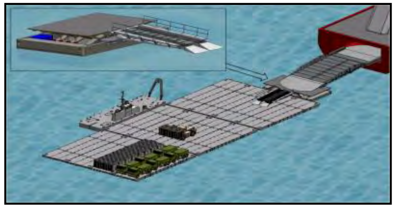
Helicopter Sling Load - JPADS

JPADS-Guidance/Navigation/Control

- **Ability to Sustain from the Joint Seabase**



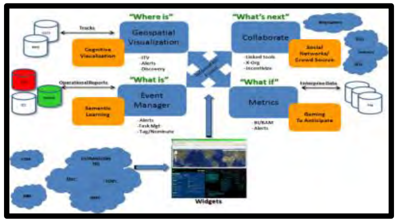
Joint Universal Causeway Interface Module



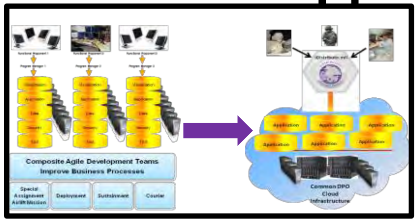
Com'l Roll-on/Roll-off Interface Platform

Sea Base Enablers

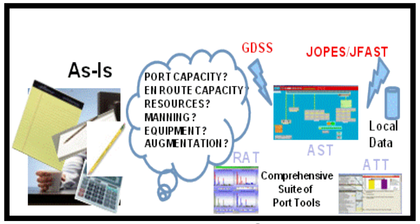
- **Command & Control/Decision Support**



Situational Awareness & Collaboration

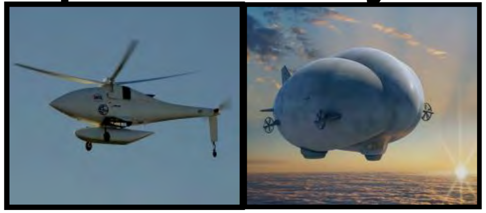


Computing Environment



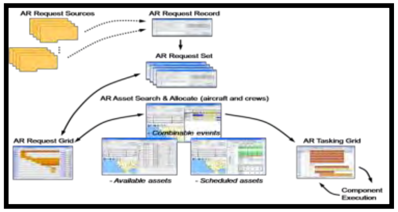
AT21/Decision Support

- **Operate in Any Environment/Energy Conservation**



Unmanned Air Systems/Hybrid

Cyberspace/Security



Support Planning for Aerial Refueling

See USTCH60-2 for complete list

www.transcom.mil/rdte

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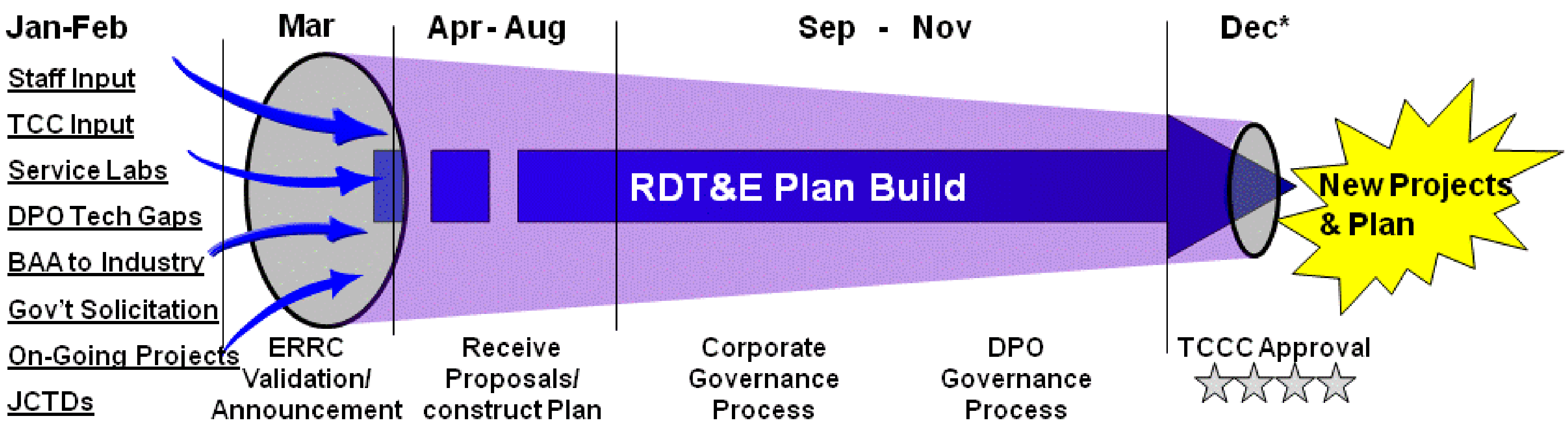
Program Summary

	FY12	FY13	FY14	FY15	FY16	FY17
Current Top Line	$43M	$34.2M	$38M	$38.3M	$39.2M	$43.1M



*OSD RDT&E budget exhibit submissions drives timeline

Leveraged over $285M in Service/OSD/Defense Agency RDT&E contributions (FY06-11) – 7:1 ROI

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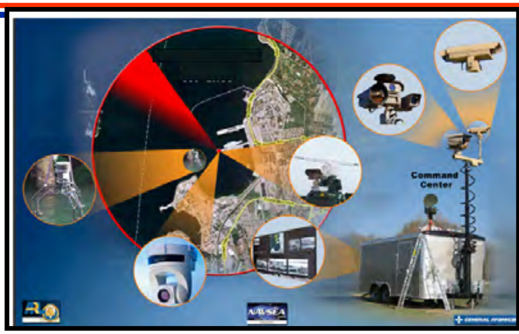
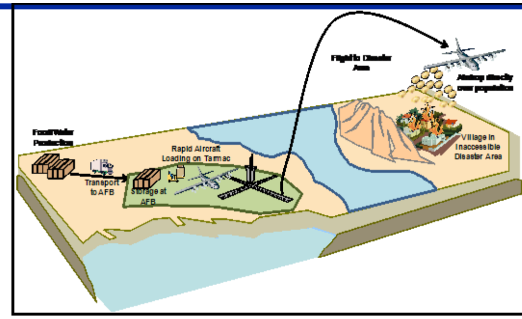
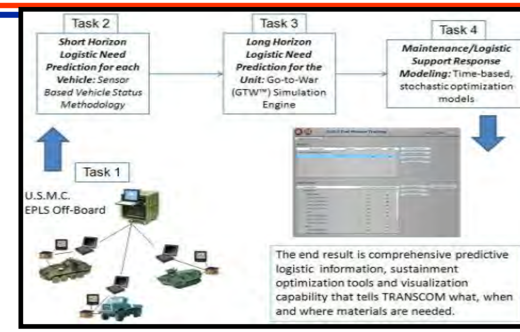
Future Focus Areas



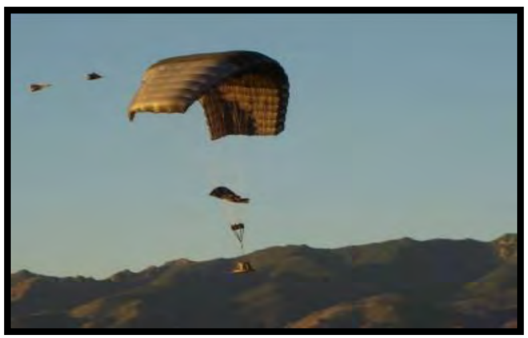
Force Protection/Security



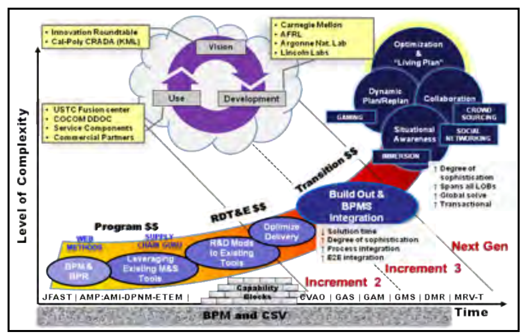
Humanitarian Airdrop Over Populated Areas



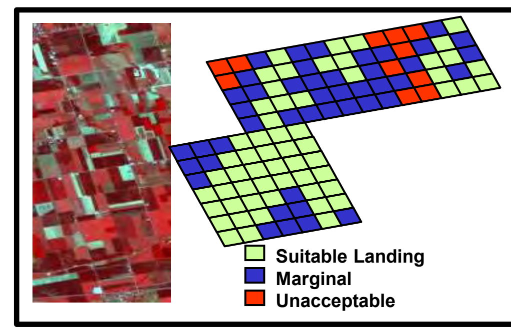
Sense and Respond Logistics



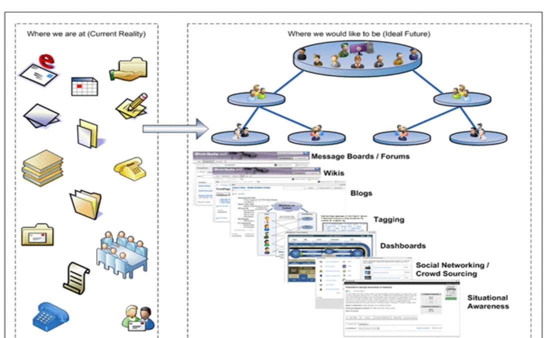
Improved Accuracy at Point of Need



Optimization



Rapid/Automated Landing Site Detection



Collaboration and Integration

Port Efficiency Enhancements

Sea Based Enablers

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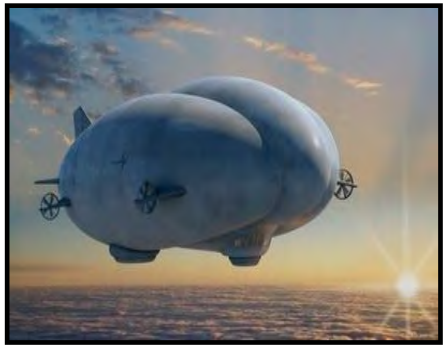
USTRANSCOM Technology Transfer Activities

(Office of Research and Technology Applications)

Knowledge Management--
Service-Oriented Architectures



Airships and Hybrid Airships

Satellite RFID

Advanced Decision-making
Tools for the Supply Chain

Over $7.5M of Industry Investment

Cloud Computing and
Data Quality

Wind Farm Effects on Radar
Performance

Science, Technology
Engineering & Mathematics

Remotely Piloted Vehicles
For Cargo Transport

We Measure Success Through the Eyes of the Warfighter & the Taxpayer!

Backups

Selected Benefits (completed efforts)

- **End to End Distribution Model**
  - Halved MCRS-16 simulation run-times; simulate all portions of deployment & distribution
  - Provided the data to support USAF decision to retire 22 C-5A
- **Joint Modular Intermodal Container: $16M/yr savings w/cardboard uni-pack**
- **Defense Distribution Expeditionary Depot**
  - Significant reduction in military inter-theater airlift for DLA managed items
  - Customer Wait Time reduced from 19.8 days to 10.8 days
- **Coalition Mobility System: 100% ROI within 2 years and $2.3M/yr thereafter**
- **Common Operating Picture (Deployment and Distribution)**
  - ID of top 100 heaviest airlifted items saving $54M annually in transportation costs
  - Delivered initial iDistribute.mil capabilities (i.e., workspace mgmt, collaboration, etc.)
- **En Route Patient Care Module**
  - Less people managing more patients/continued intervention in absence of skilled caregiver
  - Closed loop system provides ~40% reduction in O2 use over current manual methods
- **JPADS – Mission Planner: 80% reduction in recovery ops/cost & saves lives**
- **JPADS Next Generation Guidance, Navigation & Control**
  - Enhanced accuracy (< 50 meters) integrated into 2K JPADS assets; Reduce DZ by 20%
  - Reduce IED exposed convoys, safer recovery ops, increased personnel survivability
- **Low Cost Low Altitude: Reduce airdrop asset recovery/improves safety (less grnd convoys)**

Selected Benefits (completed efforts)

- **Wireless Gate Release System**
  - Doubles C-130 delivery capacity (FOC 4QFY11) (saving fuel/acft wear & tear/assoc costs)
  - Eliminates bundle damage due leap frogging (effects 20% of airdropped bundles)
- **Joint Recovery and Distribution System**
  - 101st Sustainment Brigade employing three 40T vehicles - completed < dozen missions in Afghanistan to date
  - USMC to deploy four 34T vehicles (per HQMC current trailer is unsuited for Afghan rugged off road conditions-- looking to purchase another 10 to fill Urgent Universal Needs Statement)
- **Seabasing**
  - Joint Universal Causeway Interface Module: Universal connector (vice spending $246M to replace Army Modular Causeway System and Improved Navy Lighterage System)
  - Commercial Roll-on/Roll-off Interface Platform: Provide non-existent capability to off-load commercial RO/ROs at sea – enhanced operational flexibility/could reduce sealift recap bill
  - Shipboard Selective Access and Retrieval System
    - 67% reduction in manpower required to move vehicles and containers (typically 6 to 2)
    - Improved storage (omni-directional access/movement) of mission assets
    - MHE fuel usage is cut by 67% for RO/RO operations and 100% eliminated for flat-deck operations (due use of battery/hybrid diesel/electro-hydraulic drives)
- **Next Generation Autonomic Logistics/Predictive Analysis: Will improve sustainment forecasting and enable best cost transportation solutions**

Selected Benefits (ongoing efforts)

- **Cyber**
  - Computer Adaptive Network Defense-in-Depth: Provided DOD the ability to continue critical network operations in a contested NIPR/SIPR network environments via secure enclaves
  - Cross Domain Collaborative Information Exchange: Provide bi-directional transfer across NIPR/SIPR domain for the Joint Deployment & Distribution Enterprise
- **Humanitarian Assistance Visibility Experiment/Humanitarian Expeditionary Log Project**
  - Qualified ROI is a cost savings of $147,000 ($15.00/hr x 35 hours x 70 operating days x 4 sites) and a twelvefold improvement in data visibility (from once every 12 hours to once every hour)
  - Historical example from 2008 Hurricane Ike - capability would have resulted in a cost avoidance of $5M to the taxpayer in one incident in which 450 truckloads of ice were procured and destroyed because resource visibility was nil)
- **Next Generation Wireless Communications: Army G4 draft BCA determined break even point in 2 years and ~33% out-year lower costs over current $619M-10 yr aRFID solution**
- **Support Planning for Air Refueling: Potential $265M/yr savings at $3/gal**

Selected Benefits (ongoing efforts)

- **AT21/Living Plan: Combined (TWCF/RDT&E) $884M (FY07-26) cost savings**
  - Movement Requirements Visibility-Theater: Better utilization of common user movement assets in theater is expected to provide at least a $16.7M annual cost avoidance
  - Distribution Process Nodal Model: Improve Time Definite Delivery by 10 – 15%
  - End to End Distribution Modeling: Reduce model setup and runtime by 20%; Economic Analysis states breakeven year to be FY17 (AT21 enabler)
  - Global Mission Scheduling: TACC tool to dynamically re-plan (est. cost avoidance of $6.38M/yr due more efficient use of assets/fuel savings/reduced mission support requirements/etc.)
  - Cognitive Visualization, Alerting and Optimization: Reduces time to generate multiple COAs and develop optimized solution among multiple stakeholders
  - Situational Awareness & Collaboration: Better warfighter support via improved organizational unity of effort and efficiencies thru common operational SA and networked collaborative capabilities for JDDE stakeholders
  - Enterprise Integration Lab: Mitigate technical risk and accelerated capability fielding via comprehensive functional and certification/accreditation testing
  - Dynamic Re-planning Nodal Management Air
    - Provide standard, objective, repeatable method to assess airport capacity and flow requirements
    - $0.9M/yr savings/cost avoidance (conservative estimate)
    - Could realize similar savings from seaport – providing additional $400K in FY13 to explore/assess

Selected Benefits (ongoing efforts)

- **Point of Need Delivery: No costs savings/just better warfighting capability**
  - JPADS Helicopter Sling Load: Increased operational flexibility/agility – enhanced safety (crew/helo as well as reduction in ground convoys)
  - High Speed Container Delivery System: Enhanced aircrew/aircraft survivability (70% reduction in exposure to ground threat due fast ingress/egress) while increasing accuracy of resupply (due delivery at lower altitude and higher airspeed) as well as volume (from < 2200 lbs to > 16,000 lbs)
  - Autonomous Technologies for Unmanned Air Systems: Ability to provide precision delivery (via sling load) in anti-access/austere/urban environments (minimizes risk to ground troops, eliminates pilot/aircrew from resupply equation, provides field retrograde capability). Hand-held beacon to eliminate need   for forward air controllers/ground stations.

Minimum 7:1 ROI – Program Pays for Itself

NDIA Science and Engineering Technology Conference

NAVSEA
NAVAL SEA SYSTEMS COMMAND

NAVSEA Technology Needs

June 2011

Michael L. Bosworth
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NAVSEA Organization (made simple)

NAVSEA Commander VADM McCoy
Vice Cdr   Executive Director   Staff

Program Executive Offices
(PEOs)

-Ships

-Submarines

-Aircraft Carriers

-Integrated Warfare Systems

-Littoral and Mine Warfare >>>
to Littoral Combat Ship (soon)

Headquarters Directorates

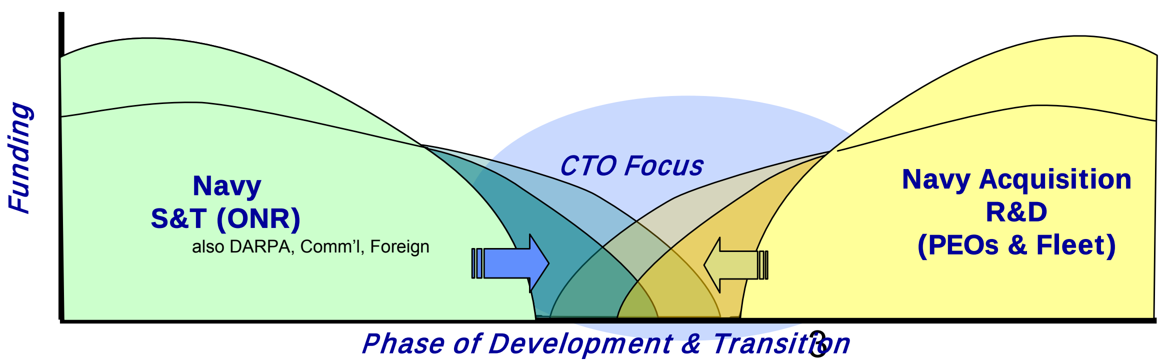
-Most notably for this venue
SEA 04 (with naval shipyards, supships)
SEA 05 (Naval Systems Engineering)
with a dozen tech groups of which
one is 05T (Technology ie R&D)

Naval Labs
- NSWC
(surface)
- NUWC
(undersea)

Fuller & official org chart at http://www.navsea.navy.mil/Organization/HQ.aspx

SEA 05 Technology Office (SEA 05T)

- Serve as Primary SEA 05 R&D and Technology Transition Staff
- Focus on transitioning technology from S&T to the Acquisition Programs and Fleet
- Manage assigned R&D Programs
- Develop a workforce that can effectively lead and transition technology into the fleet
- Partner with S&T Community, Industry, Acquisition Community, and the Fleet to produce technology development strategies and transition technology into the fleet

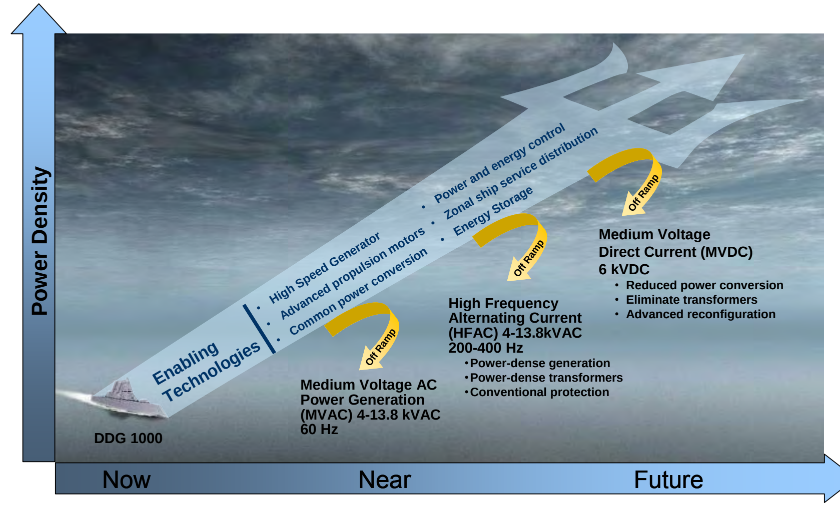


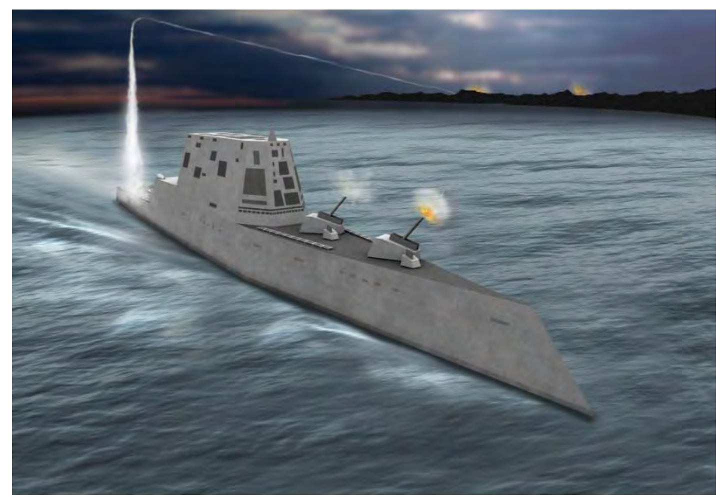
Naval Technology Needs for Today’s Fleet

- Technologies promoting the ability to affordably modernize to meet evolving threats
  - Open Architecture
  - Modularity
  - Increased Distributed System Capacity (electrical power, chill water, etc.)
  - Ability to interface with new aircraft (MV-22, JSF, etc.)
  - Ability to interface with off-board unmanned systems.
- Technologies that improve material condition of ships
  - Corrosion Control
  - Reliability improvements
- Technologies that reduce the Total Ownership Cost of Today’s Fleet
  - Energy Efficiency
  - Reduced Manning
  - Improved training methods
- Analytical Methods to enable calculating Return on Investment of Open Architecture and Modularity
  - “Real Options”

Naval Technology Needs for the Future Fleet

- Architecture driven Product Lines
  - Next Generation Integrated Power Systems
  - HVAC 21st Century
  - Open Architecture Combat Systems
- Affordable incorporation of evolving technologies
  - Railguns and Directed Energy Weapons
  - Unmanned Vehicles and Autonomy
  - New Aircraft (shipboard integration of…)
- Improved Design methods and tools
  - Ship Design Process Modeling
  - Properly Pricing Risk
  - Properly Valuing Flexibility
  - Design, Costing & Analysis Tools
- Total Ownership Cost Reduction Technologies
- Mission Effectiveness Technologies
- Improved Technology Transition Model





Need affordable robustness in a changing world

Generalities…what about specifics?

- The transition opportunities are in the acquisition shops (PEOs).
- FOR SHIPS: Look at annual 30 year Shipbuilding Plan.
  - one on-line source: http://www.militarytimes.com/static/projects/pages/2011shipbuilding.pdf
- Backup from the first of class 'award date' to early design.
- Have a new capability/technology 'ready for transition' as design concepts are being developed, competed, selected.

Fiscal Year	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Aircraft Carrier			1					1					1					1					1					1		
Large Surface Combatant	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2
Small Surface Combatant	2	3	4	4	4	3	3	3	3	2	2	2	2	2	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2
Attack Submarines	2	2	2	2	2	2	2	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	2	1
Ballistic Missile Submarines									1			1		1	1	1	1	1	1	1	1	1	1							
Amphibious Warfare Ships	1	1				1	1		1		2		1		2		1		2		1		2		1		1	1	1	
Combat Logistics Force							1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	
Support Vessels	2	1	3	2	4	2	3	3	3	4	2	3	3	2	1			1		2	1	1	2	2	2	2	2	2	2	2
Total New Construction Plan	9	8	12	9	12	9	12	9	13	9	11	10	11	8	8	7	7	8	8	8	8	8	11	8	10	7	10	9	10	7

- Less centralized data for warfare systems, HM&E & logistics systems, boats/craft/unmannedvehicles.

30yr Ship-Building Plan

SHIPs:

DDG51
DDG(X)
LHD(X)
LSD(X)
T-AO
T-ARS(X)
T-AGOS(X)
AS(X)
SSC
LCS
LCS(X)

POC: Glen Sturtevant
Glen.Sturtevant@navy.mil

SUBs:

SSBN(X)
Ohio Replacement
SSN - Virginia

POC: Regan Campbell
Regan.Campbell@navy.mil

CARRIERs:

CVN21

POC: Eric Pitt
Eric.Pitt@navy.mil

Near Term Technology For Today's Fleet

Pacing Evolving Threats:

Open Architecture
Modularity
Distributed Systems
UV Interfaces

Operating Cost Reduction:

Energy Efficiency
Automation
Improved Crew Training

Lifecycle Cost Reduction:

Low Maintenance Materials
Remote CBM
Reduce/Eliminate Corrosion
Software Reconfigurability

Lifecycle Cost Reduction*:
*additional to ones listed above

In Water Repairable Systems

Pacing Evolving Threats*:
*additional to ones listed above

New Aircraft Interfaces

Far Term Technology For The Future Fleet

Architecture Driven Product Lines:

NGIPS
HVAC 21st Century
Open Architecture

Disruptive Technology:

Directed Energy Weapons
EM Railgun
UVs

New Design & Analysis Tools:

Ship Design Process Modeling
Pricing Risk
Quantifying/Valuing Flexibility
CREATE

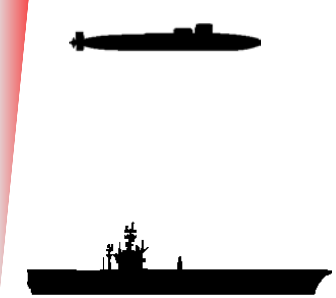
Disruptive Technology:

Large Diameter Tube Payloads

Disruptive Technology*:
*additional to ones listed above

New Aircraft

Capable, Affordable, Sustainable Fleet of 313



Summary

- Technology & Innovation for Ships, Boats, Unmanned Vehicles & the systems that integrate into them….for warfighting mission payoff.
- Affordable (crisis of cost).
- Transitionable (crisis of productization).
- Utilize existing in new configurations (to be affordable & transitionable)

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NAVSEA 05 - Naval Systems Engineering Directorate

SEA 05C - Cost Engineering & Industrial Analysis

SEA 05D - Surface Ship Design & Systems Engineering

SEA 05H - Integrated Warfare Systems Engineering

SEA 05L - Littoral and Mine Warfare Design & Systems Engineering

SEA 05P - Ship Integrity & Performance Engineering

SEA 05S – Command Standards

SEA 05T - Technology

SEA 05U - Submarine/Submersible Design & Systems Engineering

SEA 05V - Aircraft Carrier Design & Systems Engineering

SEA 05X – University Affiliated Research Center

SEA 05Z - Marine Engineering

SEA 04 – Logistics, Maintenance, and Independent Operations

SEA 07 – Undersea Warfare

SEA 08 – Nuclear Propulsion

SEA 21 – Surface Warfare

PEO Carriers

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PEO Integrated Warfare Systems

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PEO Littoral & Mine Warfare

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PEO Ships

POC: Glen Sturtevant

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PEO Subs

POC: Regan Campbell

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THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

AFRL Precision Air Drop

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Air Drop by the Numbers

60,400,000

Pounds dropped in 2010, 99+% CDS ($2.5K/bundle)

<100,000

Pounds dropped in 2010, guided systems ($30+K/bundle)

250

Distance to impact point (in meters) considered an “acceptable” drop

<50

Desired distance to impact point (in meters)

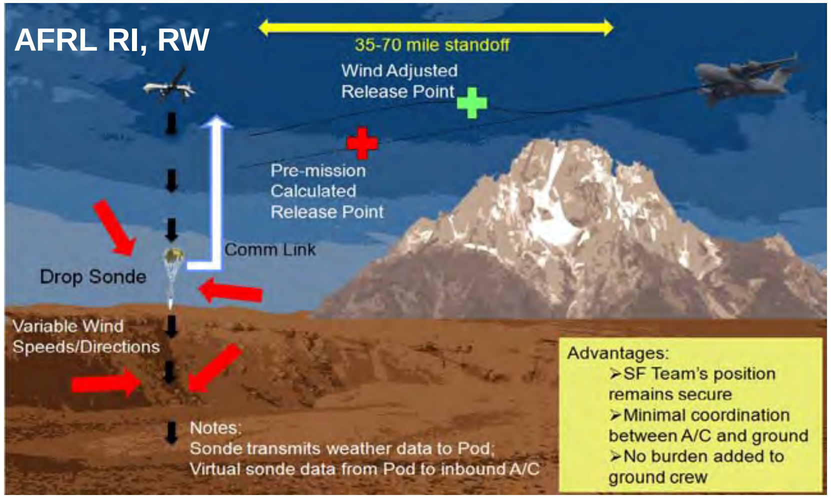
Air Drop Focus Areas

"AMC has a need to provide aerial delivery of a broad range of assets with superb accuracy from extended airdrop offset distances and higher altitudes. Single pass capability solutions should be considered…" Gen Raymond Johns, Commander AMC, 2011

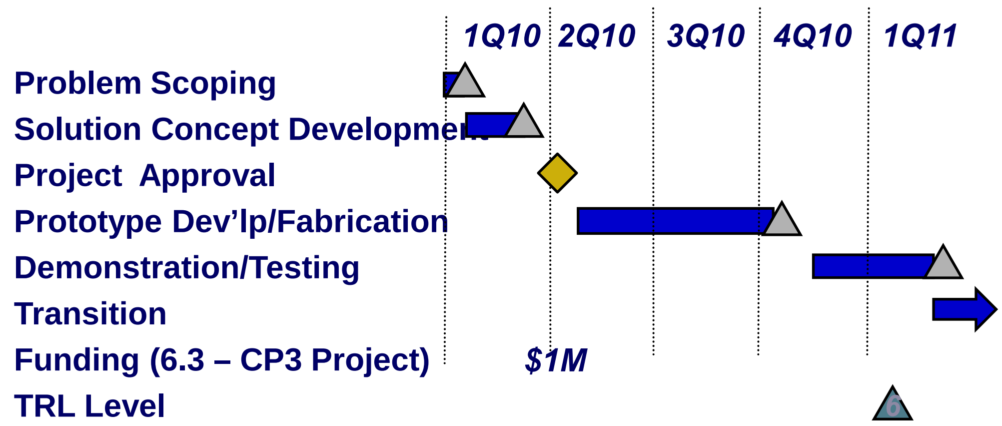
- **"Precision" was the original intent of the AFRL Air Drop focus**
- **AMC's desire was for AFRL to address urgent needs with:**
  - **Critical resupply**
  - **Humanitarian airdrop**
- **AMC's urgent needs shaped the definition of precision**
- **The AFRL Air Drop scope addresses precision as:**
  - **Single pass**
  - **Dispersion predictability**
  - **Situational awareness of bundles**
  - **Impact point accuracy**

SINGLE PASS AIR DROP
&
PRECISION AIR DROP

Single Pass Airdrop (SPAiD)



Technology InvestmentSchedule (FY10)



Description

Rapidly find technical solution for AFCENT UON to eliminate need for 2 passes over drop zones during high altitude airdrop ops

Technology

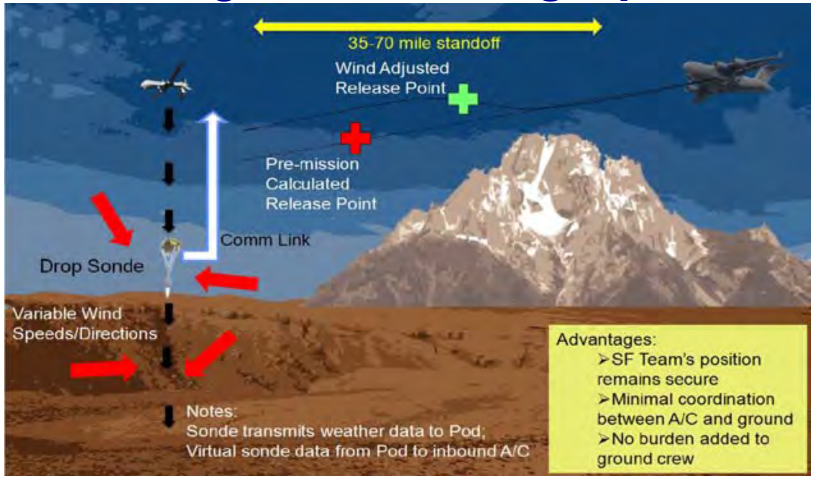
- AFRL proposed UAV-based weather drop sonde-release solution; Ready to demo in 2Q11
- Integrate into C-17, C-130 Joint Precision Air Drop System Mission Planning (JPADS-MP) Computer

Benefits to the War Fighter

- Eliminates multiple aircraft passes over drop zone
    - Reduces potential for enemy fire
    - Prevents tip-off of drop event
- Allows precision delivery of packages with lower-cost Improved Container Delivery System (ICDS)
- Simplifies mission profiles and time aloft for air delivery missions
- Solves AFCENT UON/Requirement

Single Pass Air Drop (SPAiD)
FY10 Accomplishments

- **Objective: Collect current, drop zone (DZ) weather data, which will enable mobility aircraft to perform <u>accurate</u> air drop to the target DZ in a *single pass***



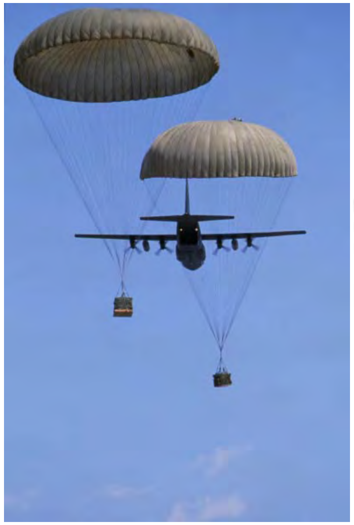
- **Challenges**
  - -Coordination Efforts
    - AMC/ AFMC/ ACC/ AFCENT
    - In-theater
  - -Reduce drop sonde size; increase reception range
  - -Pod attachment to RPA (Predator)
  - -Pod design/flight worthiness approval
  - -Surrogate flight approval/Pod components flight test
  - -UON priority--compressed schedule
  - -RPA (Predator) asset availability
    - We need a Predator for 1-week test in CONUS

M34 Dummy Hellfire Interim pod
- *~99 lbs*
- *Quick Seek Eagle Approval*

- **Accomplishments**
  - *-Smaller drop sonde – 87% reduction in weight*
  - -Predator availability in-theater; support from 62 ERS (Kandahar)
  - *-Data Storage/Forwarding*
    - *increased reception from 6nm to 100nm*
  - *-Pod slide-on attachment to Hellfire rail system*
  - *-Successful Pod components flight test, Dec 2010*
  - *-AMC/AFCENT G.O. level coordination and endorsement*
  - *-Transition to part of FCC from CP-3*

•Lightweight TMS pod
- *~15 lbs*
- *Transition 3Q11*

Precision Airdrop



Description

Develop technologies that improve the accuracy and lowers the cost of Container Delivery System (CDS), humanitarian, and guided airdrops.

Technology Challenges

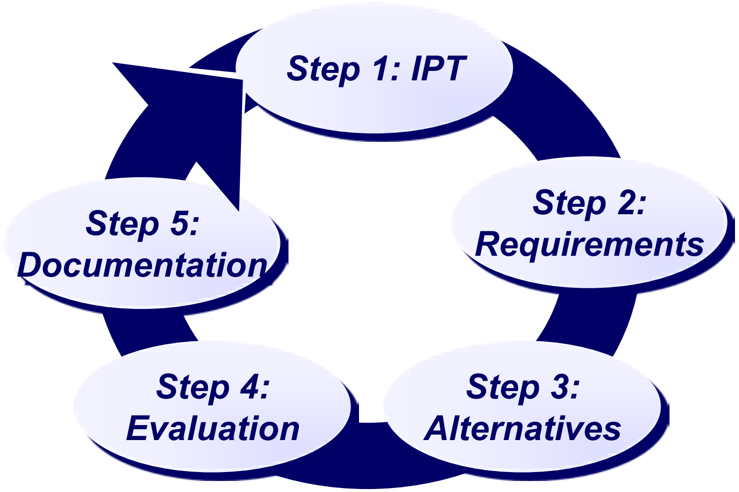
- Real-time wind sensing
- Automated green light release technology integration
- Error budget analyses and improved modeling approaches
- Low cost highly accurate guided drop systems
- Humanitarian relief delivery concepts

Benefits to Warfighter

- Improves accuracy of CDS drops
- Lowers the cost of precision drops
- Lowers the risk of unintended consequences
- Improves pre/post drop SA
- Improves bundle SA

AFRL REQUIREMENTS DERIVATION

Systems Engineering (SE) Process



- Develop Requirements and Metrics
  - Solicit Input from All Stakeholders
  - Define Measurands, Desirability Functions, and Relative Importance
  - Repeat as Knowledge Advances
- Generate Technology Alternatives and Conceptual Designs
- Perform Value Analysis to Evaluate Alternatives
  - Evaluate Alternatives against Requirements
  - Compute Desirability and Risk for Each Concept
  - Explore Trade Space
  - Generate or Refine Alternative Approaches
  - Select Most Promising Approach
- Deliver Results: Recommend Alternatives

Desirements Development

Des #	Desirement Name	Units	Obj	Risk Limit	Desirement Description	Assumption, How Tested or Other Clarification	Objective Rationale	Rationale for d-Limit	Priority	Wt
Category: A. Performance										
P01	Impact				Accuracy of impact point				y h	5
P02	Predic Disper								y h	5
P03	Accura Execut								y h	5
P04	Predic Event								y	5
P05	Platfor					compatible with aircraft variant; 1 = aircraft				5

P01: Impact Point Accuracy

Critical Resupply

Description: Accuracy of impact point, measured as the difference between planned and actual (x,y,z) location of center of the dispersion pattern on impact, based on a 3,000 ft AGL drop.

Clarification: This is not a CEP number; it is more a 90% probability number. The expectation for greater accuracy increases at lower altitude.

Unit of Measure: meters

Priority: Very High

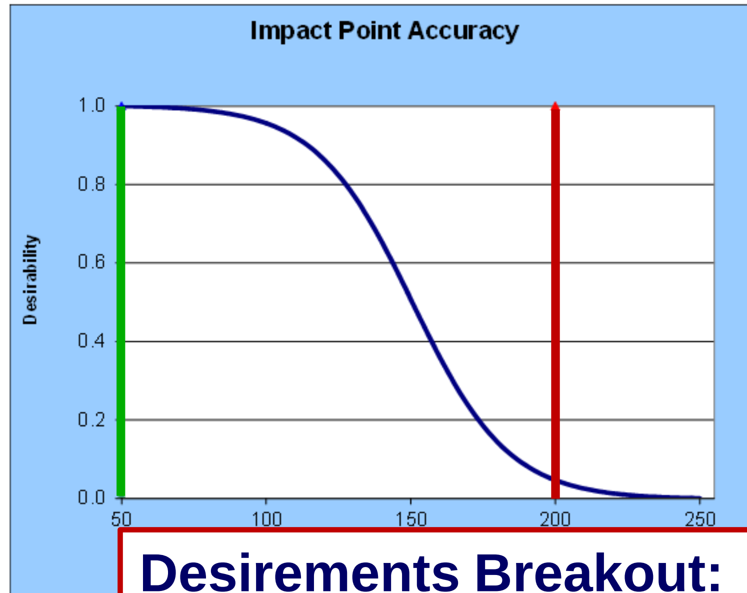
Weight: 5

Objective: 50

***Risk Limit*:** 200

Objective Rationale: 50 m 90% of the time is the objective requirement from the JPADS CDD.

***Risk Limit* Rationale:** Current level of performance. Must improve upon this.



Desirements Breakout:
- Performance – 20
- Human Factors – 7
- Cost – 5
- Security - 2

Functional Work Breakdown Structure

- Aerial Delivery Mission
  - CONEMP
  - Mission Planning
    - Intel
    - Collateral Damage Est
    - Weather Forecasting
    - Wind Profiling
    - Terrain Info Acquisition
    - Pre-mission CARP Determination
    - Mission Computer Loading
    - Mission 'Rehearsal' Sim/Replan
  - Preflight Payload Preparation
    - Packaging
    - Rigging of Payload
    - Transport to a/c
    - a/c loading
    - Rigging with a/c
  - Communication Data / Voice
    - Air to Ground Comm for DZ SA
    - Air to Ground Comm for Threat SA
    - C2 Comm
    - Weather Data Acquisition & Comm to Air Crew
    - Security / Encryption
    - Reporting Airdrop Results
  - Drop Zone Acquisition & ID
    - ID/Targeting Dynamic DZ
    - Assessment of Threat to Ground Personnel
    - Air Threat Assessment
    - Collateral Damage Reassessment
  - CARP
    - Weather Data Acquisition During Mission
    - CARP Update
    - Navigation to CARP
    - CARP Execution
  - Payload Release
    - Payload Exiting Aircraft
    - Payload Release
    - Payload Configuration
    - Crew Coordination
  - Payload Descent
    - Deceleration
    - Descent
    - Flight Path
    - Impact
  - Delivery Assessment
    - BDA
  - Payload Recovery
    - Ground Threat Assessment
    - Payload Collection & Prep for Transport
    - Retrograde

36 alternatives (notional solutions) identified to address high error-prone functional areas

Alternatives Analysis & Tradeoffs

Tradespace Refinement

Des #	Desirement Name	Units	Current		I-Skid		I-SkidAdv		I-Dun		I-DunAdv		I-Release		Active Shaping		ForceEx		Air Bags	
			Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst	Expecte	Wor/Bst
Category: A. Performance																				
P01	Impact Point Accuracy	meters	400	800	325	725	300	675	400	800	400	800	250	650	175	575	175	575	400	800
P02	Predictability of Dispersion Pattern	meters	200	400	162.5	362.5	150	337.5	200	400	200	400	125	325	87.5	287.5	87.5	287.5	200	400
P03	Accuracy of CARP Execution	yards	100	200	100	200	100	200	100	200	100	200	100	200	100	200	100	200	100	200
P04	Predictability in the Event of Malfunction	Confidence	90		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95		90	
P05	Platform Agnostic	Scale: 1–5	1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1		5	
P06	Likelihood of Avoiding Collateral Damage	Probability	90		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95		90	
P07	Communication Capability	Scale: 1–5	2	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	1	2	1
P08	Agility / Flexibility	Minutes	20		20		20		20		20		20		20		20		20	
P09c	Number of Passes	Count	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
P09h	Load Deliverable in a Single Pass	%	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
P10	Survivability of the Load	Confidence	90		90		90		93		95		90		95		90		97	
P11	Bundle-Awareness Capability	Scale: 1–5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P13	Mass Capability (Max)	lb	2200	2200	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	2200	2200

36 alternatives were given a sanity check and scored against the desirements by time frame…0-5 yrs and 5+yrs

Findings and Way Forward

- The SE process educated AFRL on air drop and the associated trouble spots
- The process became less effective with the scoring of the alternatives against the desirements
  - Lack of real data prevented an understanding of how the alternative would affect the air drop outcome
  - There was no robust error budget model or analyses available
  - Outcome set the stage for a multi-phase AFRL approach
- The AFRL Air Drop way-forward is evolving
- AFRL is proposing a Phase I discovery period where AFRL/Army Natick/AMC work to collect data from air drop flights

Way Forward – cont'd

- **AFRL has teams addressing:**
  - On-board WX sensing integrated with sniper pod technology
  - Automated Green Light Release
  - Payload Exit/Release Improvement
  - Air Drop for Humanitarian Relief
  - Low Cost Guided Air Drop
- **Each team lead has emphasized the need to capture:**
  - Aircraft dynamics at release point
  - Bundle dynamics at release point and during descent
  - Weather situation and affects
  - Parachute specifics (type, material, extraction/opening times)
- **A complete picture of the problem is needed to drive our S&T efforts to the highest payoff solution**

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Summary

- AFRL is fully engaged in the air drop problem
- The problem is challenging and needs further deep-dive understanding
- AFRL is planning on FYDP solutions that can be transitioned to AMC to address CDS and humanitarian drops
- AFRL is also working plans with the Army to make guided air drop systems more attractive
- The AFRL S&T process needs to be thorough to yield high payoff solutions

Soft Power and its use in the Asia Pacific Region

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June 2011

How is the US viewed by the international community?

What is "Soft Power"?

Posit a definition:

*** "Soft power is influencing others to act in mutual interest by appealing to shared values"**

Culture, political values, and foreign policies

Compared to "Smart Power" and "Hard Power"

*** Joseph Nye, Dean of Harvard's Kennedy School of Government**

Which "Power" is Best?

- Choosing which power(s) to use depends upon what effect(s) we're trying to achieve
- Soft power is more about winning the peace
  - Longer-term effects
  - Moral high ground
- <u>Borrowing Brilliance</u>, David Kord Murray
  - Root cause analysis: "Why is a problem a problem?"
    - Root problems for warfighting seem to point to higher level problems best addressed by soft power

What Role Does S&T Play in Soft Power?

Most nations value the development and prosperity that scientific and technological advances bring

- First, how do we equip our PACOM ambassadors to engage across the theater?
- Second, how do we use S&T to initiate and improve broader military-to-military engagement and interoperability with our allies and strategic partners?

There is so much more we can do, and at PACOM we are open to any and all S&T partnership opportunities that we can tie to our our most pressing challenges across our strategic and operational portfolios.

- <u>Be cautious of unintended effects/consequences</u>

Common Challenges and Mutual Opportunities

Two focus areas for S&T

- Humanitarian Assistance/Disaster Relief
  - Resilient Communities
    - Energy (Renewable energy sources)
    - Water (Long term, safe water supplies)
  - Education (Distance learning, Mobile Learning Environments)

- Maritime Security
  - Anti-piracy
  - Illegal fishing
  - Smuggling

Energy Efficient Water Purification focused on USPACOM HADR

- ID HADR capabilities with respect to small unit and local populace water purification.
- Ten systems assessed in a limited objective experiment as part of Crimson Viper Field Experiment 2010 (CV10) in Sattahip, Thailand.
  - Thai military operators and lab technicians operated the systems and provided subjective feedback
  - Water quality analysis was both subjective (by operators) and objective (lab analysis of samples)

ASPEN WATER 2000DM

UH SLOW SAND FILTRATION

Distance Learning

- Telemedicine with Mongolia
- Discussion of use of distance learning with Indonesia

Maritime Awareness

Senator John McCain said on Monday,

“the United States should help members of the Association of Southeast Asian Nations to develop and deploy an early warning system and coastal vessels in contested waters”

Tensions between China and other rival claimants to the strategically vital waters -- home to two potentially oil-rich archipelagos, the Paracels and Spratlys -- have escalated in recent weeks.

Source: Energy Daily June 20, 2011

The Philippines and Vietnam in particular have expressed alarm at what they say are increasingly aggressive actions by China in the disputed waters

Technology for affordable Maritime Awareness

Low Cost Dual Use HF OTH Radar

Commercial RADARSAT

Small, low-cost Autonomous UAS

Heavy Fuel
Beyond Line of Sight
Loiter 33 hours
Power 2.1 kw
Range > 2000nm
Usable payload – 76 pounds
ITAR being worked
Payloads - AIS
- FMV EO/IR
- SAR
- SATCOM

Common Challenges and Mutual Opportunities

"Tell him we haven't got time for any of his bright ideas – we've got a battle on our hands"

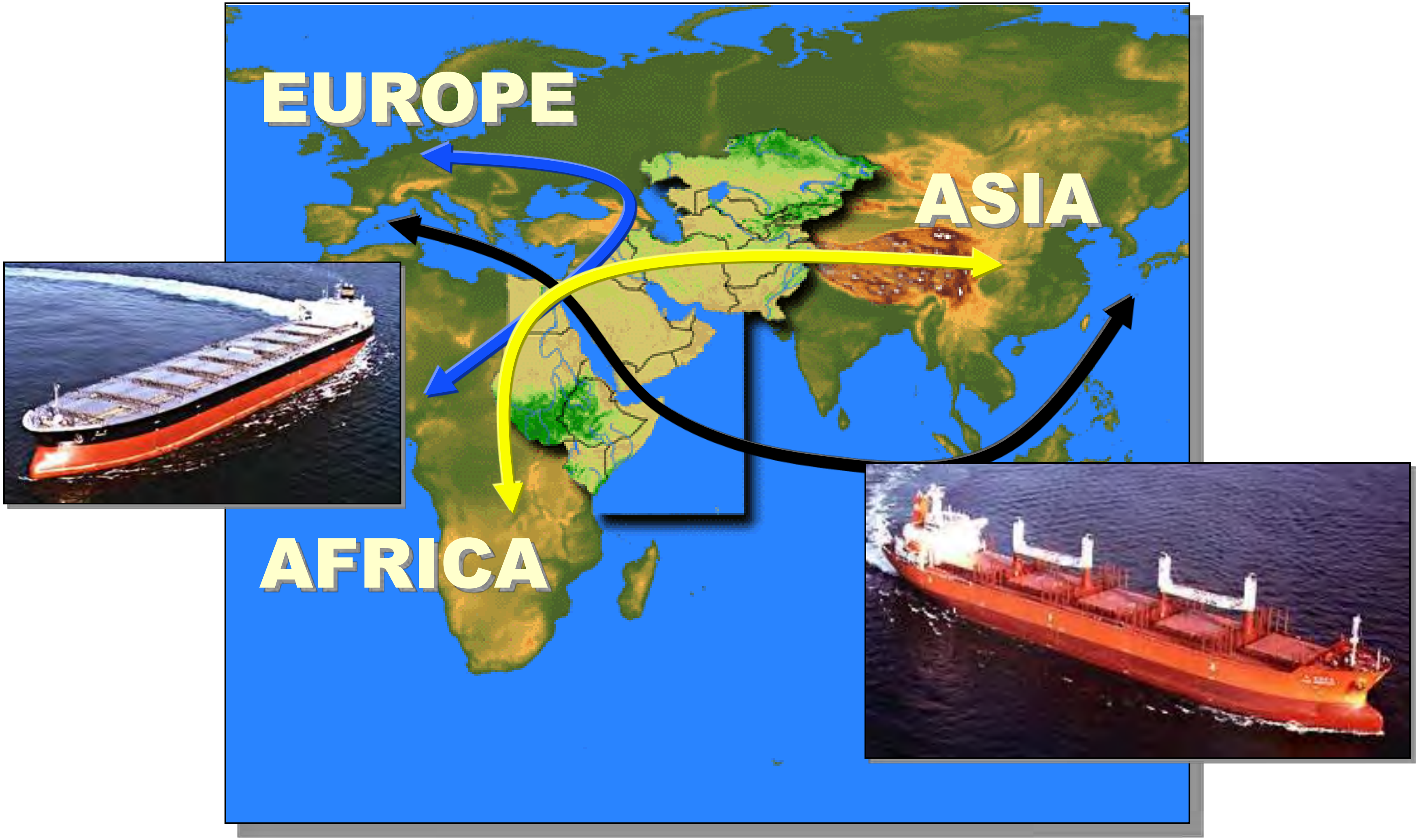
Science and Technology Development

From the Combatant Command Perspective

Where we fit in with the rest of the COCOMs

Central Region

Crossroads of Three Continents



Strategic Interests & Mission

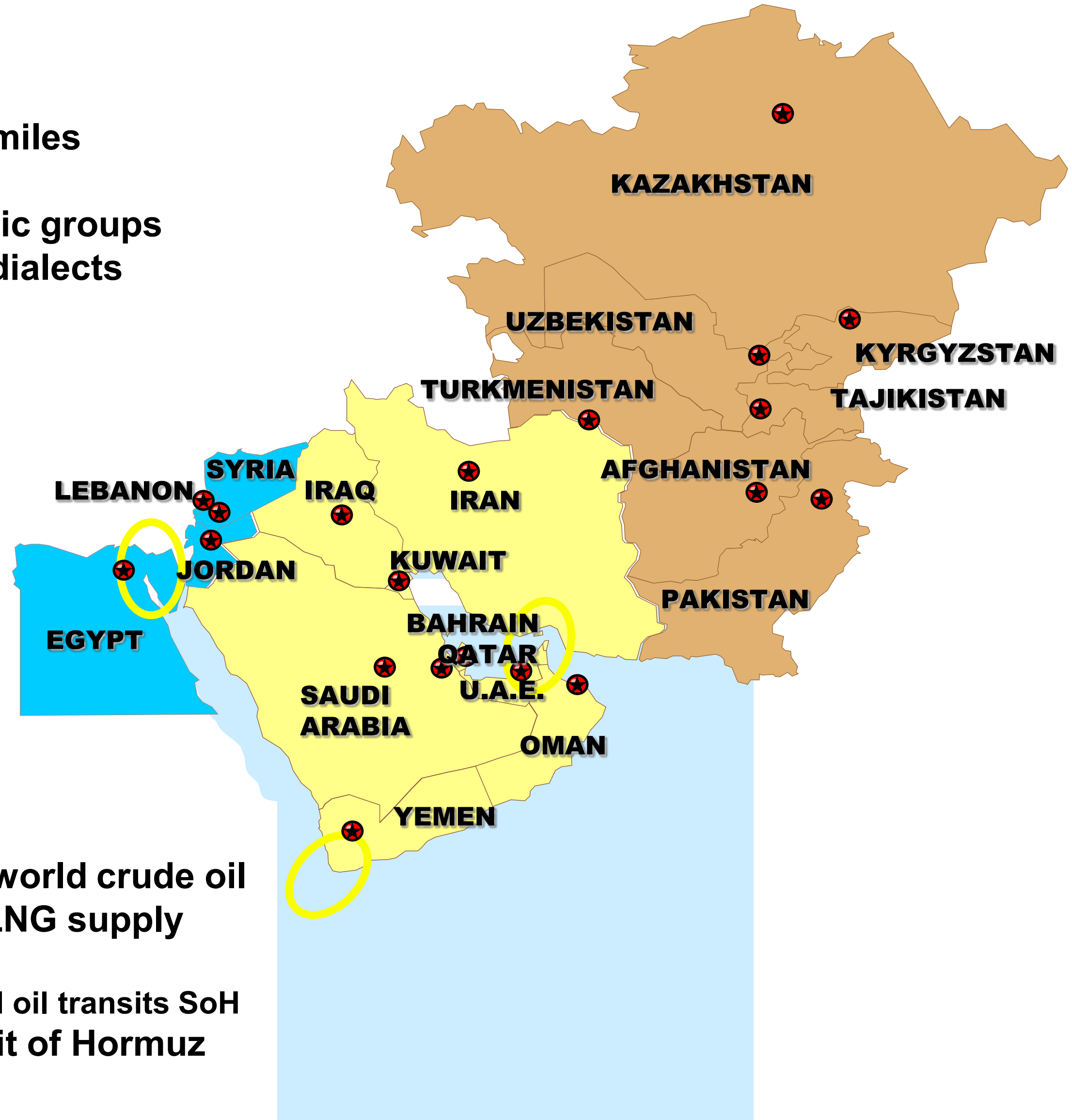
- **Security of the U.S. citizens & the U.S. Homeland**
- **Regional stability**
- **International access to strategic resources, critical infrastructure, & global markets**
- **Promotion of human rights, rule of law, responsible & effective governance, & broad-based economic growth & opportunity**

With our national & international partners CENTCOM will:

- **Promote security & cooperation among nations**
- **Respond to crisis**
- **Deter & defeat state and non-state aggression**
- **Support development & reconstruction to establish conditions for regional security, stability, & prosperity**

CENTCOM - Area of Responsibility

Complex
- **20 Countries, 4.5 million square miles**
- **1.1 Million square miles of ocean**
- **531 Million people, 16 major ethnic groups**
- **7 Major languages, hundreds of dialects**
- **4 Major religions**



Global Economic Impact
- **Arabian Gulf produces ~ 31% of world crude oil**
- **Region exports ~ 26% of global LNG supply**
- **3 x Strategic Choke Points**
  - **Appx 40% internationally traded oil transits SoH**
  - **21% of LNG goes through Strait of Hormuz**

Vision – We seek a region:

- **At peace with itself & its neighbors**
- **Focused on common security & cooperation**
- **With stable governments responsive to the needs of the people**
- **With economic development that advances the population‟swell being**
- **Free of nuclear weapons & where nuclear energy use is verifiable & for peaceful purposes**
- **With unhindered international access to strategic resources, critical infrastructure, & global markets**
- **Which does not allow the safe haven of extremists which threaten Americans or our friends & allies**

Challenges

- Lack of progress in the Middle East Peace Process
- Extremist ideological movements & militant groups
- Proliferation of WMD
- Ungoverned, poorly governed, & alternatively governed spaces
- Terrorist & insurgent financing & facilitation
- Piracy
- Ethnic, tribal, & sectarian rivalries
- Disputed territories & access to vital resources
- Criminal activities: weapons smuggling, narcotics, human trafficking
- Uneven economic & employment opportunities
- Lack of regional & global economic integration

Priority Tasks for CENTCOM

- **Reversing the momentum of the insurgency in Afghanistan**
  - **Regain the initiative**
  - **Restore public confidence in the GoA**
- **Maintain kinetic / non-kinetic pressure against threats to National security and our Allies**
- **Expand our partnership with Pakistan**
  - **Support their operations against militants**
  - **Assist in developing their counterinsurgency capability**
- **Counter malign Iranian activities & policies**
- **Counter proliferation of WMD & build partner capacity to prevent and/or respond to WMD events**
- **Bolster military & security capability of our regional partners**
- **With our partners counter piracy, illegal narcotics, & arms smuggling**
- **Ensure responsible expenditure of funds**
- **Reduce strain on the force & the cost of our operations**

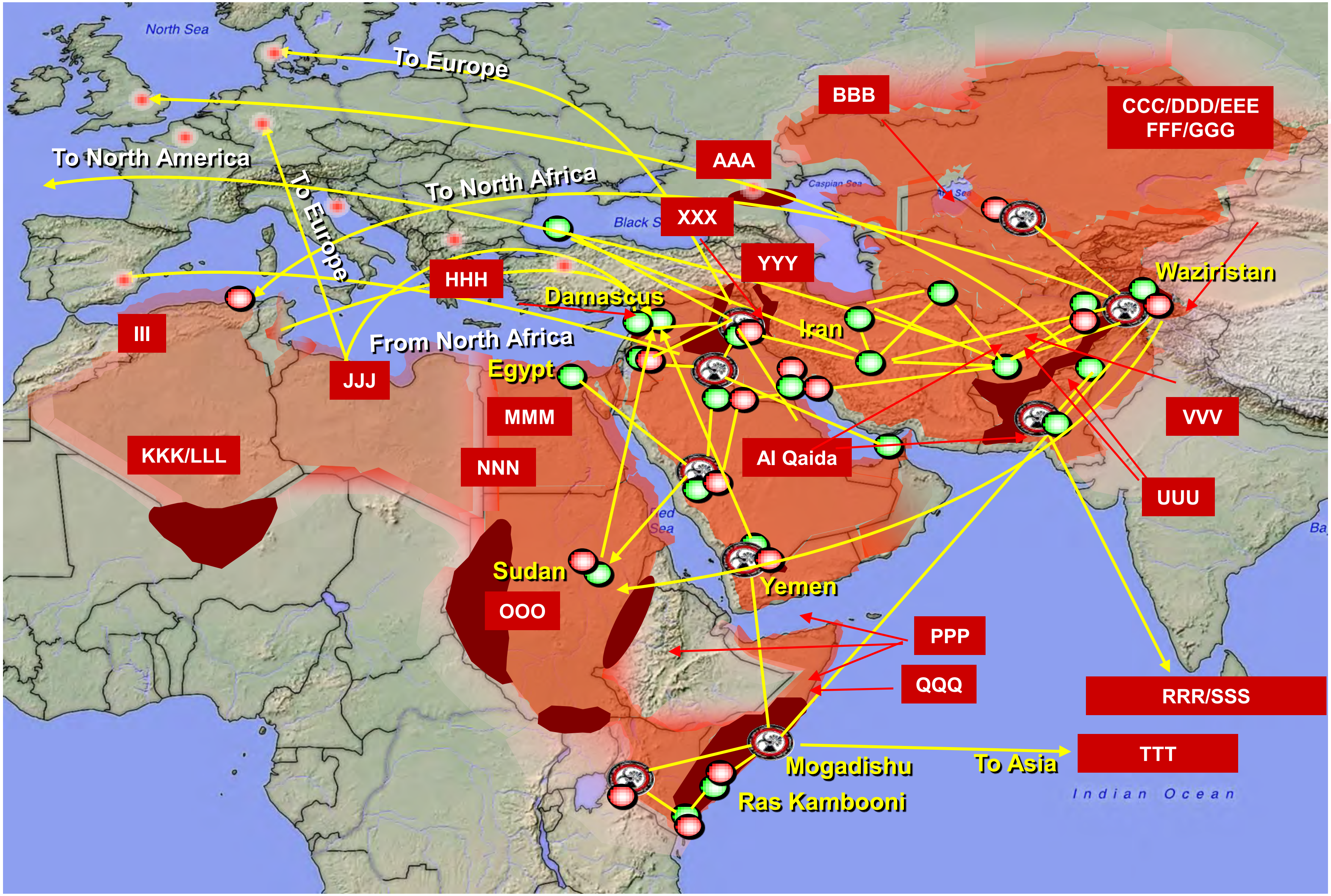
Major Activities

- **Defeat al-Qaeda & associated movements**
- **Deny sanctuary & support for violent extremist groups**
- **Counter proliferation of WMD & associated technologies**
- **Deter & counter state-based aggression & proxy activities**
- **Support peaceful resolution to long-standing conflicts**
- **Build bi-/multi-lateral partnerships**
- **Develop partner nation capacity**
- **Assist nations in their ability to protect their critical infrastructure & support robust infrastructure development**
- **Bolster at-risk states**
- **Respond to humanitarian crisis**
- **Counter arms smuggling**
- **Protect freedom of navigation**

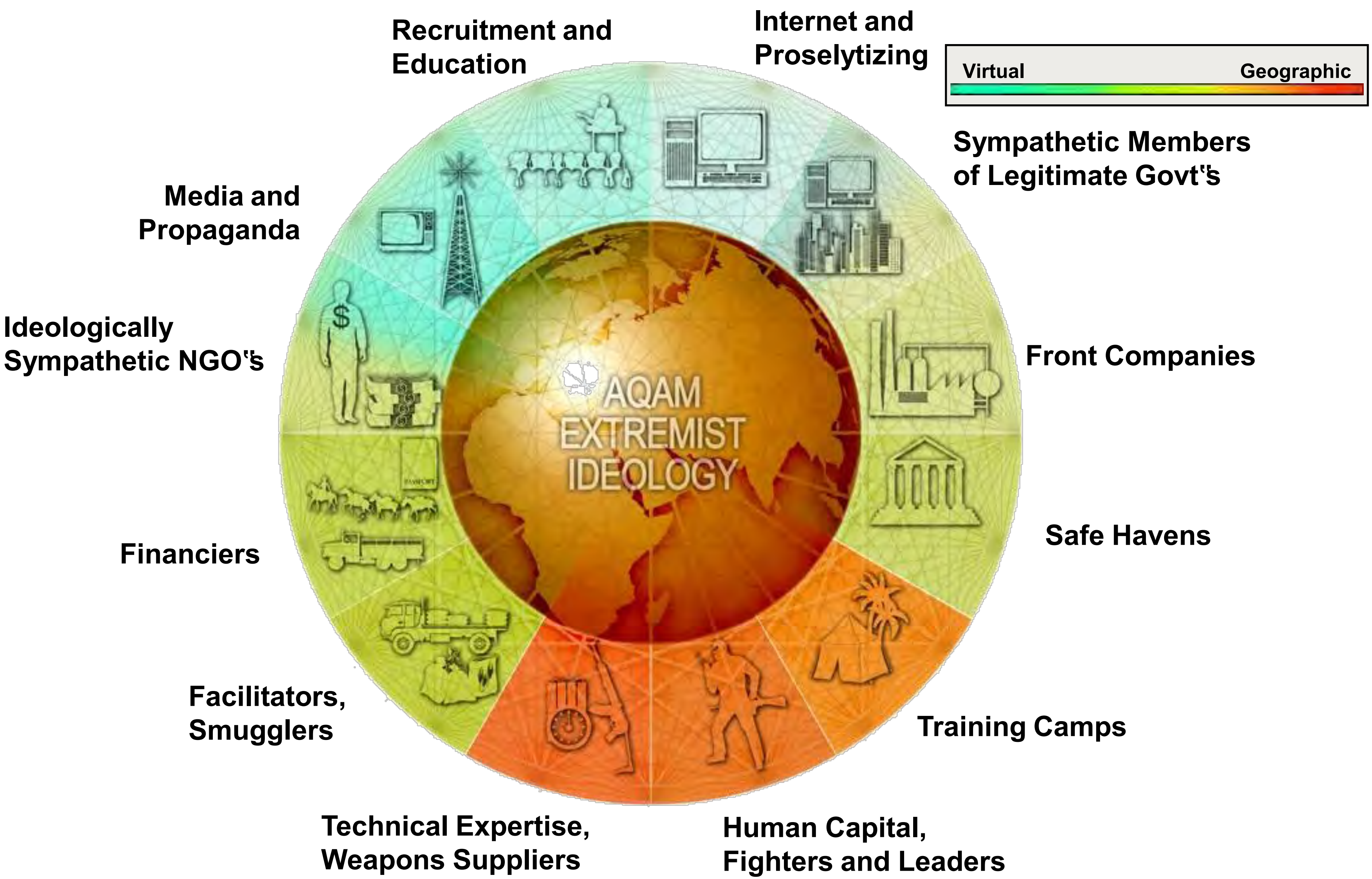
The Nature of the Enemy

- A network guided by ideology
- Amorphous worldwide network which operates as a web of cells
- Fueled by militant Islamic zeal
- Anti-Zionist
- No state boundaries
- Powerful virtual element
- “Virtual Caliphate” - All directed toward the eventual establishment of a pan-Islamic state - the “Physical Caliphate”
- Seek safe-havens, physical footholds for recruitment, training, financing, and propaganda initiatives which complement its virtual element
- Well financed and has a simplified acquisition/training/fielding strategy

Al Qa'ida and Associated Movements (AQAM)

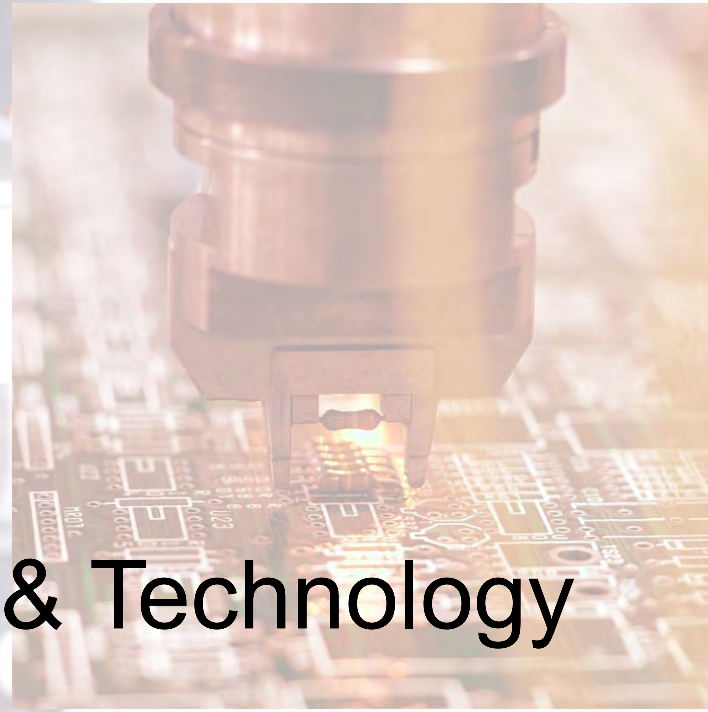


AQAM: A Threat in All Realms



It Takes a Network … To Defeat a Network

 13



The Role of Science & Technology

Charter

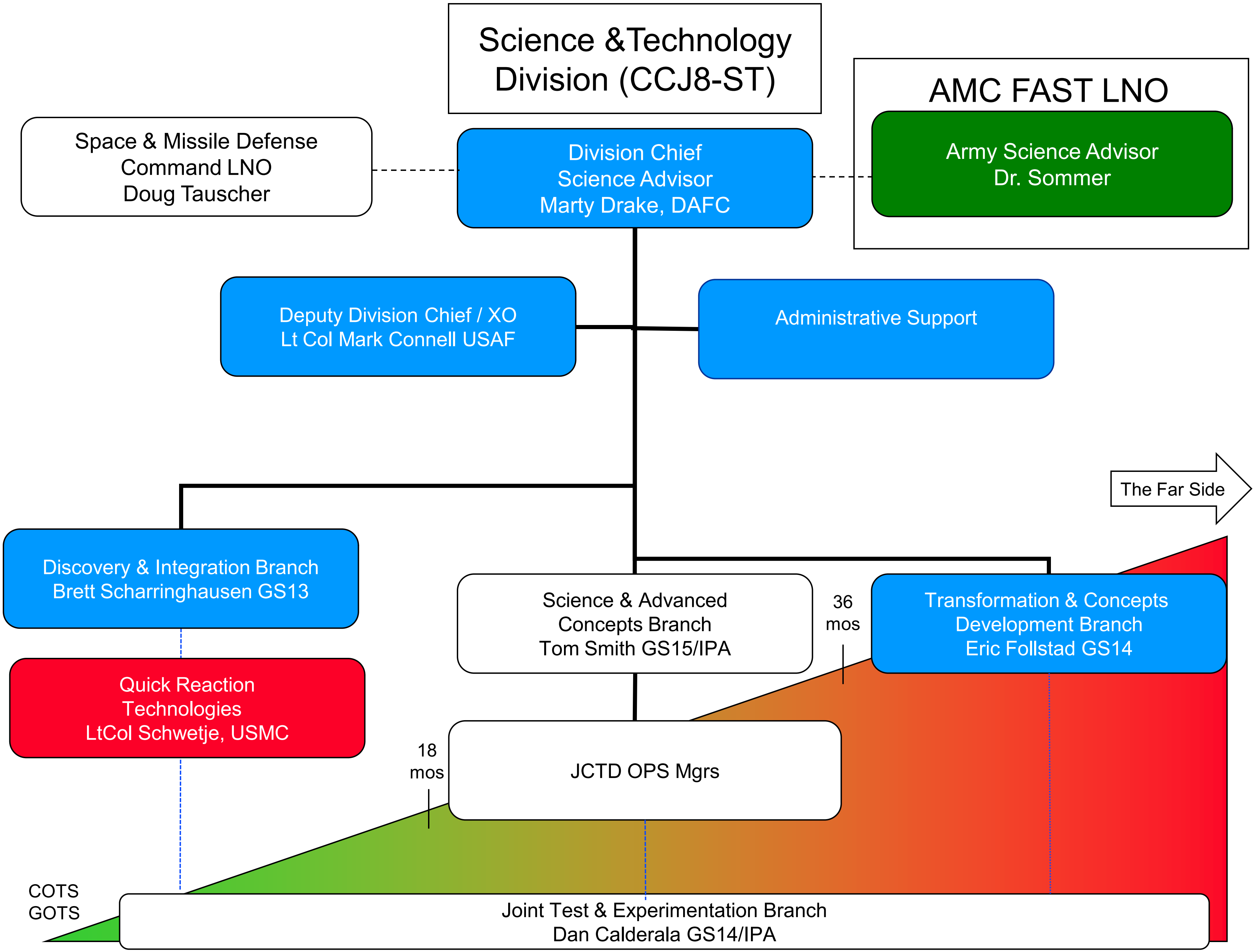
Conduct ***discovery***, ***research***, ***analysis***, and ***sponsor development*** of new and emerging technologies which have the *potential to provide material solutions* to Headquarters and Component validated Joint needs.

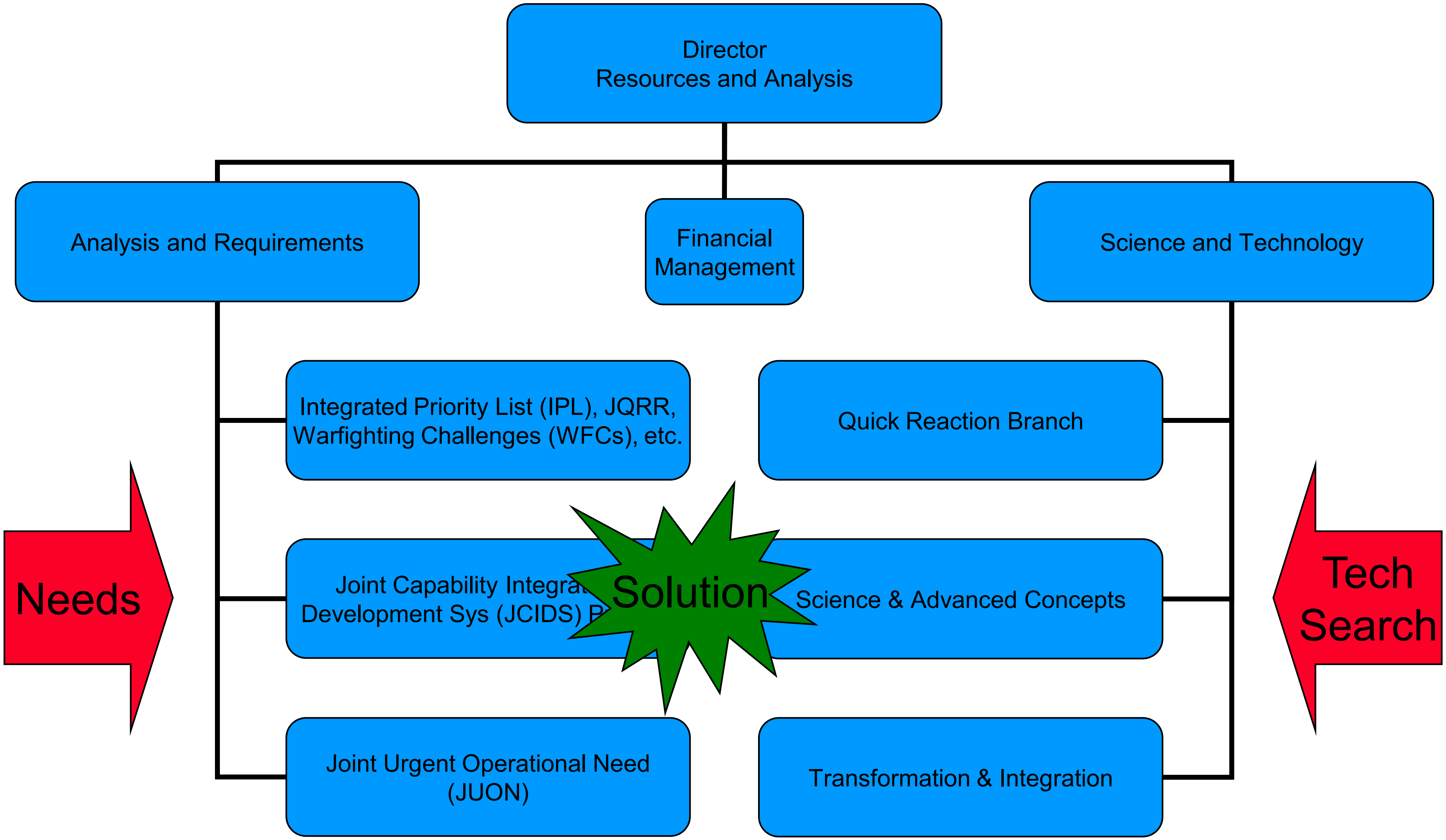
Review USCENTCOM and Component ***plans, operations***, programs, policies and activities for areas where technology will improve efficiency and effectiveness.

Integrate across USCENTCOM headquarters and Component staffs for transformational, integrating, and experimentation activities.

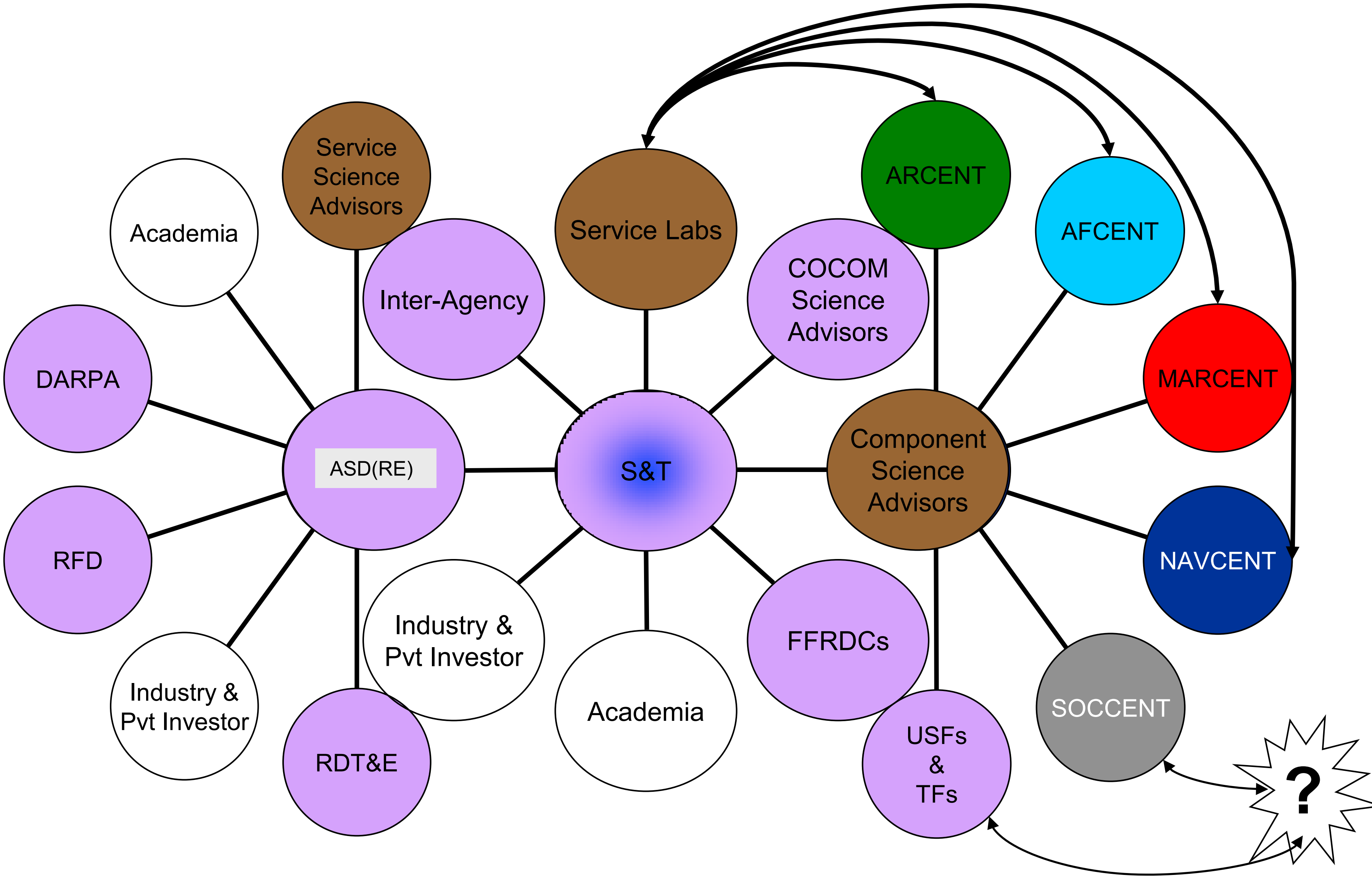
What we do

- **Technology discovery, research & analysis, and inform the staff & OSD on promising initiatives**
    - **Attend technology symposiums / reviews**
        - **Service Labs, DARPA, FFRDCs**
        - **Private industry & Academia**
    - **Conduct global market research**
    - **Provide initial feasibility / technical merit on proposals**
- **Needs pull**
    - **Conduct HQ USCENTCOM Leadership, Directorate, & Component outreach**
    - **Participate in planning, operations, & exercises**
    - **Review submissions from the requirements generation processes for technology needs to support the Warfighter**
- **Operationally Manage technologies we sponsor**
- **Participate in limited objective experiments**


Science &Technology Division (CCJ8-ST)
AMC FAST LNO
Space & Missile Defense Command LNO Doug Tauscher
Division Chief Science Advisor Marty Drake, DAFC
Army Science Advisor Dr. Sommer
Deputy Division Chief / XO Lt Col Mark Connell USAF
Administrative Support
The Far Side
Discovery & Integration Branch Brett Scharringhausen GS13
Science & Advanced Concepts Branch Tom Smith GS15/IPA
36 mos
Transformation & Concepts Development Branch Eric Follstad GS14
Quick Reaction Technologies LtCol Schwetje, USMC
18 mos
JCTD OPS Mgrs
COTS GOTS
Joint Test & Experimentation Branch Dan Calderala GS14/IPA


Director
Resources and Analysis
Analysis and Requirements
Financial Management
Science and Technology
Integrated Priority List (IPL), JQRR, Warfighting Challenges (WFCs), etc.
Quick Reaction Branch
Needs
Joint Capability Integra
Development Sys (JCIDS) P
Solution
Science & Advanced Concepts
Tech Search
Joint Urgent Operational Need (JUON)
Transformation & Integration

How we connect



U.S. Central Command Tech Focus

- **We focus on the JOINT solution that has the potential to satisfy a JOINT validated need**
- **Separate from the many technology needs of our customer(s) those technology challenges which:**
  - ***Do not have a readily available solution***
  - **For high-impact needs there is *insufficient activity pursuing a solution***
- **Seek out game-changing technologies which our customer(s) don"tknow they need**

Some technology areas we "pursue":

- Detection of CBRNE at tactically significant distances; with emphasis on the "E"
- Pre-shot counter-sniper, counter-mortar, counter-RPG technologies; with emphasis on automated systems
- Technologies which enable the transfer of information more securely, more quickly, to a wider set of users, to include the warfighter when it makes sense, with less bandwidth and dedicated support resources, e.g.:
  - Multi-level Security over single architectures
  - Bandwidth compression / reduction techniques
  - Data reduction [data=>info=>knowledge=>understanding=>wisdom]
- Through automation, remote action, new and novel techniques, technologies which reduce risk and / or stress on the force and / or improve the efficiency and effectiveness of our action(s)
- Technologies which allow for greater persistence over the battlespace with fewer platforms; employing improved sensor technology providing greater fidelity of information

Common thematic areas of concern

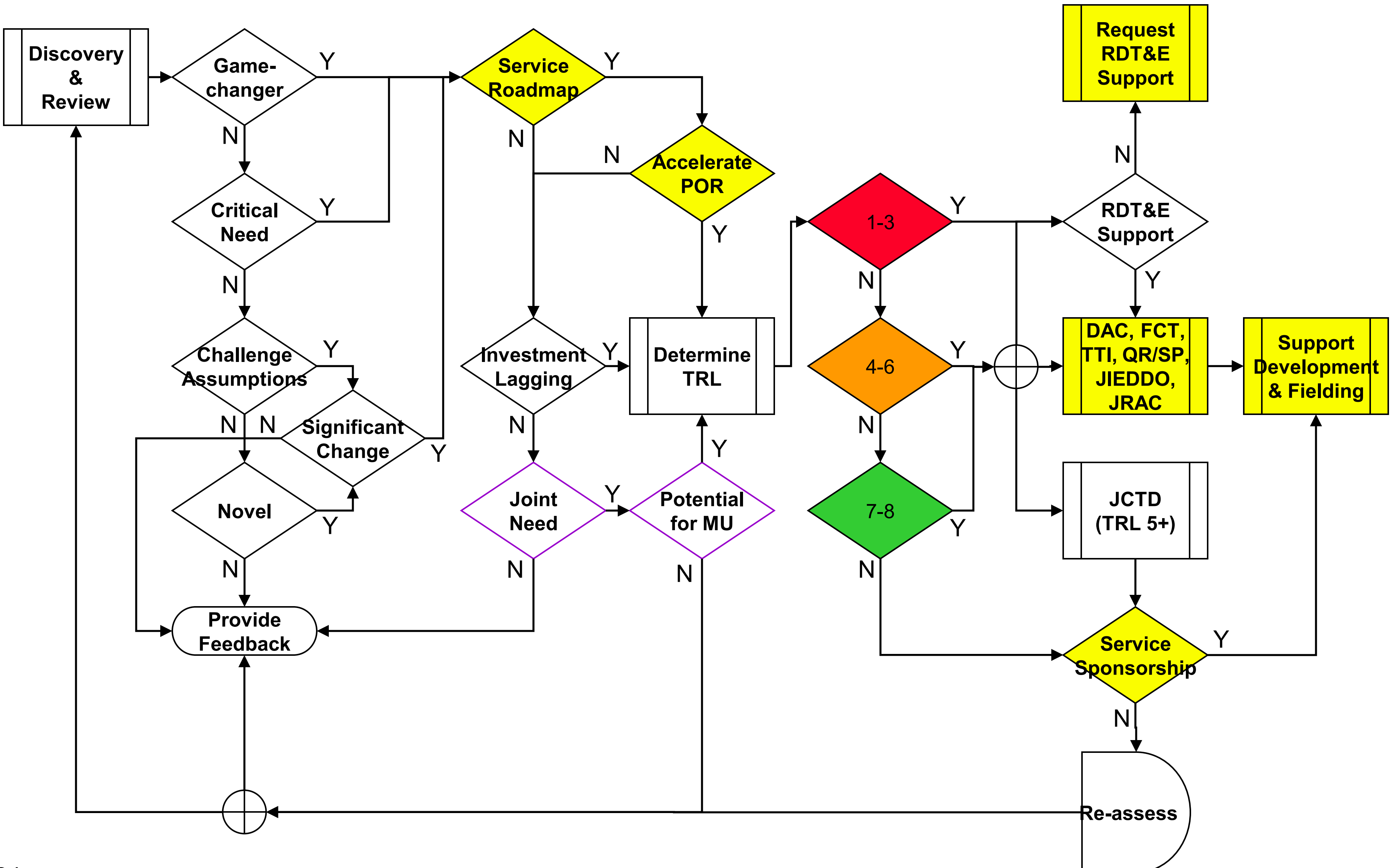
(not in priority order)

- **Detect / Defeat:**
  - **IED initiators / initiator systems**
  - **Buried / concealed IEDs**
  - **Production and assembly of IEDs**
- **HME production standoff detection**
- **Culvert access denial / alerting**
- **Persistence in surveillance**
- **Biometrics**
  - **Identity dominance**
  - **Force protection / access**
- **Non-lethal vehicle / vessel stop**
- **Reduce stress on the force:**
  - **Force Protection requirements**
  - **Increased automation**
- **Anti-swarm lethal / non-lethal**
- **More efficient / effective / timely trng**
- **Predictive analysis techniques**
- **Voice to text technologies**
- **C4ISR systems:**
  - **Info sharing between system**
  - **Multi-level security**
  - **Cross domain solutions**
  - **Faster … Better sorting / retrieval**
  - **On the move w/ GIG access to tactical edge**
    - **SATCOM, WiFi, WiMax, etc.**
- **Tagging, Tracking, and Locating (TTL)**
- **Lightweight "x" with greater "y"**
- **More power per unit of weight**
- **Scalable effects – non-lethal to lethal**
  - **Directed Energy**
  - **Kinetics**
- **True SA for Blue … Fused Red**
- **Sustaining the force – reduced size, weight, amount, and retrograde**
- **Holding all targets at risk**
- **Any sensor … any shooter; the Soldier as a sensor; any adversary … any battlespace … anytime**

What would the battlespace be like if …

- Bandwidth could be made irrelevant
- Concealed / buried explosive material could be detected at significant distances
- Tagants in dual-use items used to make homemade explosives when combined cause the mixture to inert
- Intent could be pre-determined
- A two-way certified cross-domain exchange was available
- Warfighter equipment drew its power from the environment (day or night); making power storage devices optional
- Aural simultaneous two-way translation into any language was available in a miniature form-factor
- …

Technology Review Process



When proposing a solution …
The Heilmeier Questions … adapted

- **What are you trying to do?**
  - **Articulate your objectives using absolutely no jargon**
- **Who should care?**
- **How is it accomplished today?**
- **What are the limits of the current practice?**
- **What is new in your approach?**
- **Why do you think you will be successful?**
  - **How do you define / measure success?**
  - **What is your strategy to get there?**
- **How long will it take and at what cost?**
- **What are the risks?**
- **What is your risk reduction / mitigation strategy?**
- **What are the payoffs / return on investment?**

For Technology Developers Some Points to Consider

- **Seek to understand how your solution fits in the overall DoD system of systems**
  - **Integrate with legacy systems vice replace them**
  - **Open architectures receive higher interest / support**
- **Consider partnering with others to bring a „greater" solution to the table - system best-of-breed vice at the component level**
- **Determine your relative impact to a program of record**
  - **Training**
  - **Initial fielding**
  - **Sustainment**
- **Substantiate your position with data**
  - **Testing**
  - **Cost-benefit analysis**

We are Venture Capitalists without any Capital. When a promising technology is discovered, we:

- **Seek OSD / Joint Staff / Service support for funding ***
    - **Service programs of record (PORs)**
    - **Joint Rapid Acquisition Cell (JRAC)**
    - **Joint IED Defeat Organization (JIEDDO)**
    - **Quick Reaction Funds (QRF)**
    - **Rapid Reaction / New Solutions (RR/NS)**
    - **Force Transformation / Operational Experimentation (FT/OE)**
    - **Operational Test and Evaluation (Joint Tests & Quick Reaction Tests)**
    - **JFCOM Limited Acquisition Authority (LAA)**
    - **Defense Acquisition Challenge (DAC)**
    - **Technology Transition Initiative (TTI)**
    - **Foreign Comparative Testing (FCT)**
    - **Combatant Commander Initiatives Fund (CCIF)**
    - **Defense Venture Catalyst Initiative (DeVenCI)**
- **For those technologies we desire to "sponsor"**
    - **Assist the Headquarters and Components in the development of technical proposals to satisfied identified needs**
    - **Provide oversight management to get the technology into the hands of the Warfighter**

* Not an all-inclusive list

Points of Contact

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  Transformation & Concept Development

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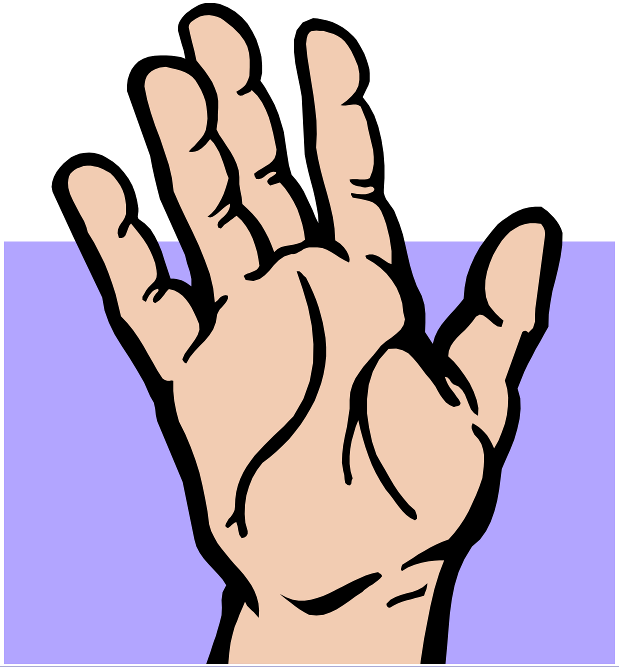
  RDECOM LNO

- **Doug Tauscher** 827-6669 doug.tauscher.ctr@centcom.mil
  SMDC LNO



Raise your Hand


U.S. Central Command
7115 S Boundary Blvd
MacDill AFB, FL 22651-5101
[Your Name Here]
Honorary Deputy Science Advisor
Contact Info
Blah, Blah, Blah

Autonomy
S&T Priority Steering Council

Team members/Affiliation:

Dr. Bobby Junker

Autonomy PSC Lead

Division Director

ONR/

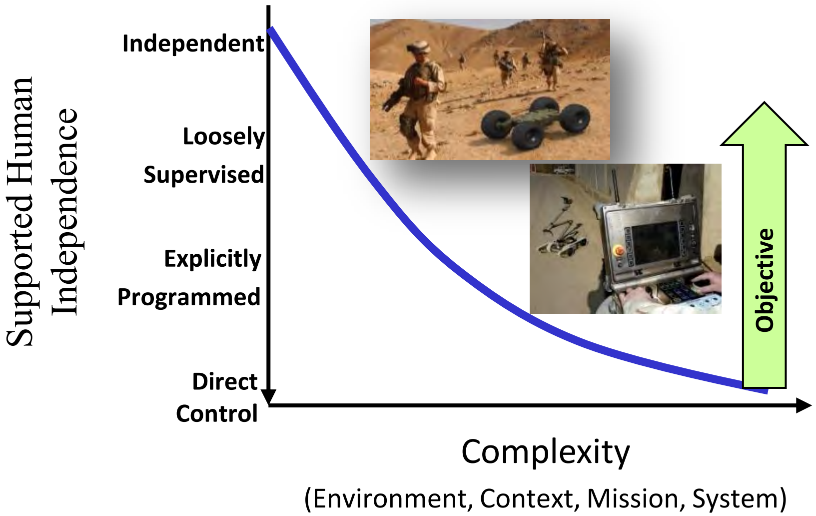
Presentation to S&T EXCOM

14 June 2011

Team Meetings held: and frequency

Two Human-Machine Relationships

Human is *Supported*



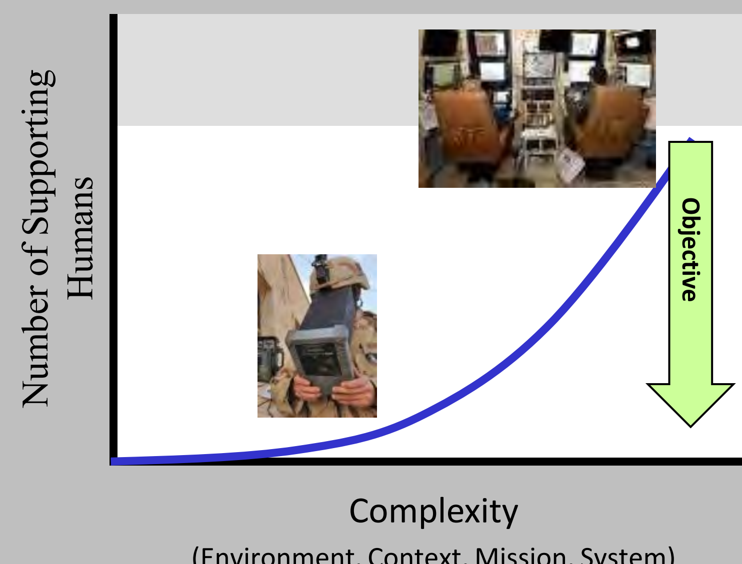
Goal

Minimize human control to defining mission

Optimum Level

System understands human intent

Human is *Supporting*



Goal

Minimize supporting humans

Optimum Level

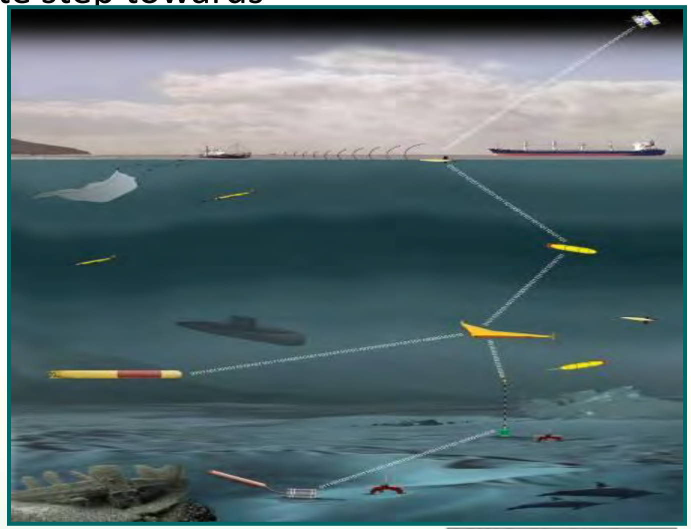
Zero

UxV and Autonomy

Now:
- Uninhabited UxVs are an intermediate step towards autonomy

We are here

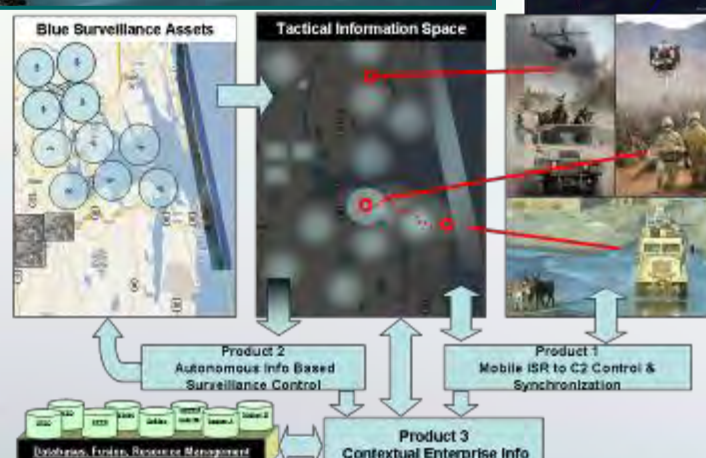
The Future



Mid-Term:
- Current UxV systems are rule-based and can support relatively simple missions, but do not operate well in complex, uncertain dynamic environments

Distributed EW

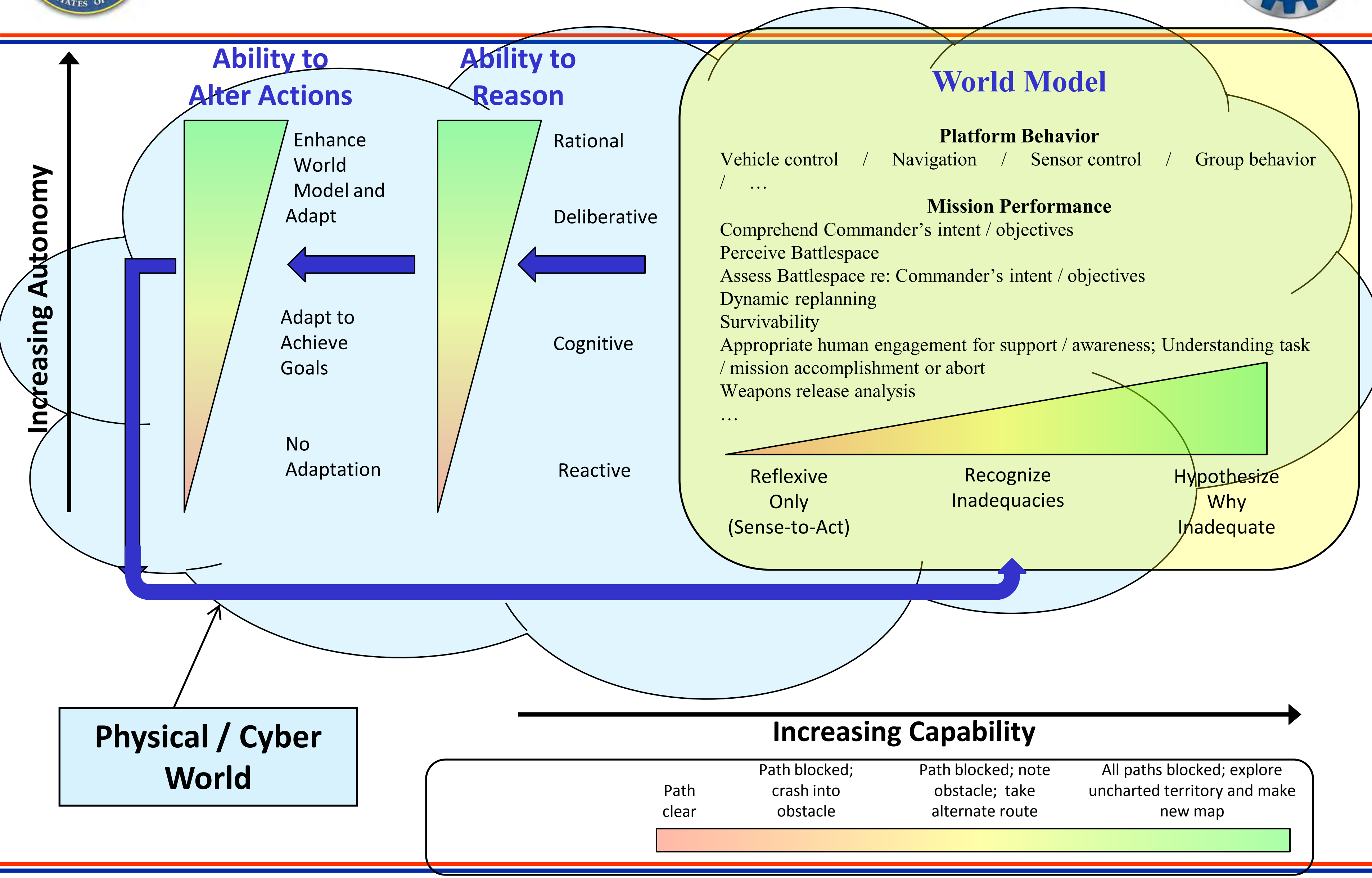
Long-Term:
- Level of reasoning capable of comprehending the battlespace
- Automated, coordinated, distributed, adaptive planning



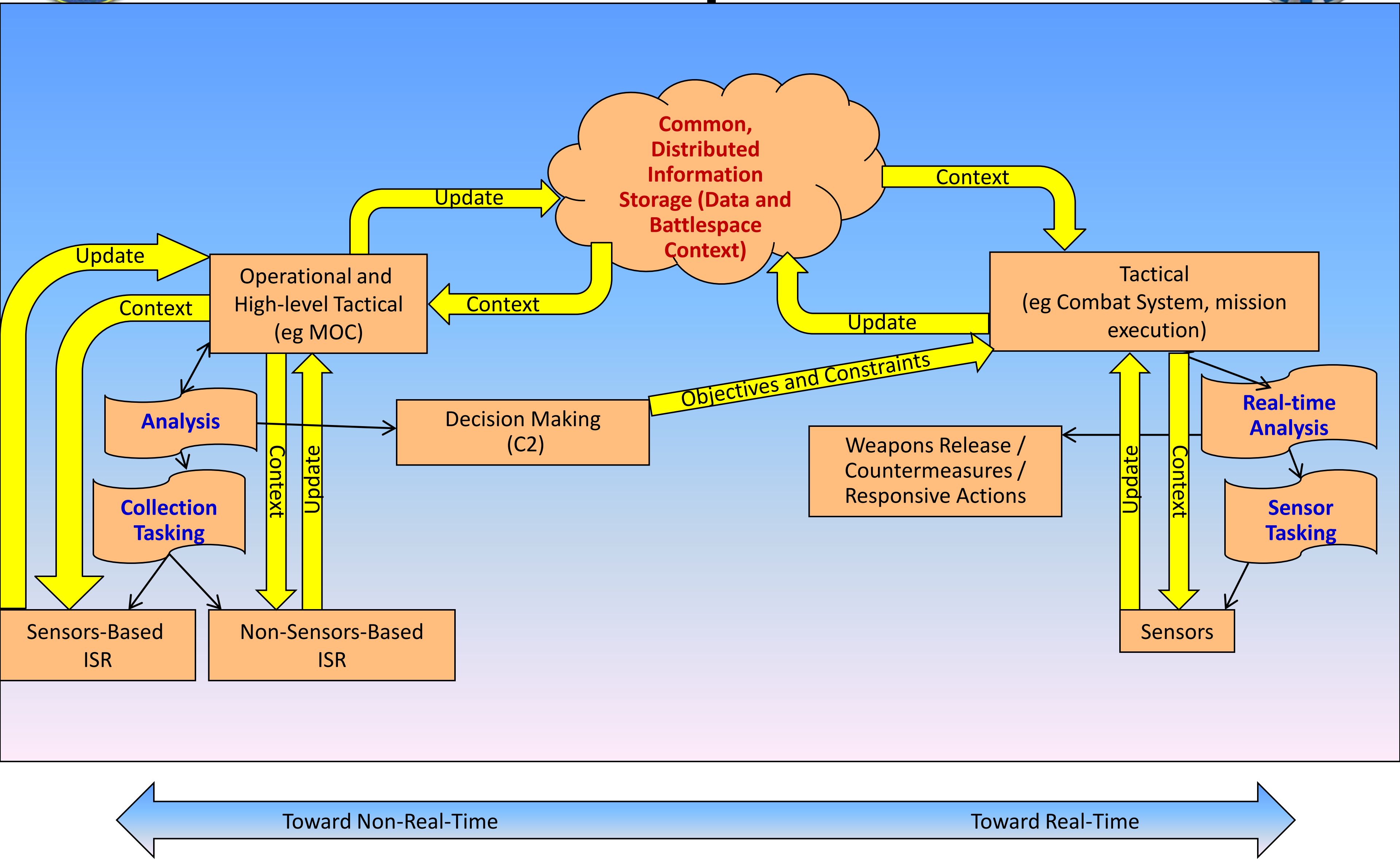
Riverine/Urban Persistent ISR

Persistent Littoral Undersea System

Levels of Autonomy



Operational and Tactical Pictures Development



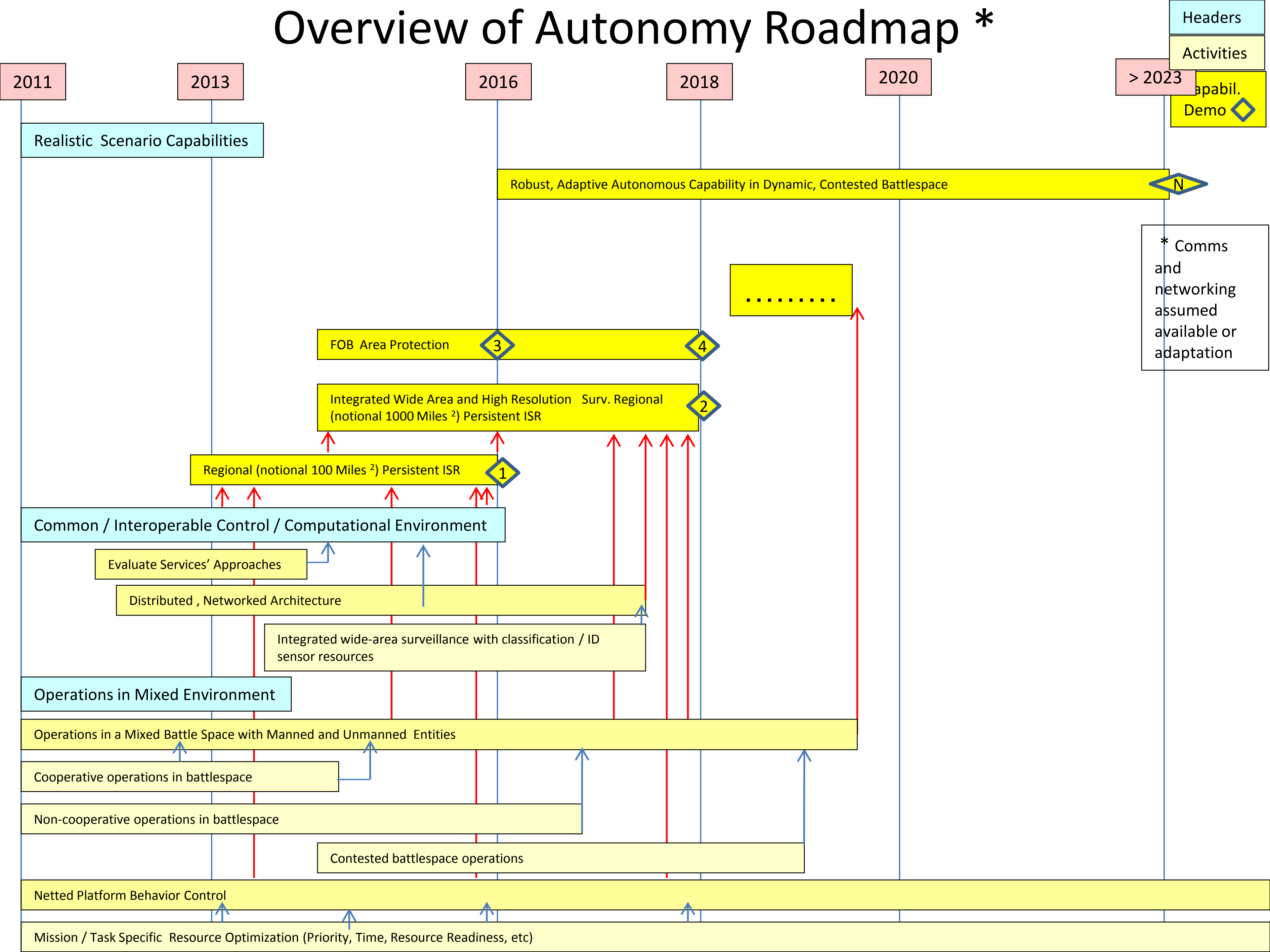
Autonomy Problem Statements

- **Problem: Insufficient manpower to support command and control of persistent, pervasive surveillance assets across relevant battlespace**
  - Desire for, at most, single operator control of unmanned teams
  - Increasing quantity and scope of ISR data pushing analysis “beyond human scale”
  - Expanding domains and time-criticality pushing decision-making “beyond human scale”
- **Problem: Operators/decision-makers don’t have appropriate level of trust in autonomy, ie too low or too high.**
  - Lack technologies for adaptive autonomous control of vehicle systems in the face of extremely harsh, unpredictable and mathematically intractable environments
  - Lack technologies to enable safe manned and unmanned operation in a mixed battlespace (civilian and military AORs)
  - V&V and C&A address only part of trust
    - Ramifications of over-reliance on autonomy in contested, complex battlespaces
- **Problem: Environments so harsh as to not reasonably permit humans to enter and sustain activity**
  - Examples include
    - High radiation, High biological, High chemical environments
  - Mission areas where one may not return

Desired End States

3 year (2016)	5 Year (2018)	7 Year and beyond (2020+)
• Develop highly flexible, interoperable environment for common control and computations • 50% staff reduction for C2 for a notional 100 sq mile area • Autonomously update battlespace context using available sources • Enable timely operational decision making based on commander's intent • Enable mixed manned/unmanned operations within common battlespace • Complete Phase 1 advanced autonomous tech development – Tailored pattern recognition – Decision making – Miniaturization of autonomous control sensors, power supplies, etc – Autonomous Protective system defeat	• No increase in supporting manpower requirements for C2 of 1,000 sq mile area • Integrated wide area – classification / ID sensor resource for autonomous cooperation • Expand mixed manned/unmanned operations to non-cooperative, but not contested battlespace • Enhanced SIGINT input to include signal internals • Continue 2nd generation prototyping • Continue Phase 2 advanced autonomous tech development – Tailored swarming tech-subterranean – Coordinated multi-unit search – Obstacle negotiation, task restructure – Threat recognition & adaptive response	• Continue evolving technologies • Complete Phase 2 advanced autonomous tech development • Initiate Phase 3 advanced autonomous tech development **Beyond** • Fully autonomous operations with periodic need for update • >75% prob of success in contested battlespace • Training/experience (warfighter culture) support inclusion of autonomous capabilities • Complete Phase 3 advanced autonomous tech development • Complete 3rd generation prototype

Overview of Autonomy Roadmap *



Notional Autonomy Roadmap *

2011 | 2013 | 2016 | 2018 | 2020 | > 2023

Headers
Activities
Capabil.

Semi-autonomous and Autonomous Analysis and Assessment

- Semi-autonomous and Autonomous Analysis and Assessment (information integration and assessment in real-time and non-real-time)
- Broad Area Entity Tracking
- Identification of normal, new, and abnormal activity
- Robust multi-platform tracking
- Autonomous Image and Video Understanding / Comprehension and Assessment
- Traditional analysis
- Object classification and identification
- Extraction of motions and actions in the context of the environment
- Identification and assessment of activities
- Assessment of group activities
- Bio-inspired Image and Video analysis
- SIGNET
- Externals
- Internals
- Cultural / Behavior Algorithms and Social Network Analysis
- Relationships and Pattern Recognition

* Comms and networking assumed available or adaptation

Headquarters U.S. Air Force

I n t e g r i t y - S e r v i c e - E x c e l l e n c e

AF Science, Technology, and Engineering Overview

U.S. AIR FORCE

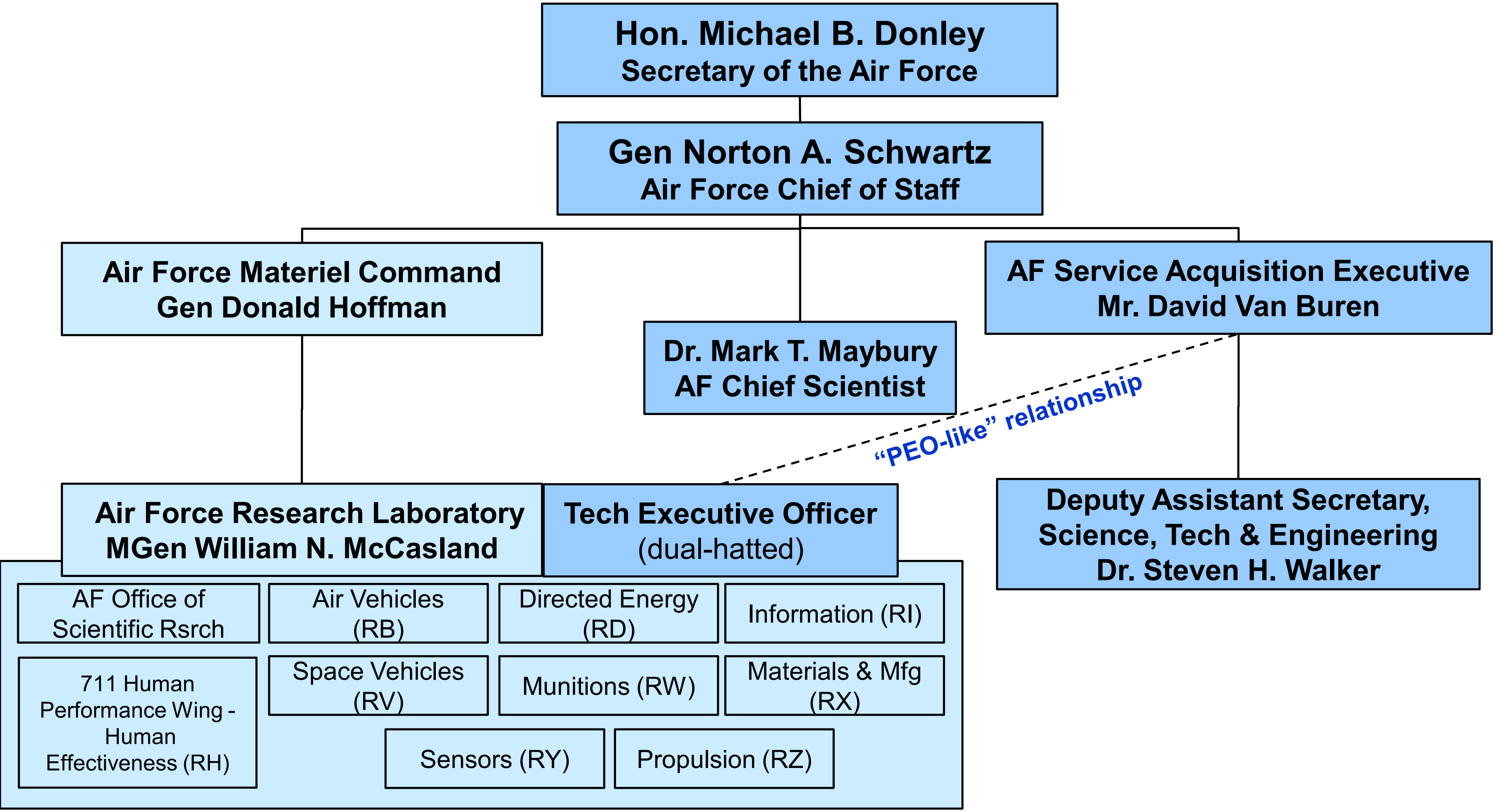
Col Mark D. Koch
Associate Deputy Assistant Secretary
(Science, Technology, and Engineering)

Agenda

- AF S&T Organization
- AF S&T Vision
- SAF/AQR
- S&T Program Tenets
- S&T Program Priorities
- Strategy Development
- Summary

U.S. AIR FORCE

AF S&T Organization



AF S&T Vision

Create compelling air, space, and cyber capabilities for precise and reliable Global Vigilance, Reach and Power for our Nation

U.S. AIR FORCE

SAF/AQR

Deputy Assistant Secretary for Science, Technology and Engineering
Dr. Steven Walker

- Congressional
- Budget

Associate Deputy Assistant Secretary
Col Mark D. Koch

Engineering & Technical Mgt Division (AQRE)

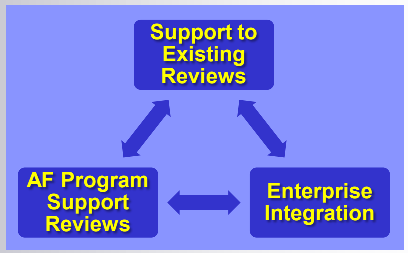
Strategy Division (AQRS)

Science & Technology Division (AQRT)

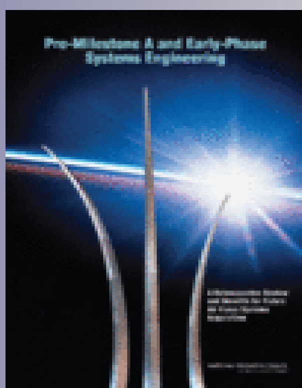
U.S. AIR FORCE

SAF/AQR Portfolio

Technical Advice to SAE



S&T Program Oversight



Life Cycle Systems Engr & Tech Policy

"Functional Directorate" & *"Capability Directorate"*

Air Force Science & Technology Strategy

U.S. AIR FORCE

S&T Strategy

S&E Career Field

Technology Transition

S&T Program Tenets

- Prepare for an Uncertain Future and Investigate Game-Changers to Shape the Art-of-the Possible into Military Capabilities
- Create Technology Options that Address Urgent Warfighter Needs and Provide New AF Service Core Function Capabilities in Support of the Joint Mission
- Maintain In-House Expertise to Support the Acquisition and Operational Communities and Modernize and Improve the Sustainability of Unique Research Facilities and Infrastructure
- Develop Future Air Force Leaders with an Appreciation for the Value of Technology as a Force-Multiplier
- Remain Vigilant Over and Leverage Global S&T Developments and Emerging Capabilities

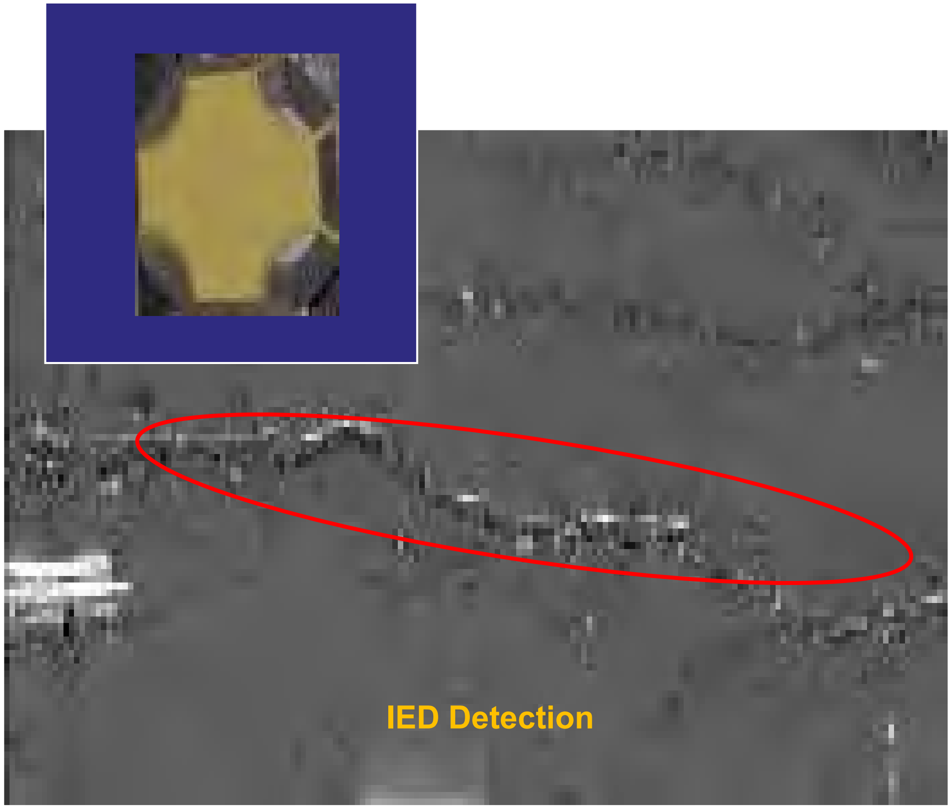
S&T Program Priorities

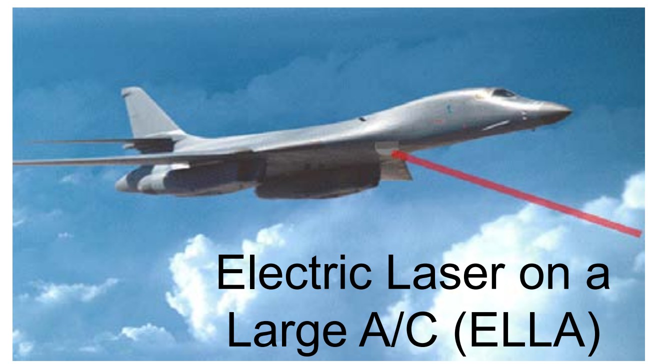
- **Priority 1:** Support the current fight while advancing breakthrough S&T for tomorrow's dominant warfighting capabilities
  - Enable the AF to operate effectively and achieve desired effects in all domains and all operations
  - Improve the agility, mobility, affordability and survivability of AF assets

The Right Balance - 6.1/6.2/6.3, All Domains, Performance vs. Affordability

U.S. AIR FORCE

Support the Current Fight While Advancing Breakthrough Capabilities





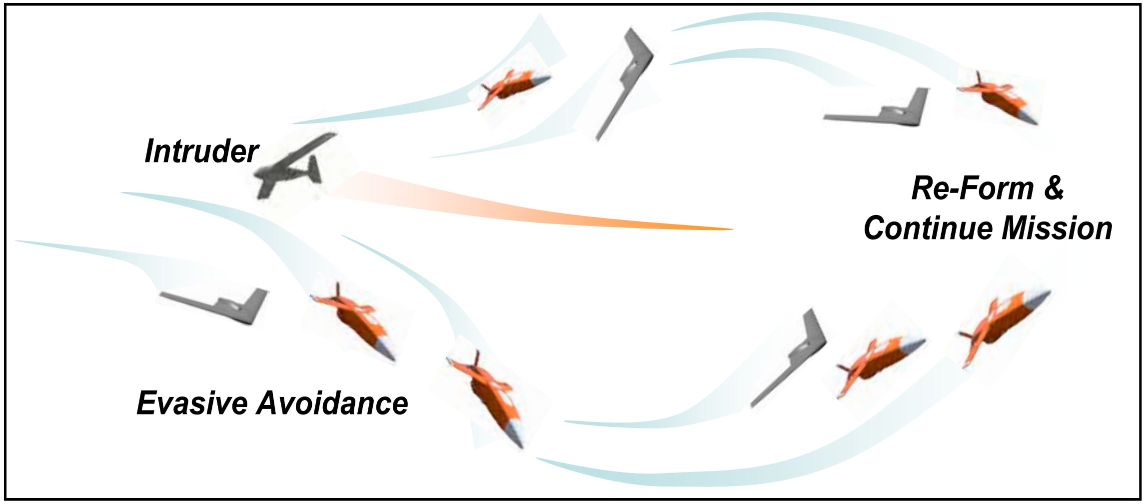
Support the Current Fight…. Advancing Tomorrow's Capabilities

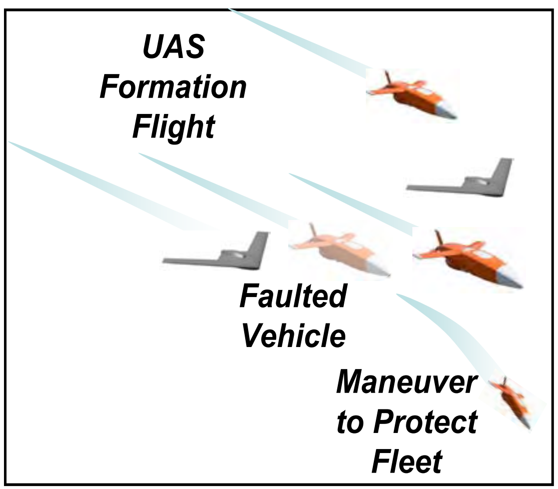
S&T Program Priorities

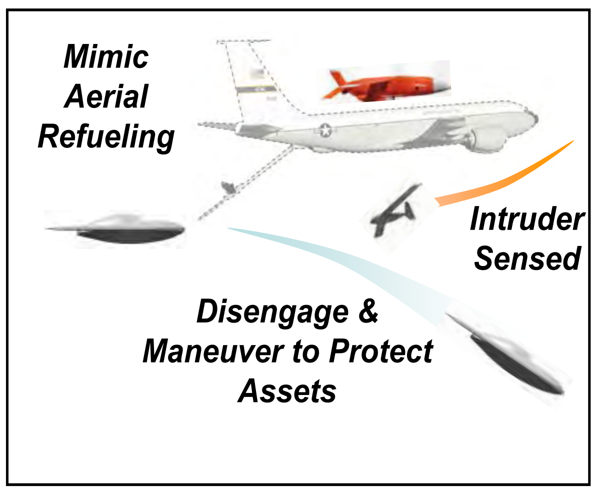
- **Priority 2:** Execute a balanced, integrated S&T Program that is responsive to AF Service Core Functions; Increase emphasis in S&T that will:
  - Improve the sustainment, affordability and availability of legacy systems
  - Reduce cyber vulnerabilities while emphasizing mission assurance
  - Support the needs of the nuclear enterprise
  - Deliver autonomous systems and human performance augmentation technologies envisioned in Technology Horizons
  - Provide robust situation awareness to enhance decision-makers' understanding and knowledge by improving ISR capabilities and data PED
  - Enable long-range precision strike
  - Reduce energy dependency

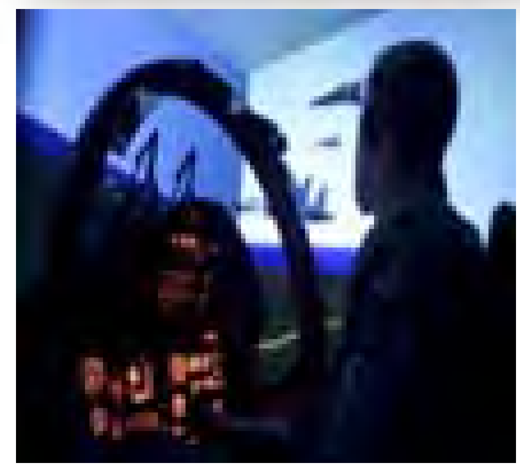
Where Do We Invest the Next Dollar

Delivering Human Performance Augmentation and Autonomy



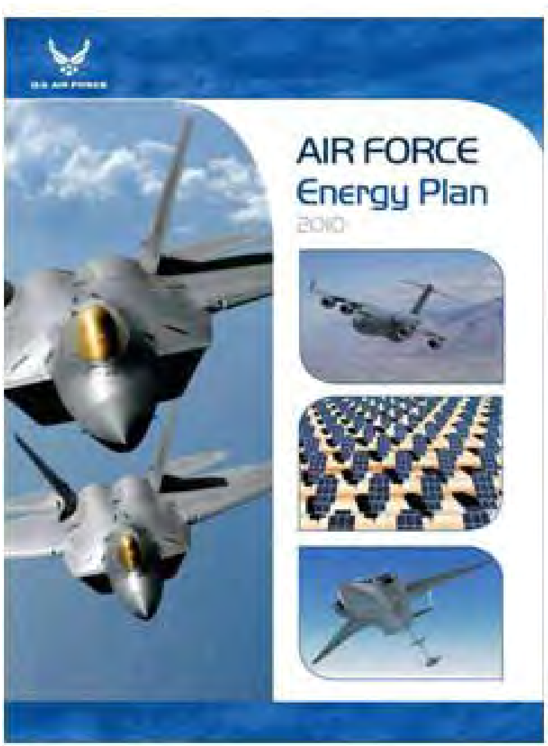




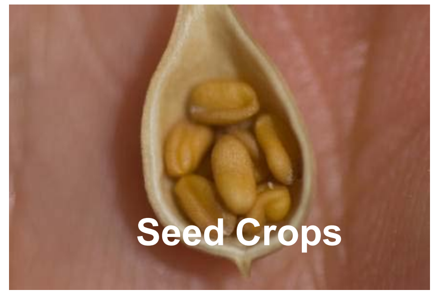


Reduce Energy Dependence

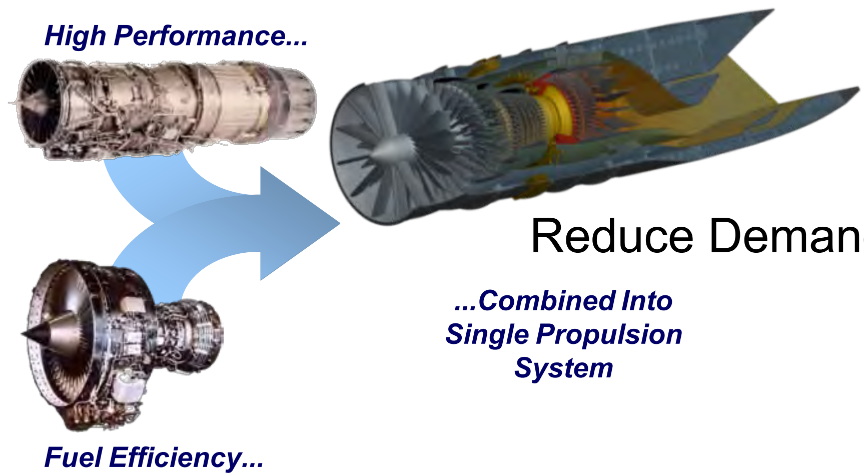
U.S. AIR FORCE



Change the Culture



Increase Supply



Reduce Demand

...Combined Into Single Propulsion System

Make Energy A Consideration In All We Do

S&T Program Priorities

- **Priority 3:** Retain and shape the critical competencies needed to address the full range of S&T product and support capabilities
  - Increase level of in-house basic research
  - Enhance critical competencies of the organic cyber workforce
  - Support AF STEM initiatives to develop and optimally manage the future S&E workforce

Shaping the Current and Future Workforce

Retain and Shape Critical Competencies Internal to AFRL

Provide Organic Basic Research and Advanced Development Opportunities in Critical Areas

Industrial Base

- Greater consideration given to non-domestic sources
- Greater need for acquisition and sustainment decision makers to be provided with usable, current IB information
- Greater need for the AF to provide clear guidance in terms of shaping the IB
  - Critical domestic capabilities – technologies and skill sets
  - Sufficient competition – supply chain management
  - Risk mitigation tools
- S&T community has an important role to play here

U.S. AIR FORCE

S&T Program Priorities

- **Priority 4:** Ensure the AF S&T program is integrated into the AF Corporate requirements and programming processes
  - Be a trusted partner of the acquisition/sustainment community – assess tech maturity/enhance and accelerate tech transition
  - Leverage R&D efforts within industry – including small businesses
  - Develop and demonstrate technology solutions that decrease manufacturing risks

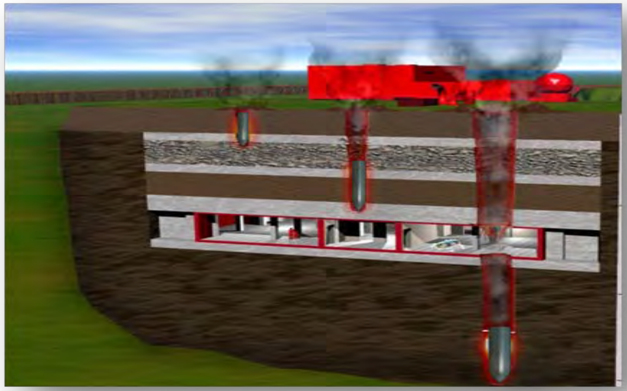
Bridge the Valley of Death

Flagship Capability Concept

- Definition: An integrated technology project collaboratively developed by MAJCOM(s), Center(s), and AFRL that:
  - Addresses a documented and prioritized MAJCOM capability need
  - Is commissioned via AF S&T Governance structure
  - Is traced to a CRRA Gap, linked to a Service Core Function Master Plan
- Attributes:
  - Initial systems engineering and development planning (DP) initiated
  - Somewhere between a leading DP concept and a prototype
  - Assigned to lead Center for transition
  - MAJCOM transition manager identified
    - Transition funding (6.4) committed two years prior to S&T completion
  - Defined S&T baseline/exit criteria
  - S&T project ideally completed during current FYDP

Initial Set of Flagships

1. **High Velocity Penetrating Weapon (HVPW)**
2. **Responsive Reusable Boost for Space Access (RBS)**
3. **Selective Cyber Operations Tech Integration (SCOTI)**



Flagships Helping Bridge the Valley of Death

U.S. AIR FORCE

Strategy Development Efforts

- Energy
- Cyber
- Hypersonics
- Space Situational Awareness
- Sustainment

U.S. AIR FORCE

X-51A Program Objective

Flight test the AF Hypersonic Technology (HyTech) scramjet engine, using endothermic hydrocarbon fuel, by accelerating a vehicle from boost (~M=4.5) to Mach 6+

BOEING

Pratt & Whitney
A United Technologies Company

- **Acquire ground and flight data on an actively cooled, self-controlled operating scramjet engine (rules and tools development)**
- **Demonstrate viability of an endothermically fueled scramjet in flight**
- **Prove viability of a free-flying, scramjet powered, vehicle (Thrust > Drag)**

Survivable, High Speed Weapon

Enabling Capabilities

Hypersonic Air Vehicle and Propulsion Technologies Enable Long Range at High Speed with Effective Payload

Precision Strike

Variable Warhead Effects

Long Range

Aircraft Systems
Internal bombers
External fighters

Net Enabled
In-Flight Targetable

High Speed

Rapid, Responsive Strike in Anti-Access/Access Denied (A2/AD) Environments

Operation in A2/AD Environments

Penetrate Denied Areas (Survivable)

Large ground coverage area

High utility in space-denied areas

Mach 4+ Cruise

Runway Takeoff and Landing

Turbine Based Combined Cycle

Reusable, Long-Life Airframe

On-Demand Flight in A2/AD Environments

U.S. AIR FORCE

Summary

- Air Force Depends on the S&T Program to discover, develop, and demonstrate high-payoff technologies across all domains – *Tech Push*

- S&T Program Priorities, Program Tenets, and Processes aligned to turn science and knowledge into militarily relevant capabilities – *Tech Pull*

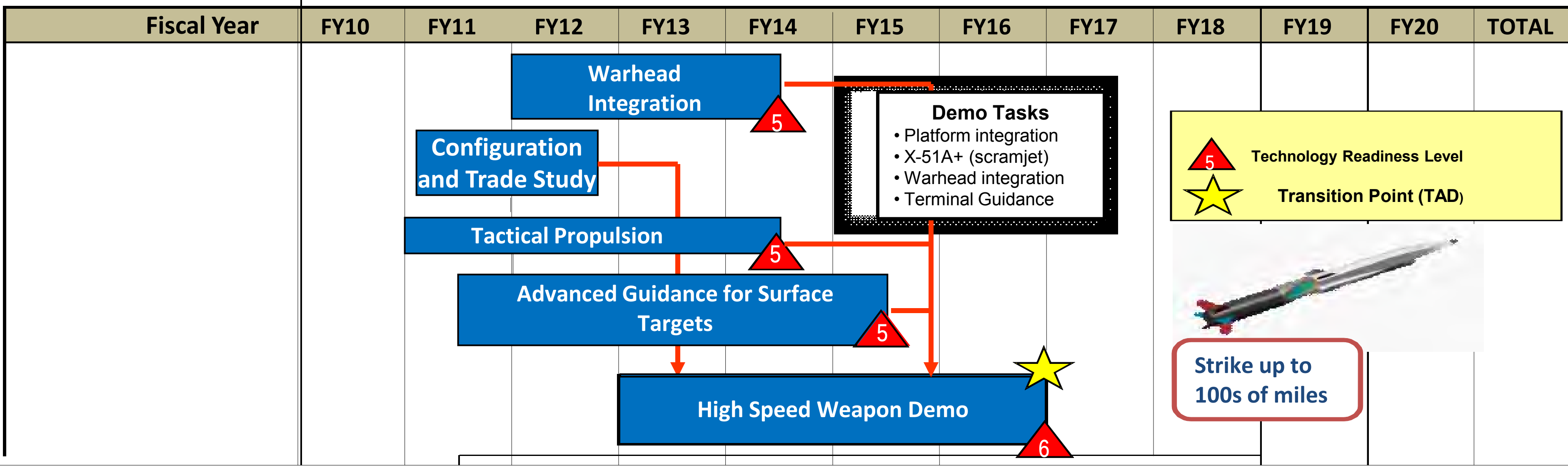
- Flagships linking S&T, Development Planning, and MAJCOM transition funding into HAF-commissioned AF Capabilities – *The Bridge Over The Valley of Death*

- Industrial Base, Engineering, and Technical Management – *Improving Acquisition Outcomes*

BACKUPS

U.S. AIR FORCE

High Speed Weapon Roadmap

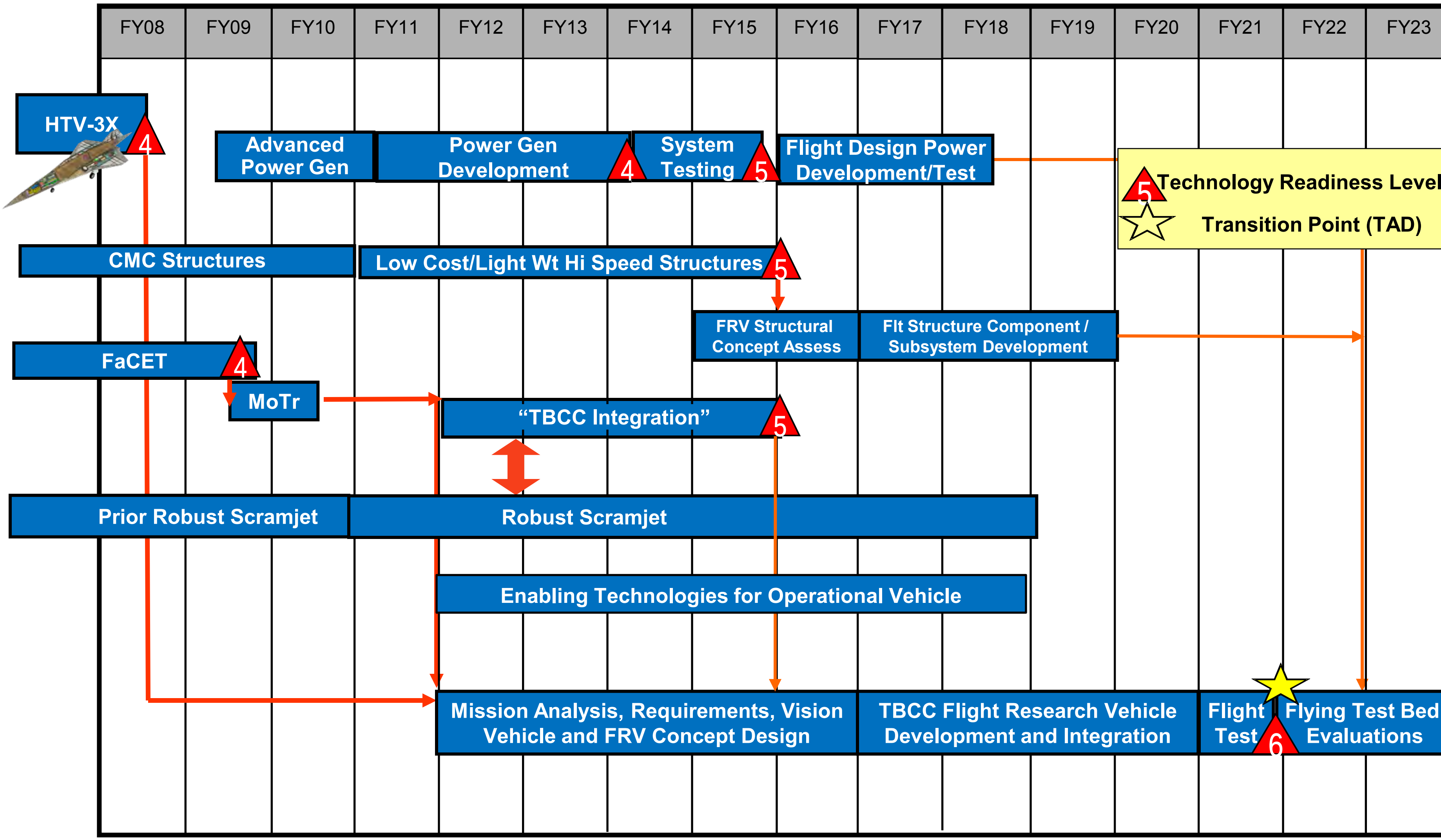


TECHNOLOGY GAPS

- High Speed Multimode Seekers
- Anti Jam GPS
- Alternative high speed guidance (GPS denied environment)
- Compact energetic booster
- Aeroconfiguration, structures and materials, control surfaces, TPS
- Compatibility with current and emerging fighters and bombers
- Compatibility with Navy/VLS

U.S. AIR FORCE

High Speed Aircraft Roadmap

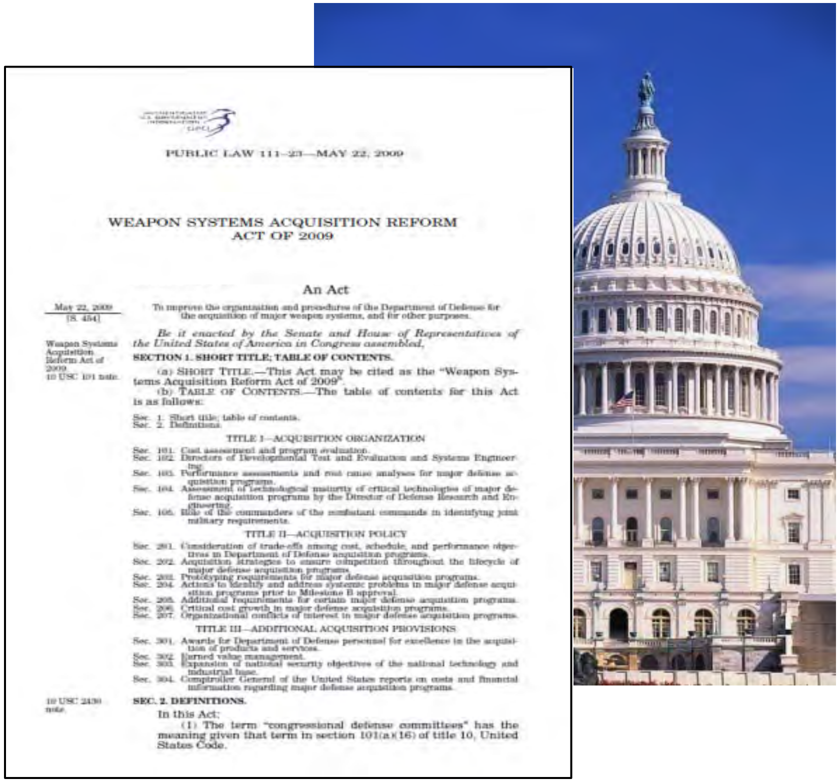


Revitalizing Development Planning (DP)

Weapon Systems Acquisition Reform Act (WSARA) of 2009 requires:

Director, Systems Engineering to "Review the organizations & capabilities of the military departments with respect to…*development planning* …and identify needed changes or improvements"

SAE to "develop & implement plans to ensure the military dept has provided appropriate resources for: *Development planning and systems engineering organizations with adequate numbers of trained personnel*"



PUBLIC LAW 111–23—MAY 22, 2009

WEAPON SYSTEMS ACQUISITION REFORM ACT OF 2009

An Act

May 22, 2009
[S. 454]

To improve the organization and procedures of the Department of Defense for the acquisition of major weapon systems, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Weapon Systems Acquisition Reform Act of 2009.
10 USC 101 note.

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "Weapon Systems Acquisition Reform Act of 2009".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

10 USC 2430 note.

SEC. 2. DEFINITIONS.

In this Act:

(1) The term "congressional defense committees" has the meaning given that term in section 101(a)(16) of title 10, United States Code.

What is Development Planning?

U.S. AIR FORCE

- Acquisition contribution to AF-level capability planning
- Early analyses of technical issues, risks, and resources
  - Inform sponsors and decision makers on realm of the possible
  - Greatest leverage prior to Materiel Development Decision
- Systems engineering efforts define the trade space of concepts
- DP activities foundation for new system development
- Results in high-confidence estimates of cost, schedule, and technical performance

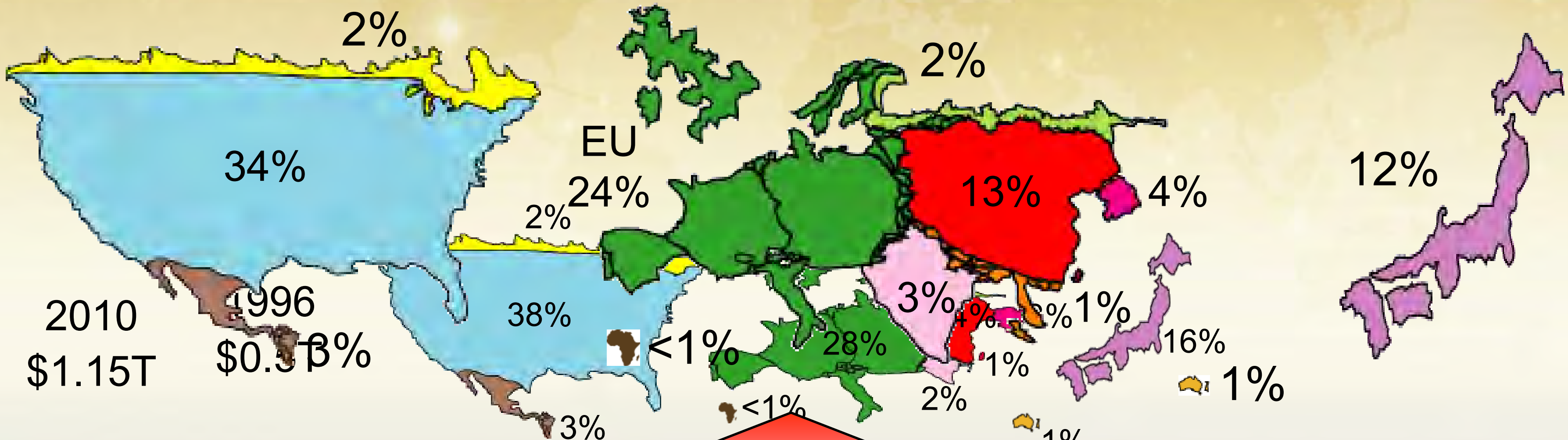
Naval S&T Overview

Dr. Joseph Lawrence
Director of Transition
Office of Naval Research
June 22, 2011

Revolutionary Research . . . Relevant Results

OFFICE OF NAVAL RESEARCH

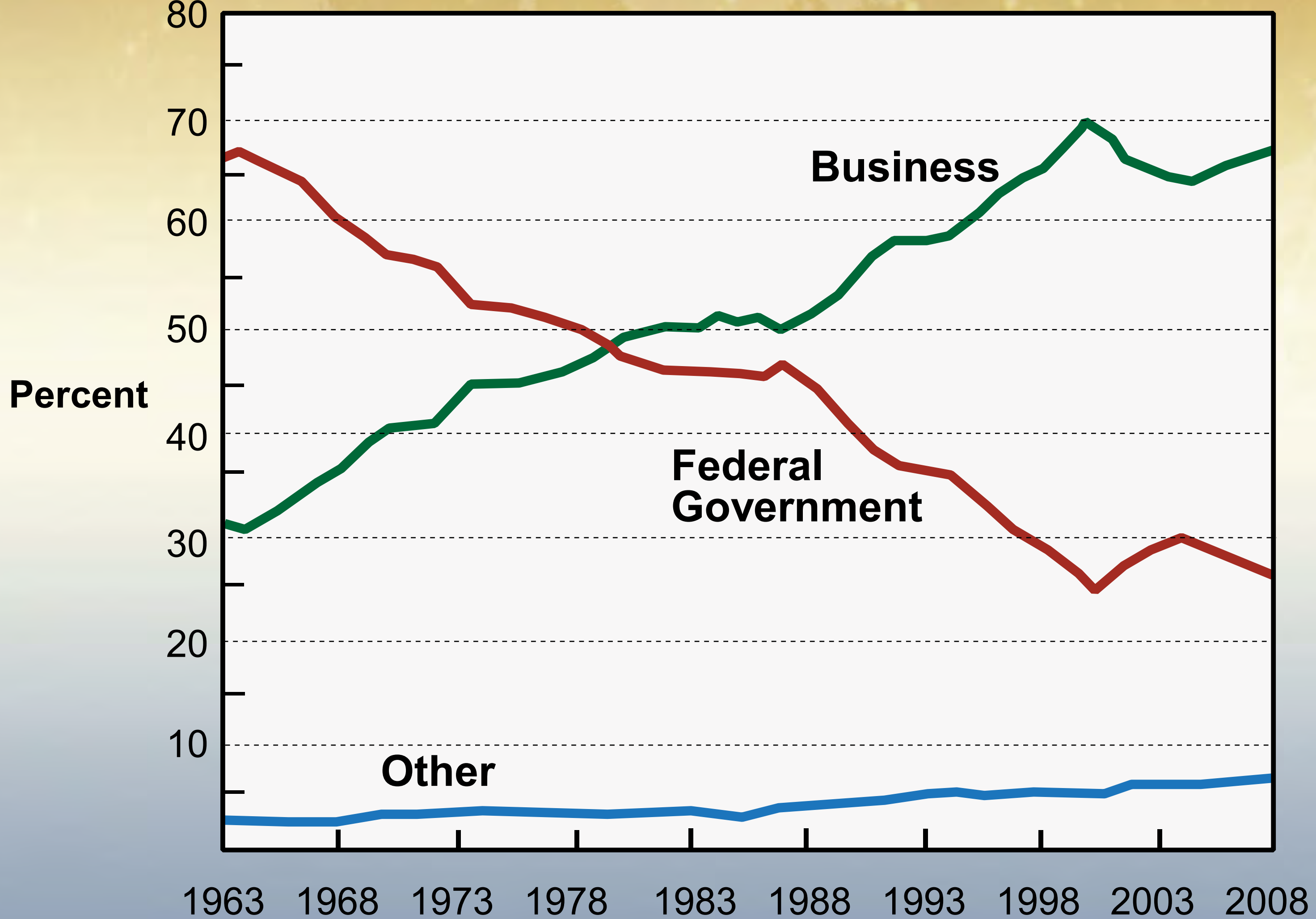
Global R&D Trends



* UIS S&T database; World Bank - PPP

** OECD 2010 PPP; 2010 Global R&D Report (Battelle)

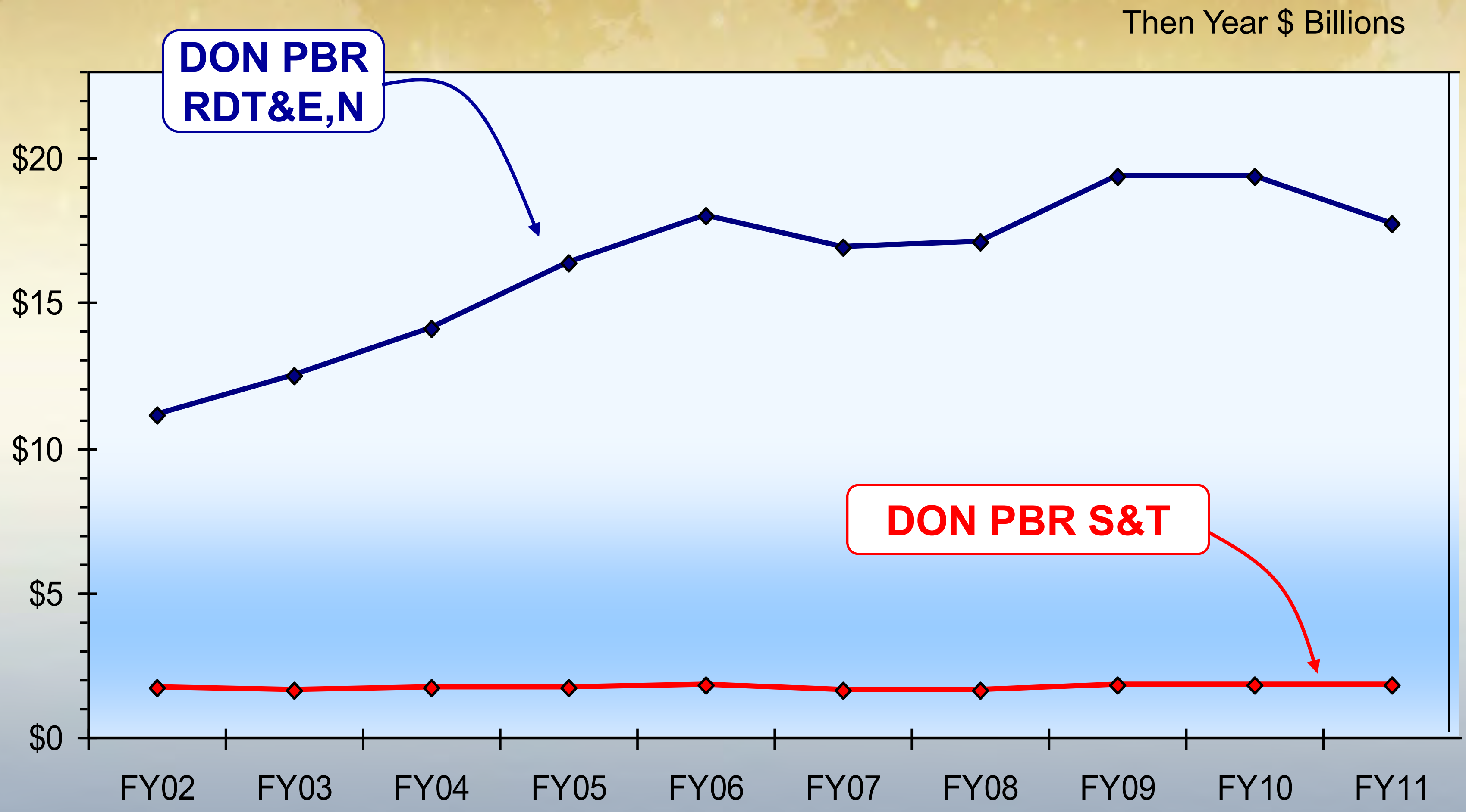
R&D Investment Trends



Source: National Science Foundation, Division of Science Resource Statistics, *Science and Engineering Indicators 2010*

Revolutionary Research . . . Relevant Results

RDT&E 6.1 – 6.7



88 Years of Naval Research

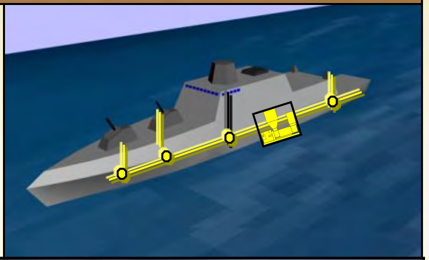
Looking Back ……

Revolutionary Research . . . Relevant Results

….. And Looking Ahead

- Power & Energy
- Directed Energy & Hypersonics
- Information Dominance
- Autonomous Systems
- Total Ownership Cost Reduction
- Naval Warfighter Performance





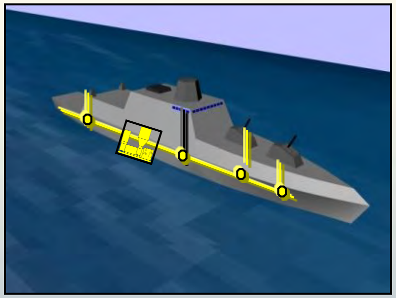


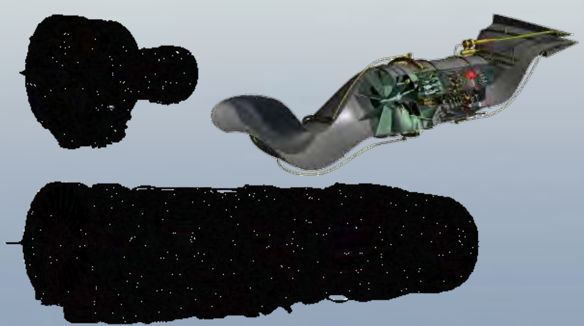
Revolutionary Research . . . Relevant Results

Power & Energy

1. Sail a "Green Strike Group" by 2016
2. 50% of Navy energy from alternative sources by 2020,

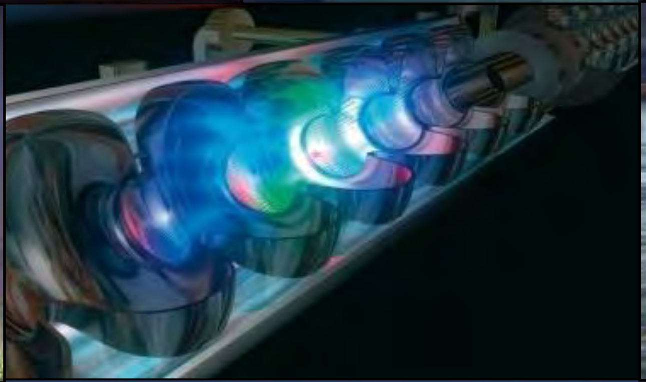
- Fuels
- Power Generation
- Energy Storage
- Efficient Distribution
- Energy Usage





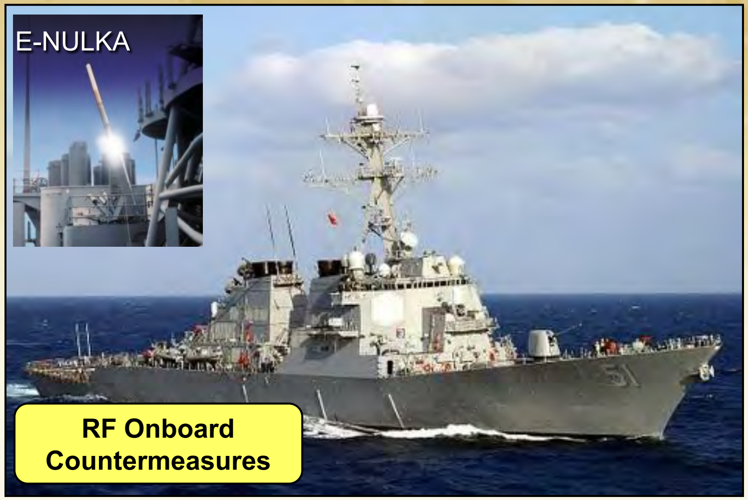
Directed Energy & Hypersonics

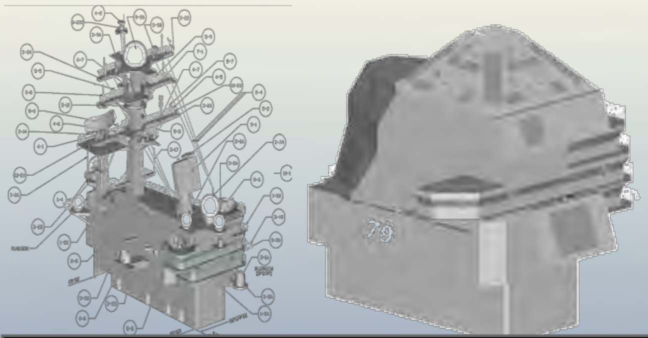
- Fight at Hypervelocity & Speed of Light
- Deepen the Magazines
- Increase Depth of Fire
- Broad Range of Missions



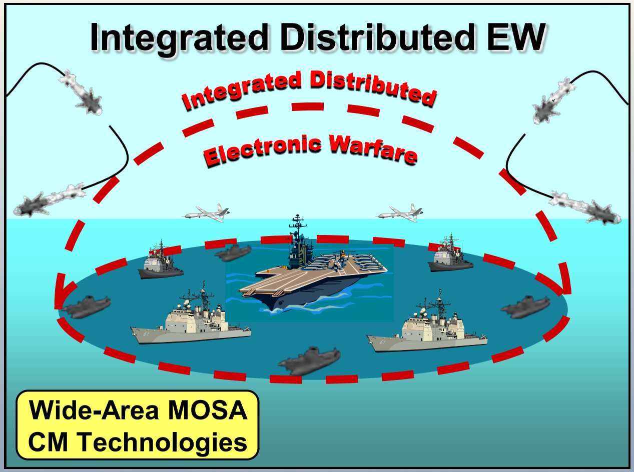
Revolutionary Research . . . Relevant Results

Dominating the Electromagnetic Spectrum

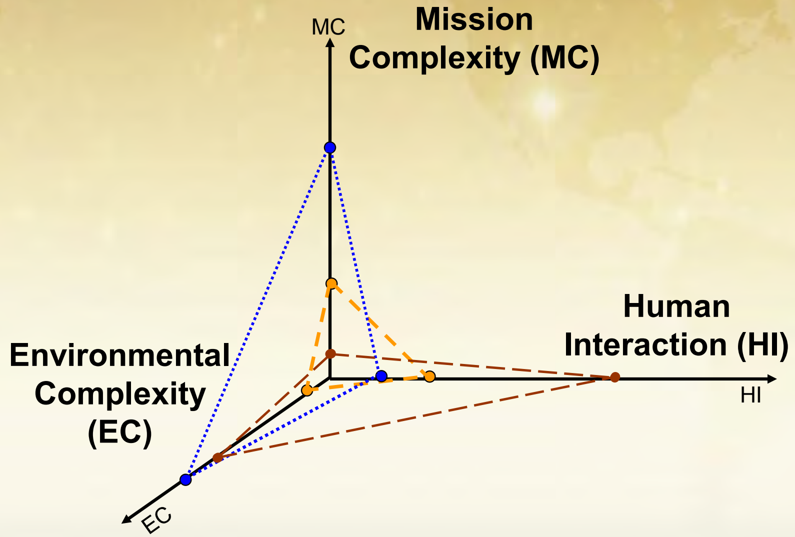


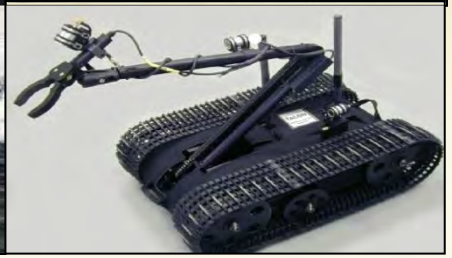


Integrated Topside Innovative Naval Prototype Program (INTOP)

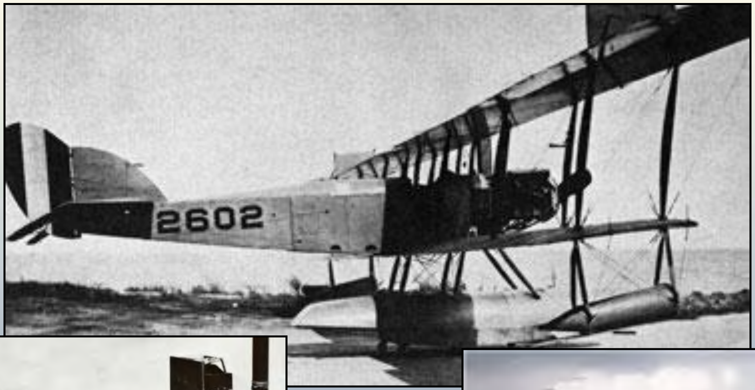


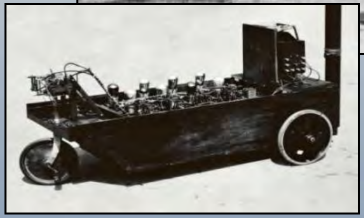
Autonomy





- Changes everything
  - Tactics to strategy
- Hybrid force with manned systems
- Power & Energy implications
- Mission CONOPS development

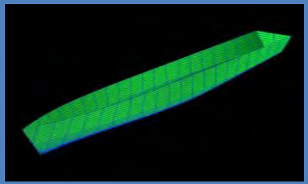




Revolutionary Research . . . Relevant Results

Total Ownership Cost

Design

10%

Acquisition

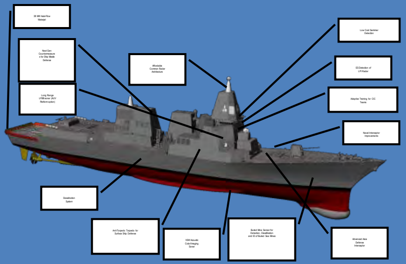



20-30%

Operations & Support



Modernization



Disposal



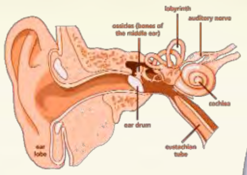
60-70%

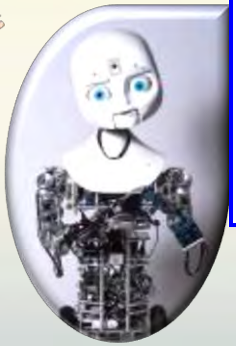
Revolutionary Research . . . Relevant Results

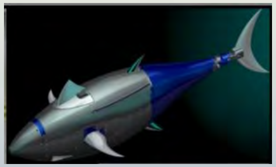
Naval Warfighter Performance

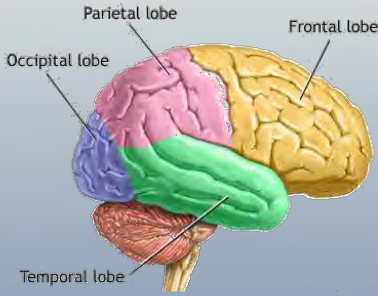
Human Systems Integration
- Manpower & Personnel Management
- Training & Digital Tutors
- User-Centered Design
- C2 Decision Support
- Human, Social, Cultural Sciences
- Safety / Hearing

Bio-Engineered Systems
- Marine Mammal Health
- Bio-Sensors / Materials
- Microbial Fuel Cells
- Bio Robotics
- Human-Autonomy Systems





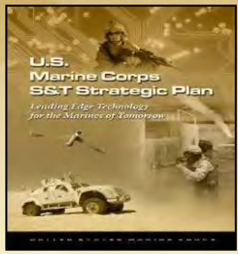


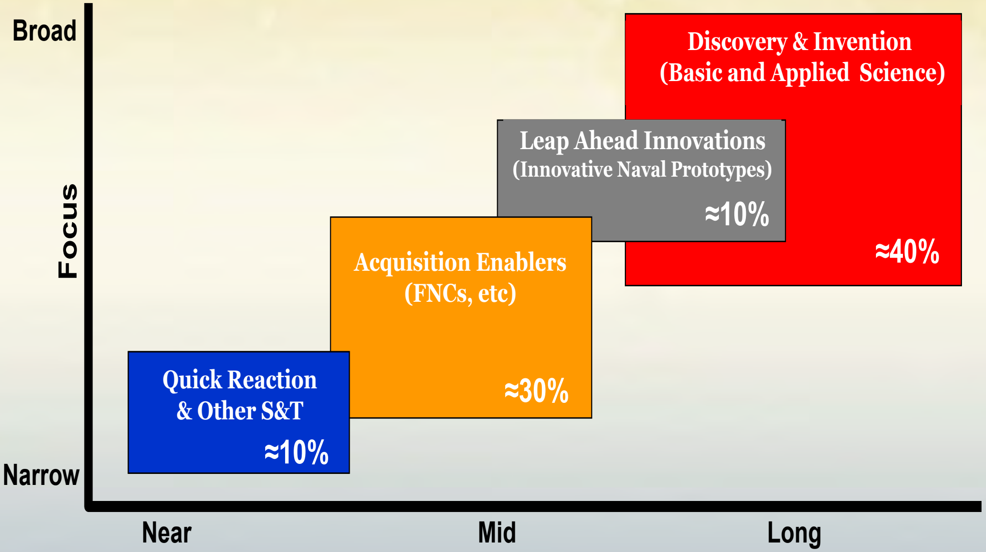


Undersea & Expeditionary Medicine
- Undersea Medicine (NNR)
- Point of Injury Care
  - "Lighten the Load"
  - Treat hemorrhagic shock
- Automated Medical Care
  - CASEVAC / Patient Movement

Naval S&T Strategic Plan

Revolutionary Research . . . Relevant Results





Focus Areas

- Power and Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric & Irregular Warfare
- Information Superiority and Communication
- Power Projection
- Assure Access and Hold at Risk
- Distributed Operations
- Naval Warfighter Performance
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Total Ownership Cost

Tech Solutions

FNCs

INPs

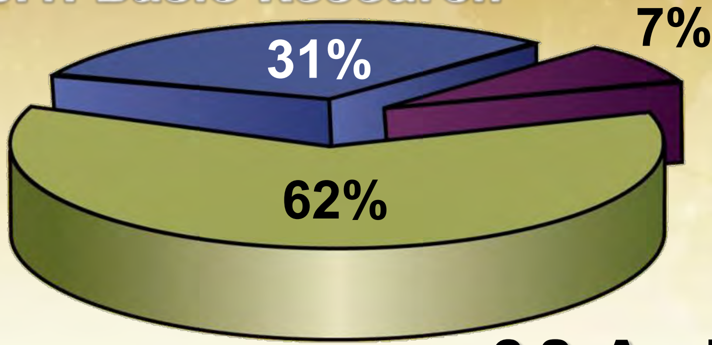
D&I

How We Execute

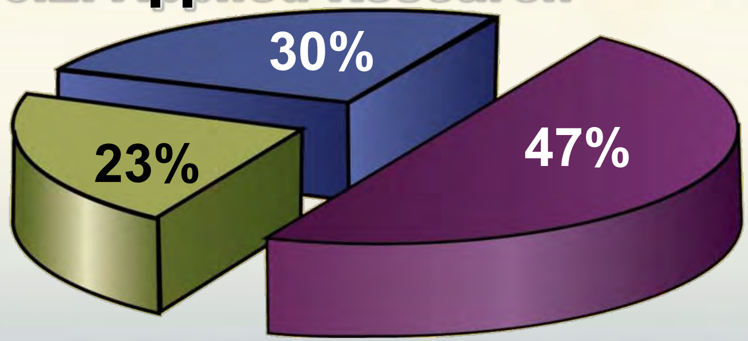
- **70 Countries**
- **50 States**
- **1,078 Companies**
  - **- 859 small businesses**
- **1,035 Universities & Nonprofit Entities**
  - **- 3,340 principal investigators**
  - **- 3,000 grad students**

Investment Balance

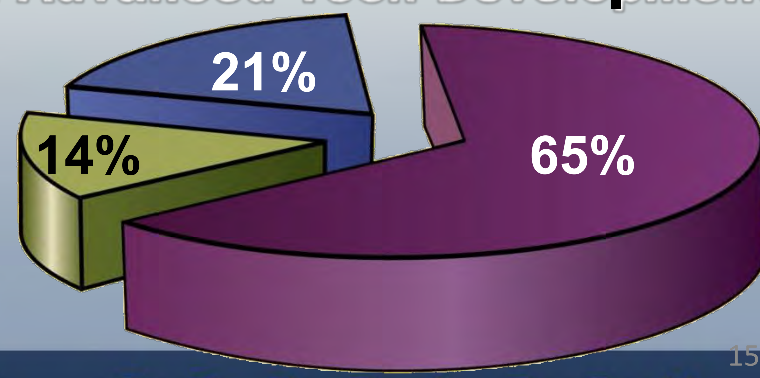
6.1: Basic Research



6.2: Applied Research



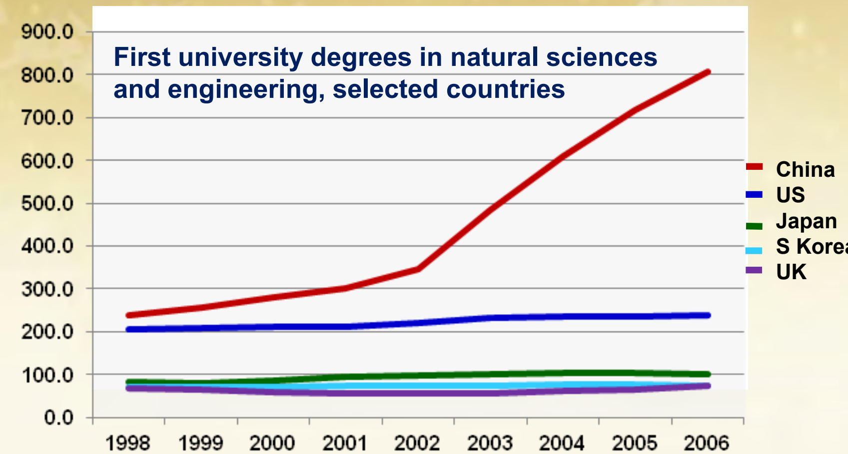
6.3: Advanced Tech Development

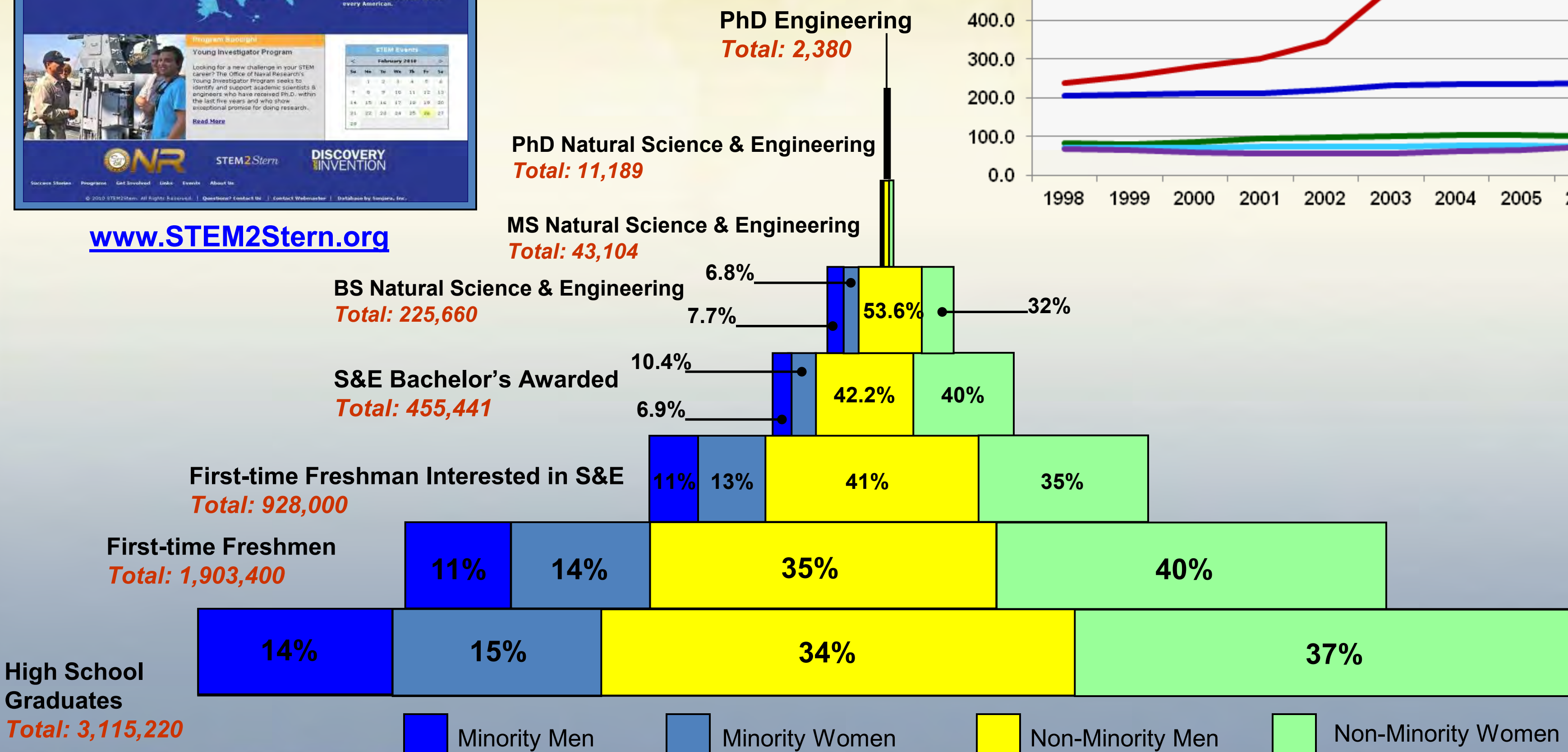


- Naval Labs and Centers
- University & Nonprofit
- Industry

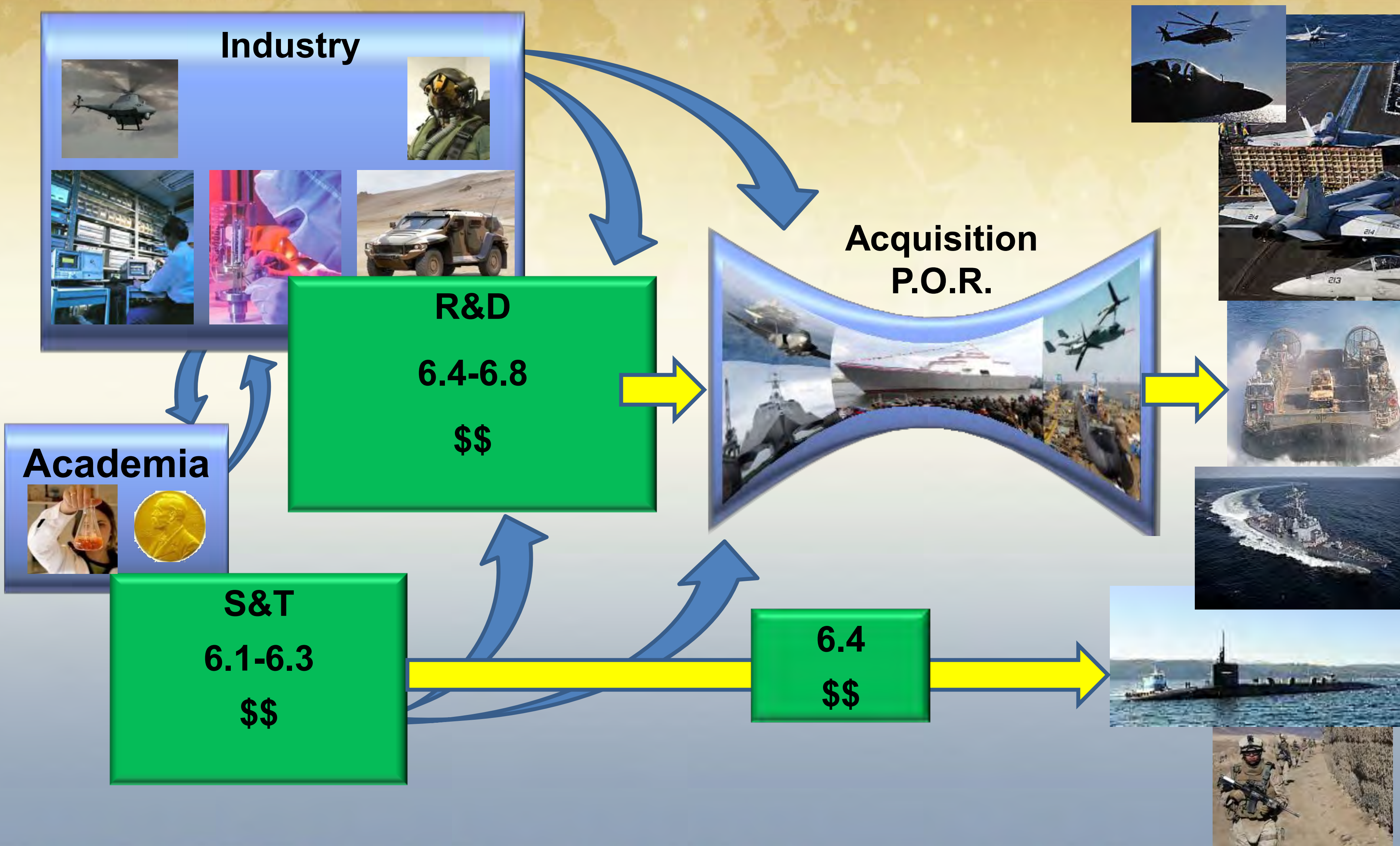
STEM

www.STEM2Stern.org





Speed to Fleet



Why it Matters

"I never, ever, want to see a Sailor or a Marine in a fair fight!

-Adm. Gary Roughead
Chief of Naval Operations

We Want To Hear From You!

- *ONR Website:*
  www.onr.navy.mil

- *ONR Central Phone Number:*
  703-696-5031

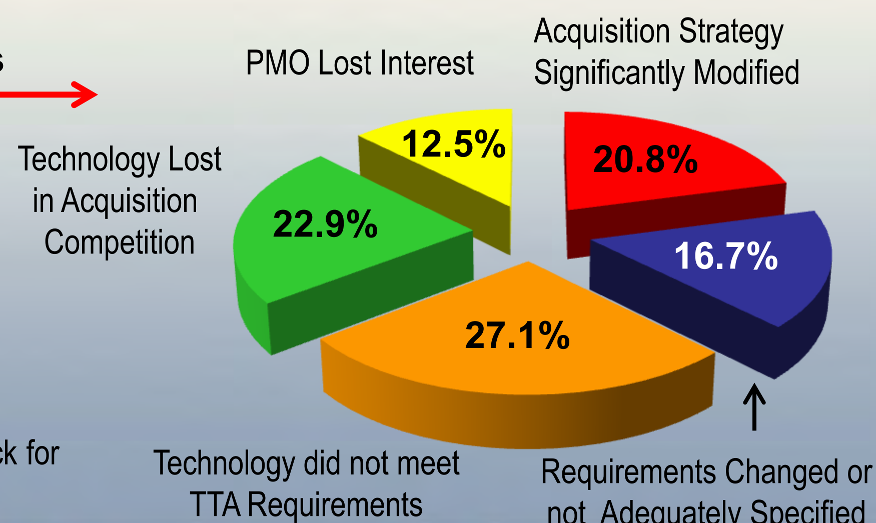
Back-up

Transitions

Successfully delivered 83% of the FNCs to Acquisition

FNC Delivery Year	Products Planned to Deliver	Products Delivered to Acquisition	Deployed	On-Track for Deployment	Still With Acquisition Program	Did Not Transition
FY10	19	15	1	7	5	2 (13%)
FY09	35	32	2	12	11	7 (22%)
FY08	47	35	8	12	3	12 (34%)
FY07	32	26	7	8	1	10 (38%)
FY06	34	30	7	4	2	17 (57%)
Total	167	138	25	43	22	48 (35%)

Forensics



ONR Global

Revolutionary Research . . . Relevant Results

- Develop partnerships
- Leverage global S&T advances
- Avoid technology surprise

A Great Place to Work

- *#1 "Best Place to Work"* in the Navy
  - *Partnership for Public Service*
- *"Most Admired Employer"*
  - *Black Engineer* magazine
  - *Hispanic Engineer* magazine
  - *Women of Color* magazine
- *#1 Patent Portfolio worldwide among government agencies from IEEE Patent Power Scorecard*
  - *232 patents in 2009*
- *Popular Science Magazine's 2010 Best of What's New Winner*
  - *NEAH Power Systems' Infinity Fuel Cells*
- *TIME Magazine's "Best Inventions of the Year"*
  - *2009: Microbial Fuel Cell*
  - *2008: NEXI, MEMRISTOR*

The Best Places to Work
IN THE FEDERAL GOVERNMENT

CAREER COMMUNICATIONS GROUP'S
2008 MOST ADMIRED COMPANIES

A BEST DIVERSITY COMPANY
Chosen By The Readers Of
Diversity/Careers
2009

BLACK ENGINEER OF THE YEAR
AWARDS CONFERENCE
FEB 18-22, 2009
BALTIMORE, MD

IEEE

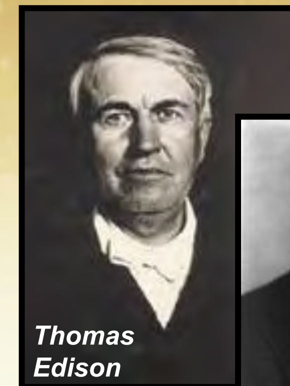
POPSCI

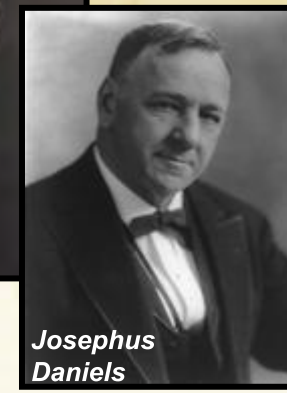
TIME

Revolutionary Research . . . Relevant Results

The Office of Naval Research

Naval Research Laboratory *(Appropriations Act, 1916)*
"[Conduct] exploratory and research work…necessary …for the benefit of Government service, including the construction, equipment, and operation of a laboratory…."

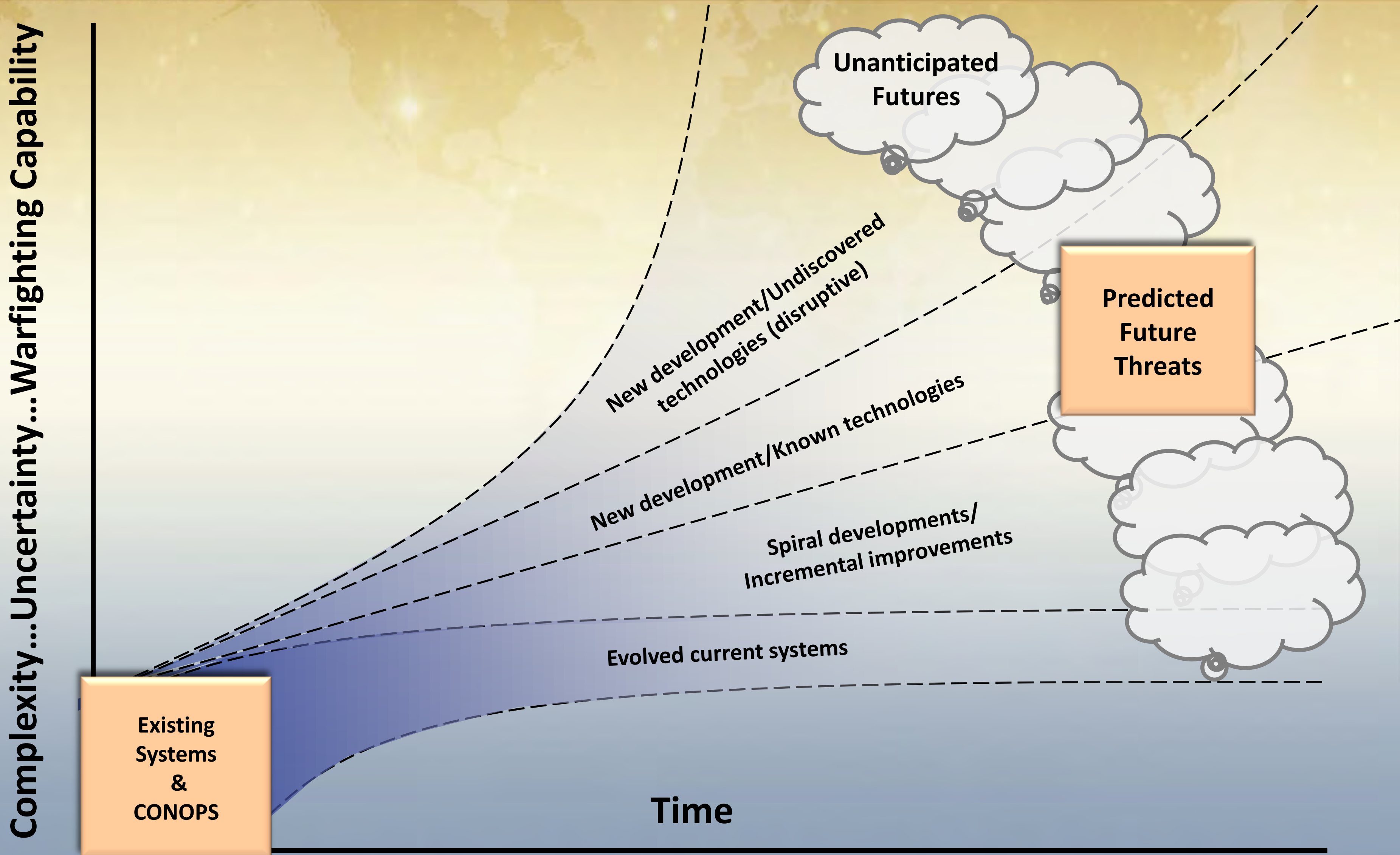




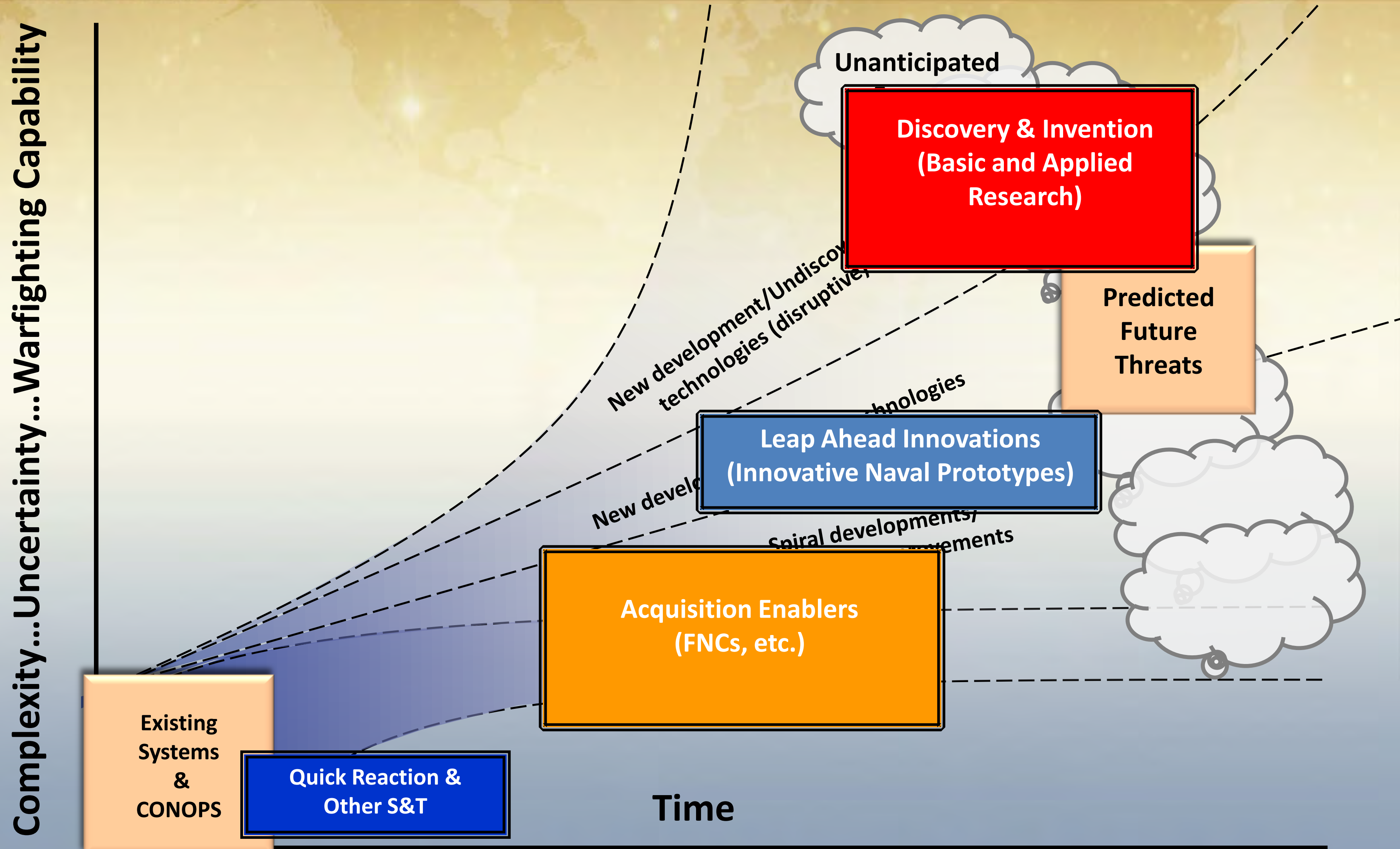
Office of Naval Research *(Public Law 588, 1946)*
"…plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future of naval power, and the preservation of national security…"

Transitioning S&T *(Defense Authorization Act, 2001)*
"…manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

Uncertain Future

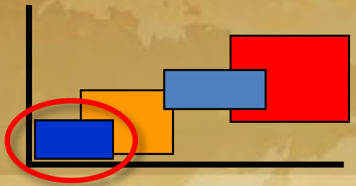


Uncertain Future



Quick Reaction S&T

(1-2 Year) Off-The-Shelf Technologies




TECHSOLUTIONS

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TechSolutions Request Form
Office of Naval Research

This form is designed for active United States Navy and Marine Corps Personnel only.
I understand that this form is to be used for unclassified and Non-Naval Nuclear Propulsion Information issues only.

User Information

* Rank/Social Title:
* First Name:
* Last Name:
* Email:
* Phone:
* Search For Command or Provide Organization: Search
* Homeport:

How did you hear about us?

Problem Identification

Fill in all applicable information and attach any documents, photos, drawings, etc. that may be useful in further identifying your problem and/or idea.

* A. What is your observation and or problem?

B. What does the Solution need to do?

- Rapid solutions to problems identified by deckplate Sailors and Marines
- 1 year turnaround time
- Video: www.youtube.com/usnavyresearch
- Requests submitted online

  www.onr.navy.mil/techsolutions

Revolutionary Research . . . Relevant Results

Future Naval Capabilities

(3-5 Year) Component Technologies

Revolutionary Research . . . Relevant Results

Technology Oversight Group

S&T Corporate Board

★★★★

VCNO **ASN (RDA)** **ACMC**

CNR-Executive Secretary

N8/N2/N6

USFF **PDASN**

MCCDC **CNR**

★★★

TOG

N4* **N1/N093***

N8F

(Ex Sec)

TOG Working Group

0-6/GS-15 reps

Sea Shield

★★

N86
MCCDC
USFF N803
PEO LMW
ONR 32

Sea Basing

★★

N85B
Dep. CG MCCDC
USFF N804
PEO Ships
ONR 33

Sea Strike

★★

N87
HQMC Aviation
USFF N8
PEO U&W
ONR 35

Naval Expeditionary Maneuver Warfare

★★

N85B
HQMC PP&O
USFF N8
MCSC
ONR 30

FORCENet

★★

N6F
Dir HQMC C4
NETWARCOM
SPAWAR 05
ONR 31

Power & Energy

★★

N45
USMC HQ
USFF N8
NAVSEA 05
ONR 03T

Enterprise & Platform Enablers

★★

N8F
HQMC I&L
USFF N433
NAVSEA 05
ONR 03T

Force Health Protection

★★

N0931
TMO, USMC
FFC N02H
NMSC
ONR 34

Capable Manpower

★★

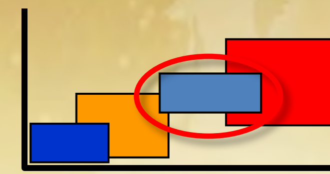
N15
USMC Training/Ed
USFF N1D
NAVAIR TSD
ONR 34

Revolutionary Research . . . Relevant Results

Innovative Naval Prototypes

(5-10 Year) Disruptive Technologies

- High Risk / High Payoff
- Innovative and game-changing
- Approved by Corporate Board
- Delivers prototype



Tactical Satellite

EM Railgun

Persistent Littoral Undersea Surveillance

Sea Base Enablers

Free Electron Laser

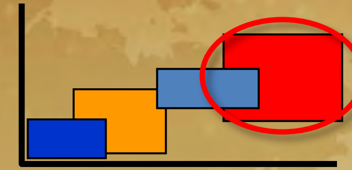
Integrated Topside

Large Displacement UUV

AACUS

ONR
Revolutionary Research . . . Relevant Results

Basic Research

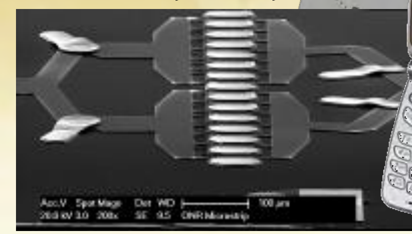


(1-25 Year) Undiscovered & Emerging Technologies

- Diverse portfolio
- Fosters innovation
- Long-term
- Investment in people
  * 56 Nobel laureates

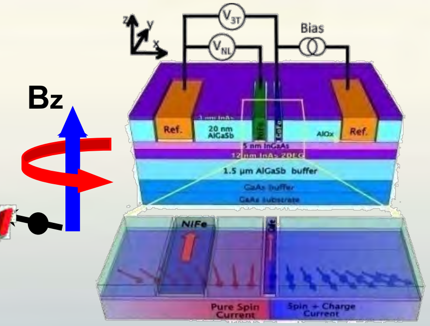
1st U.S. Intel satellite
GRAB

Semiconductors
GaAs, GaN, SiC



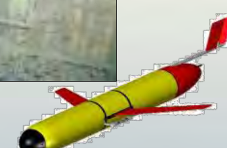
EW

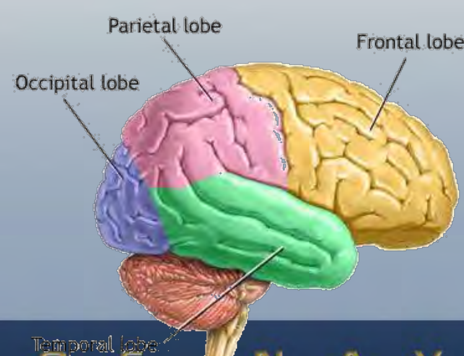
Spintronics



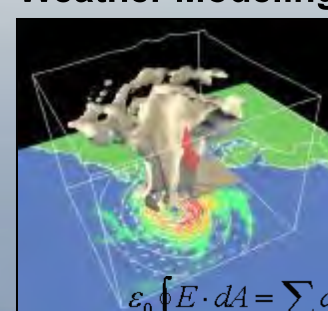
Arctic Research

GPS

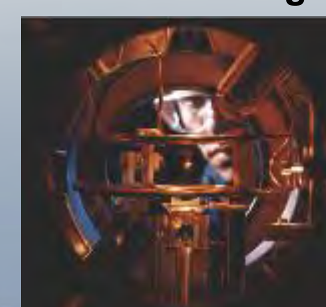




Weather Modeling



Laser Cooling



The Challenge: "Speed to Fleet"

"I never, ever, want to see a Sailor or a Marine in a fair fight! … We have to get technology to the Fleet faster."

- Adm. Gary Roughead, Chief of Naval Operations

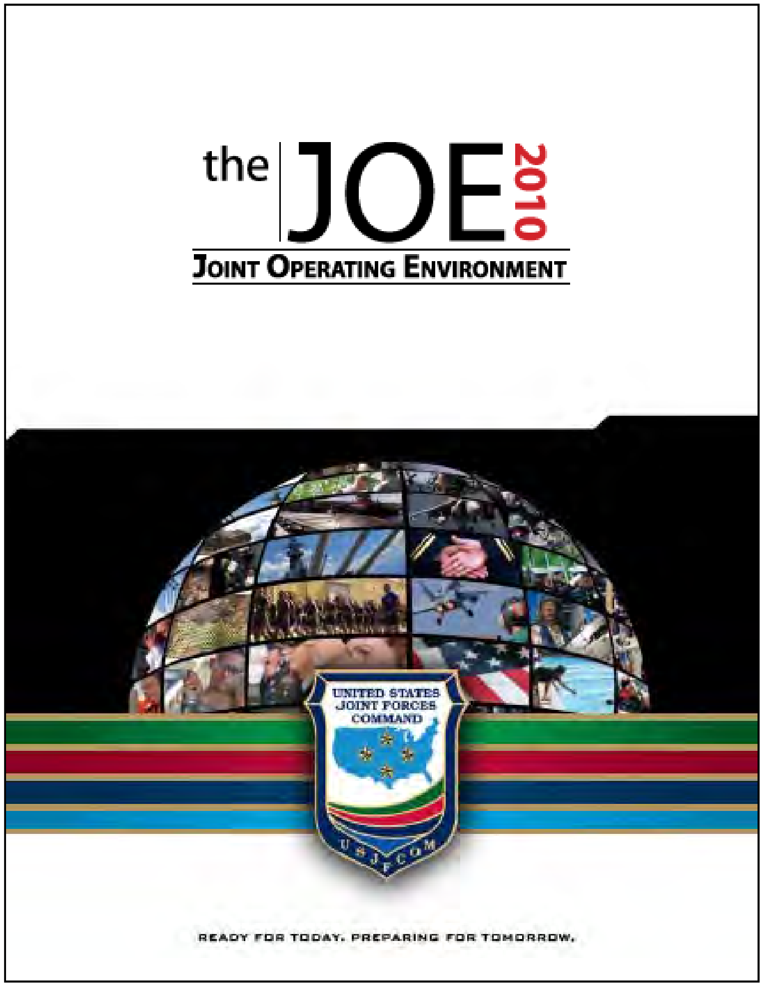
Shaping the Department's S&T Strategy

21 June 2011

The Honorable Zachary J. Lemnios

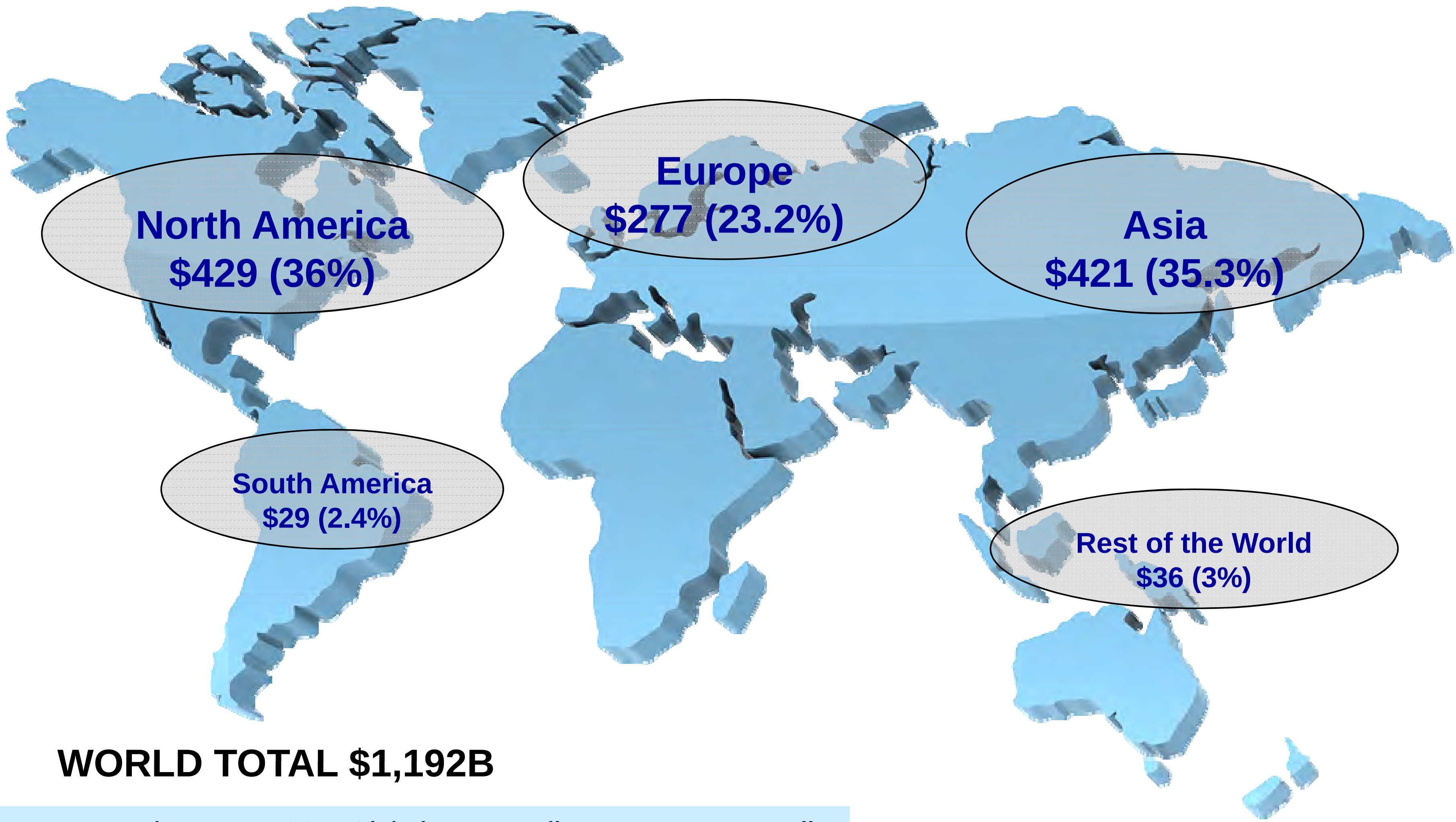
Assistant Secretary of Defense for Research and Engineering

Global Challenges and Trends



- **Shifting Global Demographics**
- **Globalization shifts**
- **Energy**
- **Climate change & natural disasters**
- **Cyber as a new domain**
- **Challenges to existing state structures**
- **WMD proliferation**

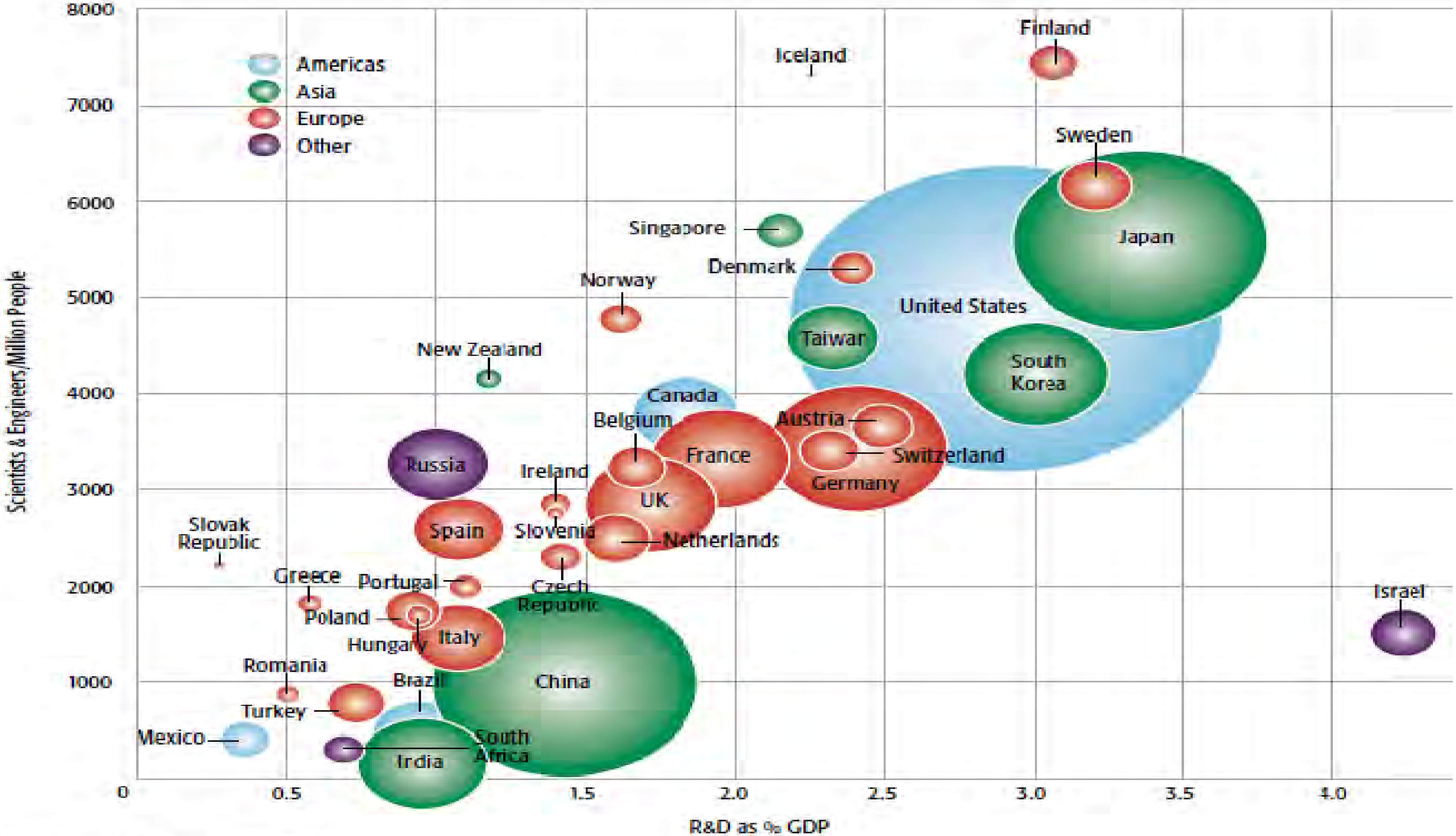
Globalization of R&D



WORLD TOTAL $1,192B

Source: www.rdmag.com "*2011 Global R&D Funding Forecast*" - Battelle

World R&D Trends: A Global Shift



Source: Battelle, *R&D Magazine*, OECD, IMF, CIA

Guidance Roadmap

<u>Target Affordability and Control Cost Growth</u>

- Mandate affordability as a requirement
  - At Milestone A set affordability target as a Key Performance Parameter
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<u>Incentiviz</u>

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- Ex
  pil
- Re
  de

<u>Promote</u>

- Pr
- Re
  - Require open system architectures and set rules for acquisition of technical data rights
- Increase dynamic small business role in defense marketplace competition

<u>Improve Tradecraft in Services Acquisition</u>

- Create a senior manager for acquisition of services in each component, following the Air Force's example
- Adopt uniform taxonomy for different types of services

n
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re-compete of

contracts for

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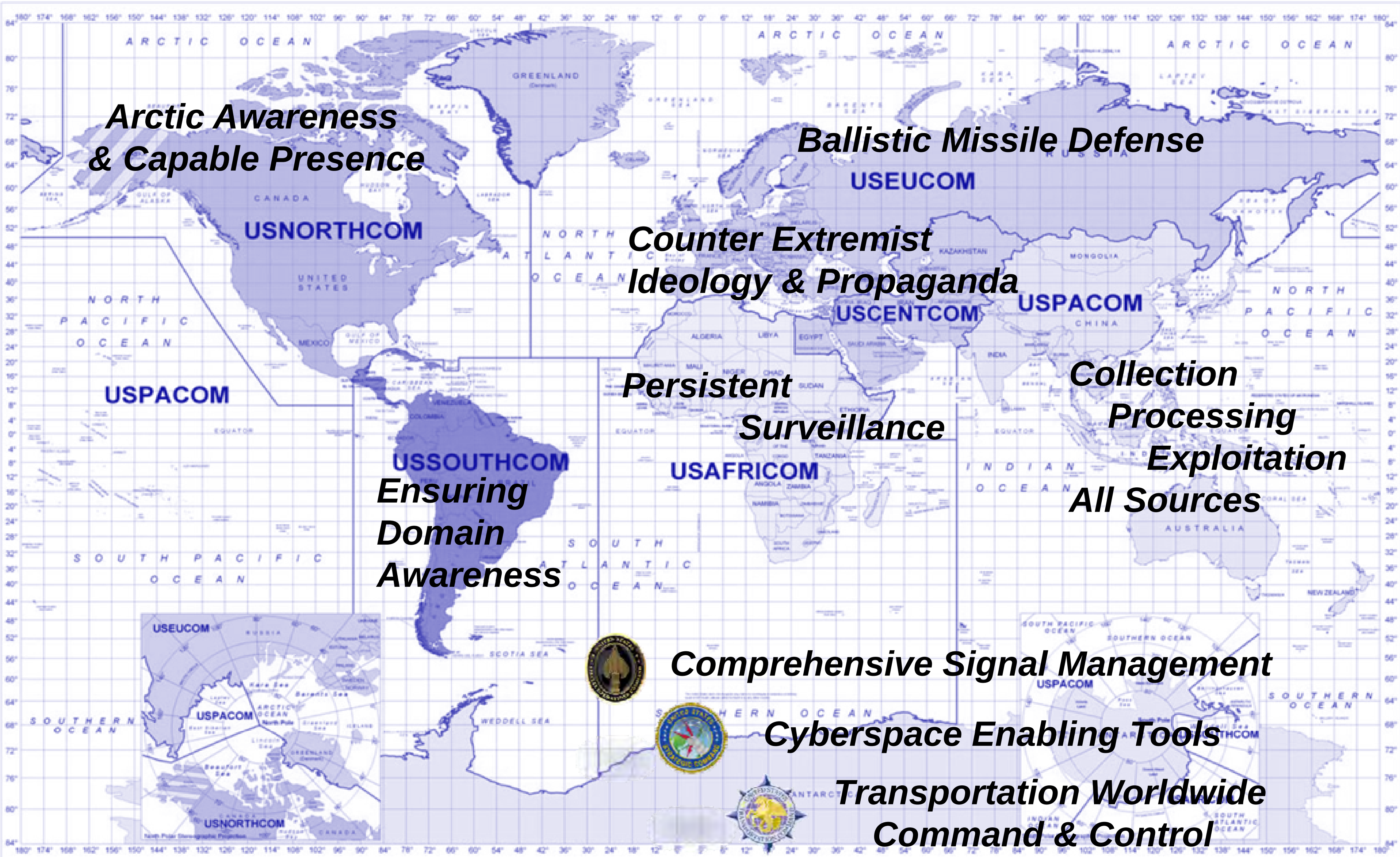
sary to support
o significant

ressional

nplementary
(FPRRs) to

- **Target Affordability and Control Cost Growth**
- **Incentivize Productivity & Innovation in Industry**
- **Promote Real Competition**
- **Improve Tradecraft in Service Acquisition**
- **Reduce Non-Productive Processes and Bureaucracy**

Support to Combatant Commanders



Continuing the Push for Capabilities to the Fight

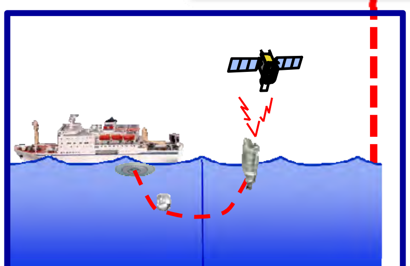
FY 11									FY 12		
Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar

Force Directed Layout

Operational 3D JCTD

Rapid Reaction Tunnel Detect JCTD

SCAR Fire Control System



Sea Tracker JCTD

Robotic Moving Targeting System

RF Combat ID Patches

SOF Sensor Fusion Night Vision

SOF Sinuous Spiral Antenna

Submersible Multi-Fuel Outboard Engines

XFC Submerged Launch UAV

Nat'l Tech Nuclear Forensics JCTD

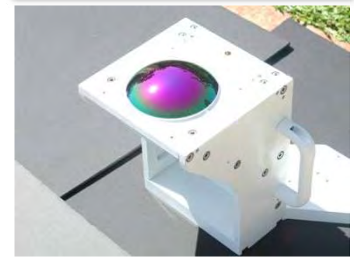
RIO JCTD

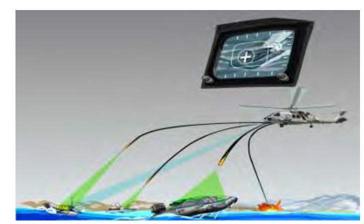
Pyrolysis Solid Waste Disposal

Submarine Survivor Locator Device

Precision Sniper Rifle

Hostile Fire Detection System



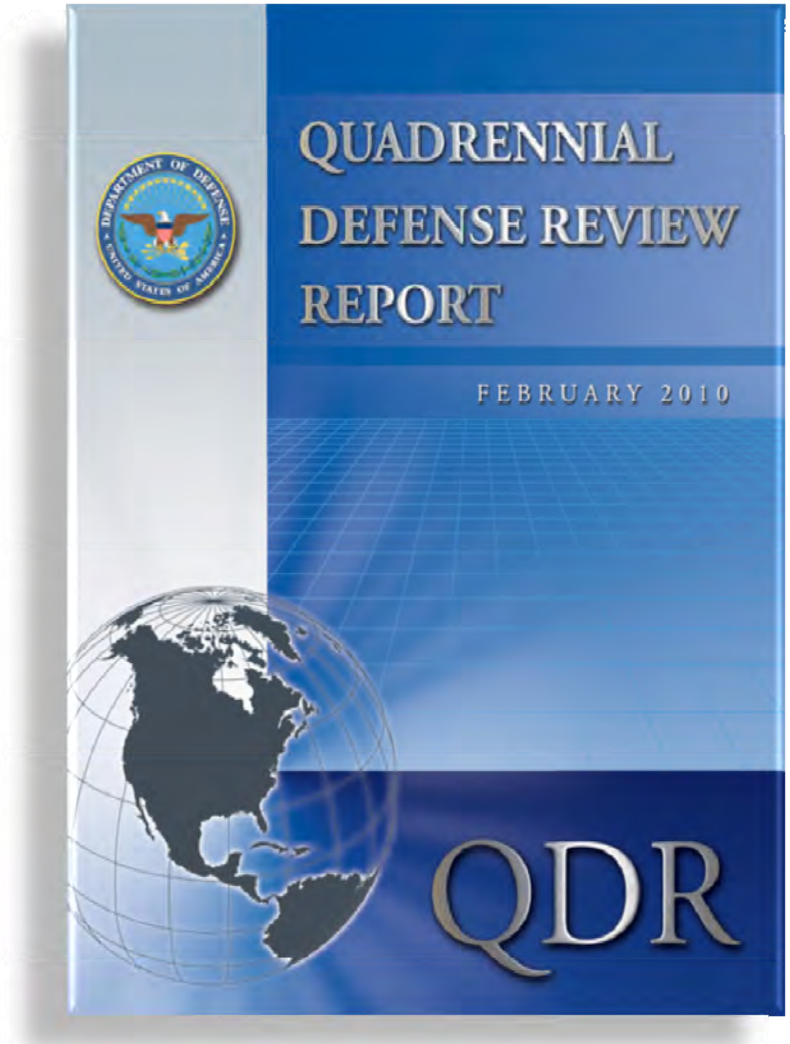


MEDUSA JCTD → July 12

Imperatives

1. Accelerate delivery of technical capabilities to win the current fight.
2. Prepare for an uncertain future.
3. Reduce the cost, acquisition time and risk of our major defense acquisition programs.
4. Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.

Quadrennial Defense Review Missions Require New Capabilities



1. **Defend the United States and Support Civil Authorities at Home**
2. **Succeed in Counterinsurgency, Stability, and Counterterrorist Operations**
3. **Build the Security Capacity of Partner States**
4. **Deter and Defeat Aggression in Anti-Access Environments**
5. **Prevent Proliferation and Counter Weapons of Mass Destruction**
6. **Operate Effectively in Cyberspace.**

Capability Priorities
for FY13-17

Complex Threats

- Electronic Warfare / Electronic Protection
- Cyber Science and Technology
- Counter Weapons of Mass Destruction

Force Multipliers

- Data-to-Decisions
- Autonomy
- Engineered Resilient Systems
- Human Systems

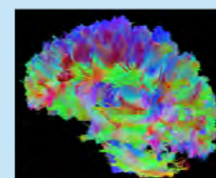
High Interest Basic Science Areas

Synthetic Biology

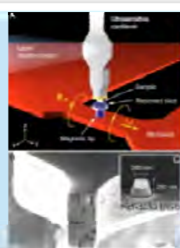
Human Behavior Modeling

Novel Engineered Materials

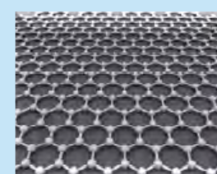
Cognitive Neuroscience



Quantum Information Science



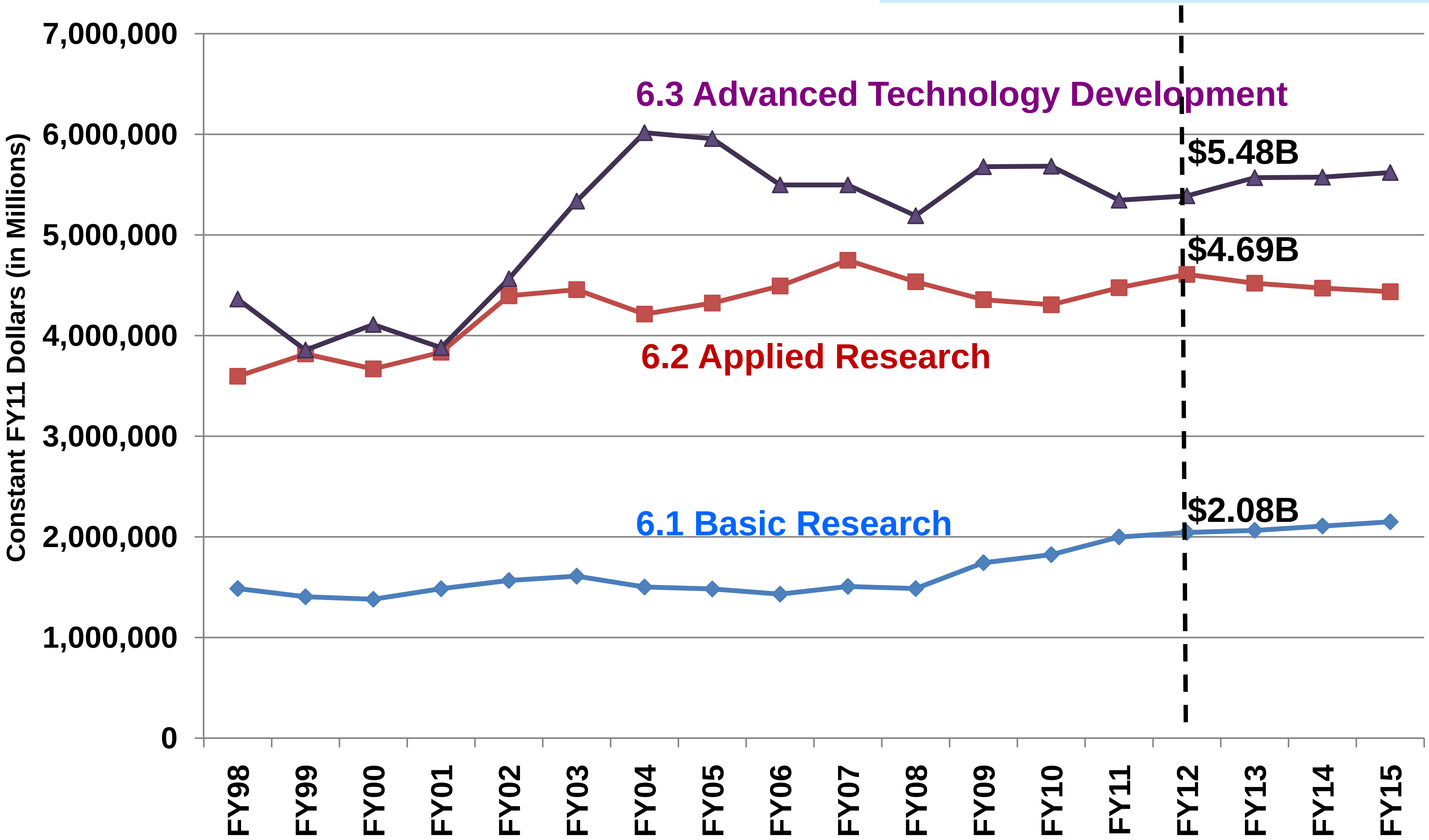
Nanoscience



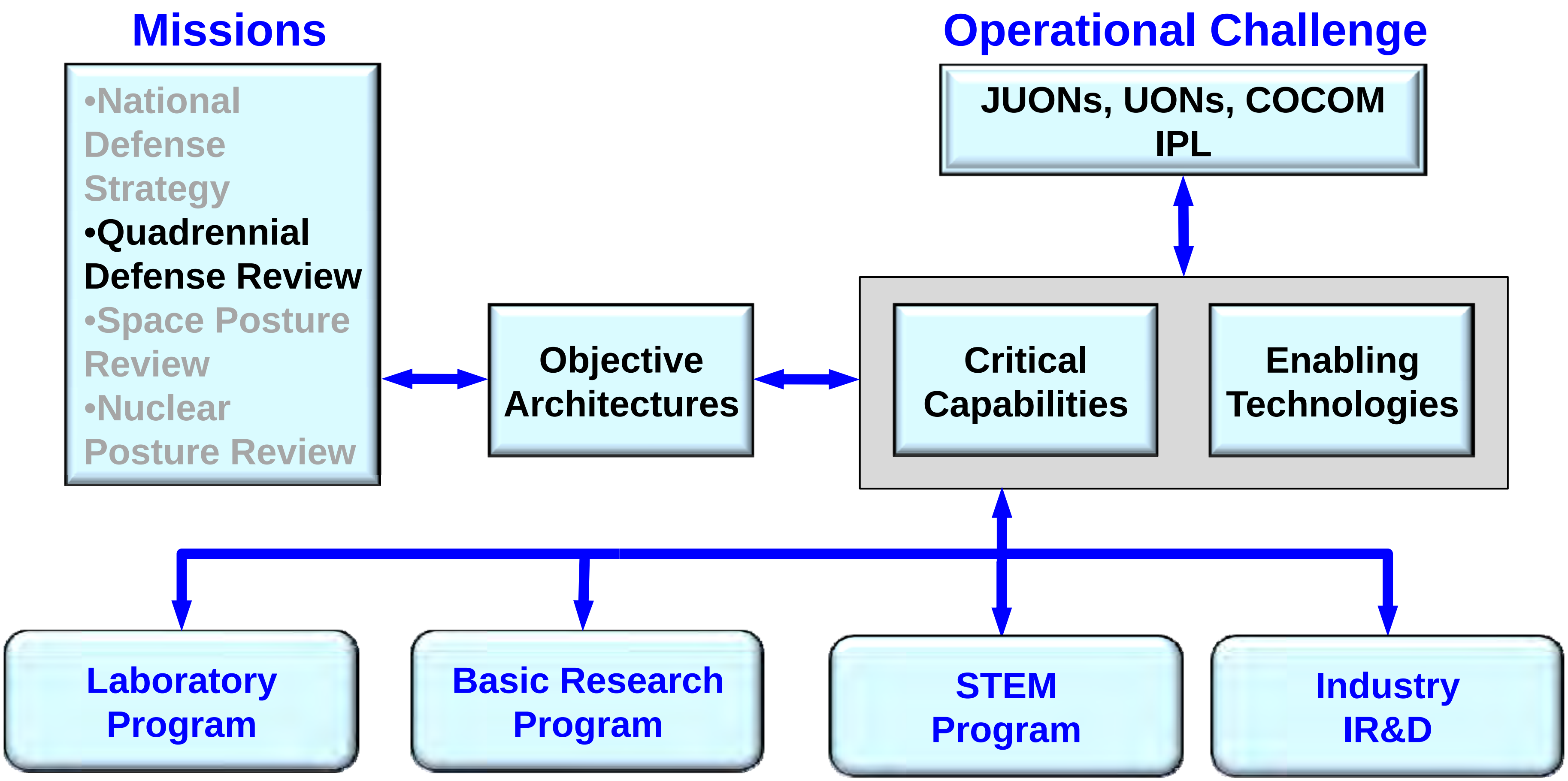
DoD S&T Funding By Budget Activity

- President's Budget Requests – in Constant FY11 Dollars -

Total FY12 S&T request = $12.25B



Integrated S&T Enterprise



S&T Executive Committee (EXCOM)

Lt Gen Larry Spencer
J8

Ms. Kathleen Hicks
DUSD(SPF)

Mr. Zach Lemnios
ASD(R&E)

Mr. Andrew Weber
ASD(NCB)

Mr. Brett Lambert
DASD(MIBP)

Dr. Regina Dugan
DARPA

Dr. Steven Walker
DASAF(STE)

Dr. Marilyn Freeman
SAAL-ZT

RADM Nevin Carr
CNR

Conference Summary

- **FY2012 President's Budget Request**
- **ASD(R&E) Programs**
  - Basic Research
  - Rapid Fielding
  - Test & Evaluation
  - Trusted Foundry
- **Department S&T Emphasis Areas**
- **Components' S&T Program Overviews**
- **Combatant Command Briefs**

THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

High Velocity Penetrating Weapon Program Overview

13 Apr 2011

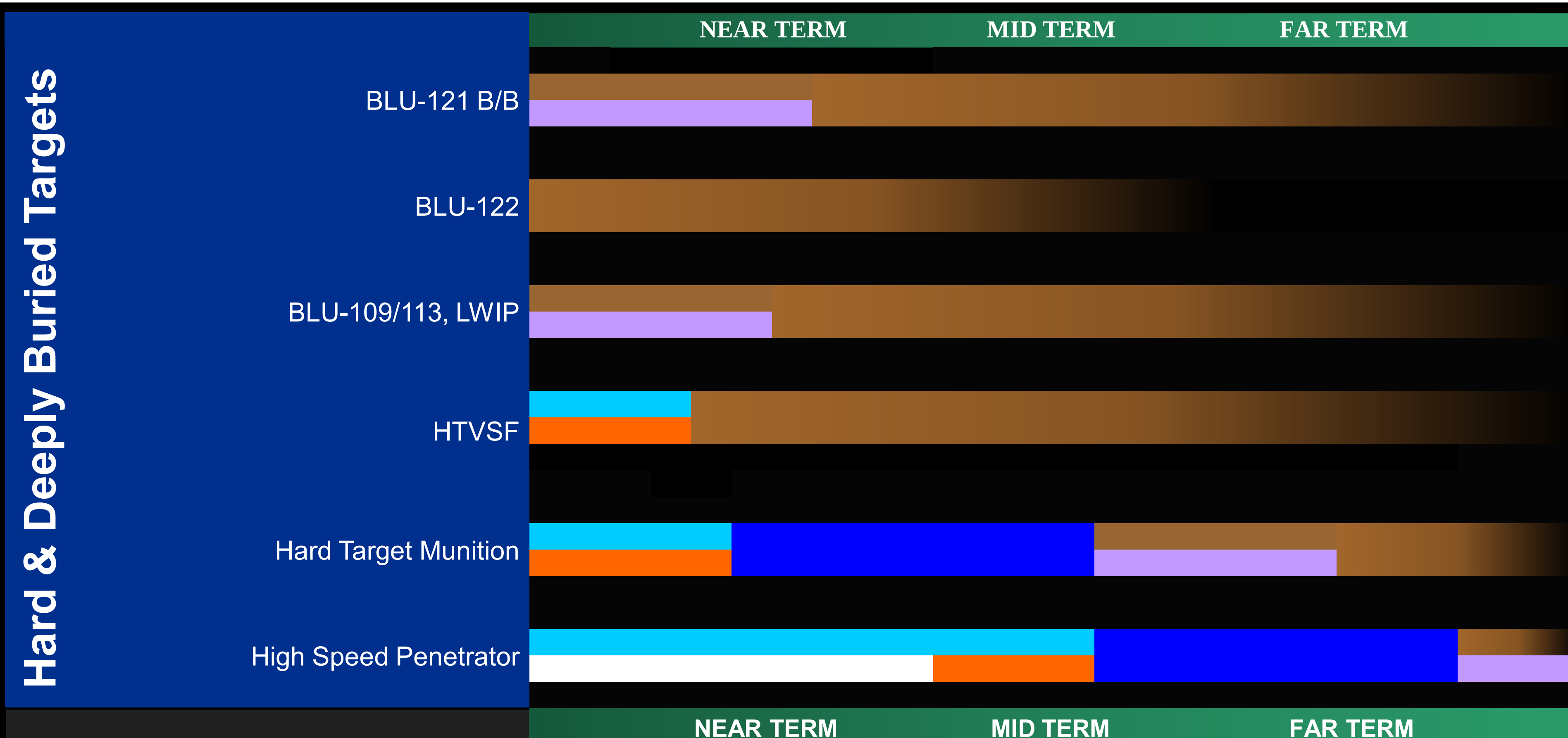
Leo Rose, AFRL/RW
Program Manager
850-883-2188

96ABW-2011-0151

Distribution A: Approved for public release; distribution unlimited

U.S. AIR FORCE

HDBT Weapons Roadmap
(Notional)



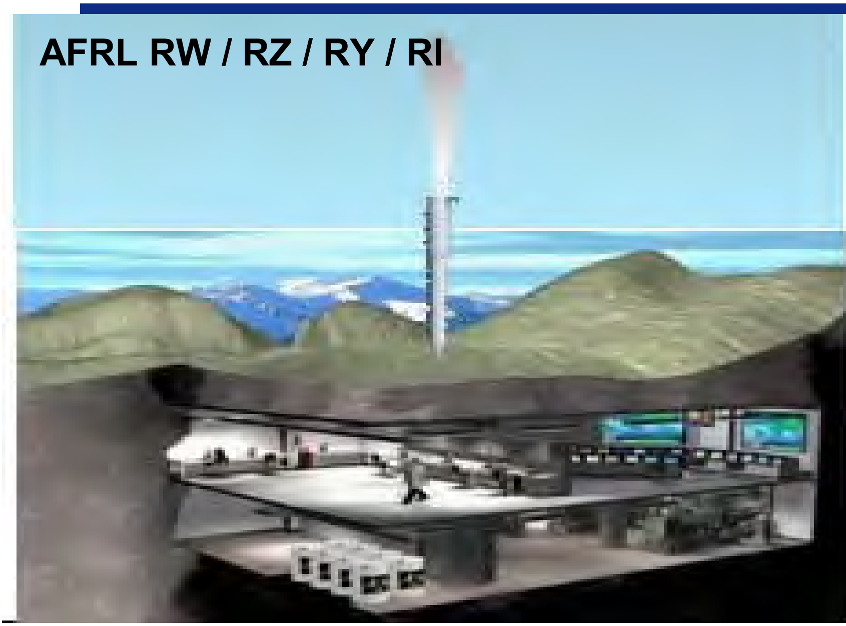
CP DP S&T Acq Program

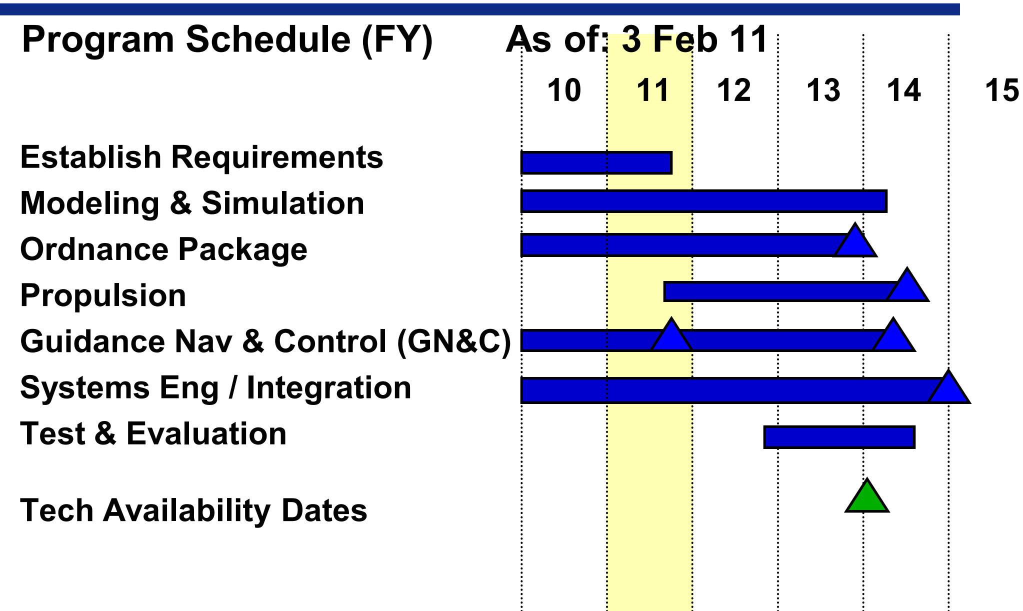
Future Acq Program O&S Production

96ABW-2011-0108

U.S. AIR FORCE

High Velocity Penetrating Weapon (HVPW)





Description

Provides improved penetration capability of hard, deep targets with boosted impact

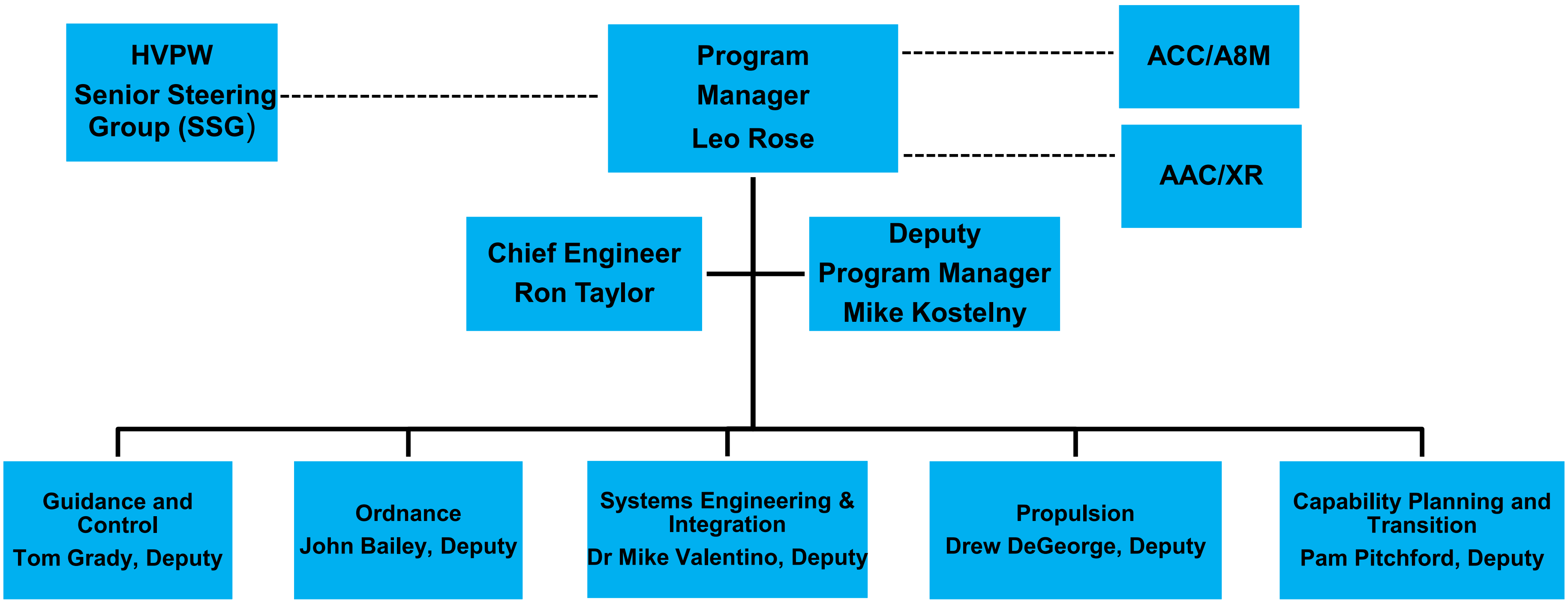
Technology

- Survivable ordnance package
- GN&C (precision navigation, terminal flight control)
- Propulsion (performance, GN&C interactions, IM)

Benefits to the War Fighter

- Defeats emerging hard targets
- 2000 lb weapon
- Internal carriage on F-35
- Increased loadout for other bomber/fighters

High Velocity Penetrating Weapon Team

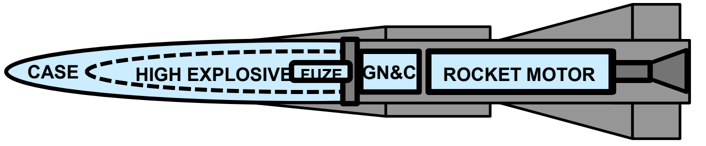


High Velocity Penetrating Weapon Sys Engineering & Flight Vehicle Integration

96ABW-2011-0151

U.S. AIR FORCE

Systems Engineering & Flight Vehicle Integration



- **Flight Vehicle Integration**
  - **Subsystem requirements, specs, models for subsystem trades, M&S**
  - **System trades of GN&C, warhead/fuze, and airframe/propulsion**
  - **Initial Technology Demonstration flight test vehicle concept development**
- **Aircraft Integration, Carriage & Release**
  - **F-35 internal carriage**
  - **Platform electrical and physical constraints**

Flight Vehicle Integration Major Technical Challenges

- Focus on ***integration*** issues associated with terminal accuracy and vehicle orientation
  - Airframe / control surfaces
  - GN&C algorithms
  - Booster misalignment, shock & vibration
- Scope of effort varies dramatically depending on desired TRL
  - AFRL/RW effort will end at subcomponent demonstrations not integrated flight test
  - AAC/XR CCTDs will provide initial trade space

U.S. AIR FORCE

HVPM Integration with F-35

- F-35 physical fit requirement
  - F-35 physical fit requirement will be validated to a “stay within volume”
- Bay Acoustics and Temperature Issues
  - Goal is to use standard design practices as those of current systems
- Bomb Rack, Launcher
  - Goal is to use current F-35 equipment (e.g. BRU-68)
  - 1760 / 1553 Weapon-Store Interface/Data Bus
  - Some electrical and message content changes as typical with new weapons
- Ground Handling Equipment (e.g. loaders)
  - Goal is to design to current systems; minimize use of adaptors

THE AIR FORCE RESEARCH LABORATORY
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High Velocity Penetrating Weapon Ordnance Package

96ABW-2011-0151

U.S. AIR FORCE

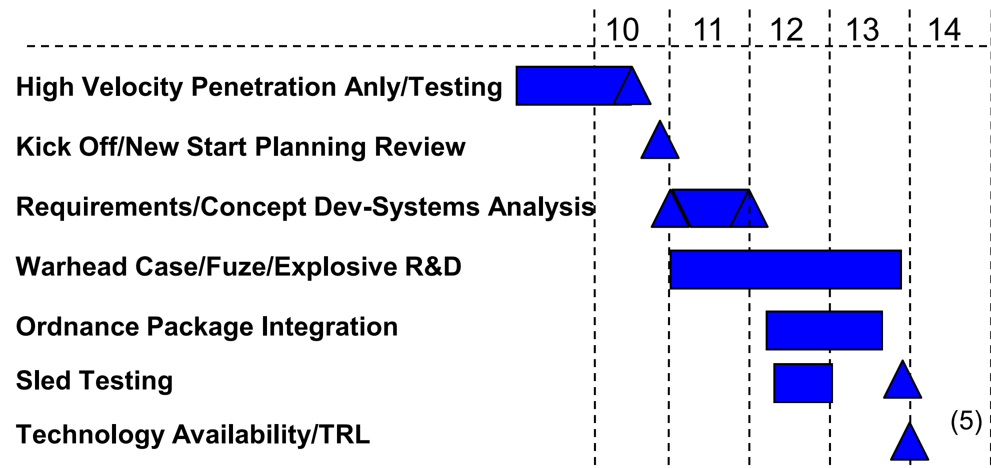
Conventional Survivable Ordnance Package (CSOP)

Boosted Penetrator/F-35

Survivable explosive payload

Miniaturized, survivable, intelligent fuzing

Technology Investment Schedule (FY)



Description

Warhead that survives and functions after a boosted impact into hard target

Technology

- Survivable intelligent-fuze technology
- Survivable energetic explosive
- Survivable warhead case
- Modeling & Simulation Tools – Penetration mechanics, lethality & material characterization
- Leverage ongoing R&D

Benefits to the Warfighter

- Penetrating weapon capability for F-35 in a 2000 lb class weapon
- Increased reliability with innovative fuze design which allows for redundancy
- Safer munitions through improved high explosive development

U.S. AIR FORCE

Fuze Technology

- **Hardened Miniature Fuze Technology (HMFT) Post Impact Module**
  - **Successfully demonstrated survivability and post impact burst point system functionality**
  - **Very High G (VHG) and airgun shock test environments**

Laboratory-VHG Test

Laboratory-Airgun Test

- **Task added to existing HMFT Contract for FY11 HMFT Feasibility Study for CSOP**
  - **Conduct contractor laboratory testing**
  - **Mechanical design updates**
  - **Assess and document HMFT axial/lateral shock survivability in cannon tests**
- **HMFT Feasibility study & analysis**
  - **Requirements evaluation (signal, power, communications, arming)**
  - **Interfaces**
  - **Mechanical packaging & mounting**

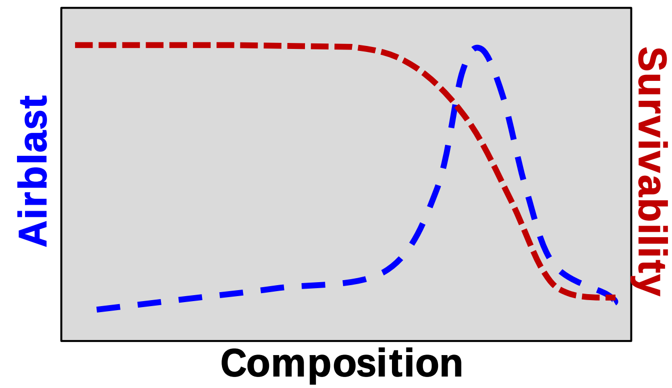
Explosive

New Development

Approach

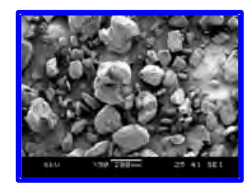
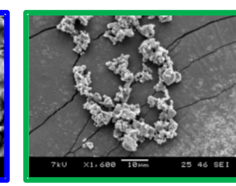
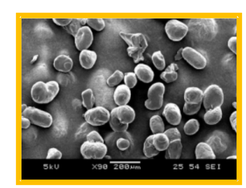
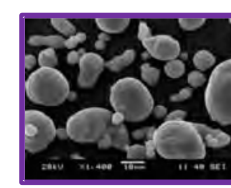
- **Map out the formulation design space via systematic "Mixture Design" methodology**
  - **A type of statistical, "Design of Experiments"**
- **Quantify the tradeoff in design parameters**
  - **Airblast, sensitivity – survivability, & mechanical properties**
- **Apply residual knowledge**
  - **Validation data for theory and M&S**
  - **Reduce formulation time for future application requirements**
  - **Identify the range of possibilities for current ingredients**

Hypothetical Trade-off in Properties



Progress

- **Ingredients selected, all existing with MIL-SPEC's**
- **Composition limit inputs found – 45 run matrix generated**
  - **Mixture viscosity was primary constraint**
- **Gathered extensive laboratory-scale safety test data**

THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

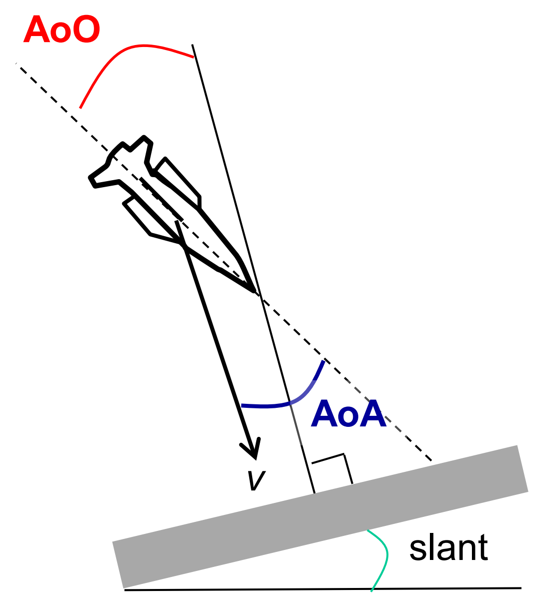
High Velocity Penetrating Weapon Guidance Research S&T Plan

96ABW-2011-0151

U.S. AIR FORCE

Control

- **Boosting with a rocket adds some issues:**
  - **Motor/thrust misalignment**
  - **Control authority, especially with oblique trajectories (*e.g.* slant targets)**
  - **Vibration / acceleration effects**
- **HVPW could have significant problems during boost**
  - **Angle of Obliquity (AoO) – could be unknown**
  - **Angle of Attack (AoA) – interacts with AoO**
- **Must control closely to ensure:**
  - **Maximum penetration**
  - **Fuze survives impact**



U.S. AIR FORCE

Risk Assessment

Largest risk / least maturity in following component areas:

- **CEP control**
- **Angle of Attack (AoA) sensing & control**
- **Trajectory shaping for optimized rocket firing**
- **Rocket integrated control**

Philosophy: methodical modeling and tool-up to:

1. **Show maturity of guidance subsystem**
2. **Prepare for more than one MS-A contractor conceptual design**

THE AIR FORCE RESEARCH LABORATORY

LEAD | DISCOVER | DEVELOP | DELIVER

High Velocity Penetrating Weapon Propulsion

U.S. AIR FORCE

HVPW Propulsion

- HVPW derived operational systems will require a new rocket motor
- HVPW propulsion potential design/technology challenges include
  - Thrust alignment/alignment control
  - Energy management
  - Tight propellant burn rate specification
  - Increased performance
  - Wrap-around motor
  - Service life through extreme environments

Questions

Leo Rose, GS-15
AFRL/RW
HVPW Program Manager
ROSEL@EGLIN.AF.MIL
850-883-2188

The DoD T&E/S&T Program

George Rumford
Program Manager

Test Resource Management Center
Test & Evaluation / Science & Technology Program
(TRMC, T&E/S&T)

NDIA 12TH Annual Science & Engineering Technology Conference

Test Resource Management Center (TRMC)

- **DoD Field Activity**
- **Direct Report to USD(AT&L)**

☆☆☆ SES Director

Oversee Test Infrastructure
Major Range & Test Facility Base (MRTFB)
Other T&E Facilities Within & Outside DoD

Develop T&E Strategic Plan
Biennial 10-Year Strategic Plan for DoD T&E Resources

Administer Corporate T&E Investment Programs
Centrally-Funded T&E Investment Programs (T&E/S&T, CTEIP, JMETC)

Certify T&E Budgets
Annual Certification of Military Departments & Defense Agencies T&E Budgets

The STEWARD of the DoD Test Infrastructure

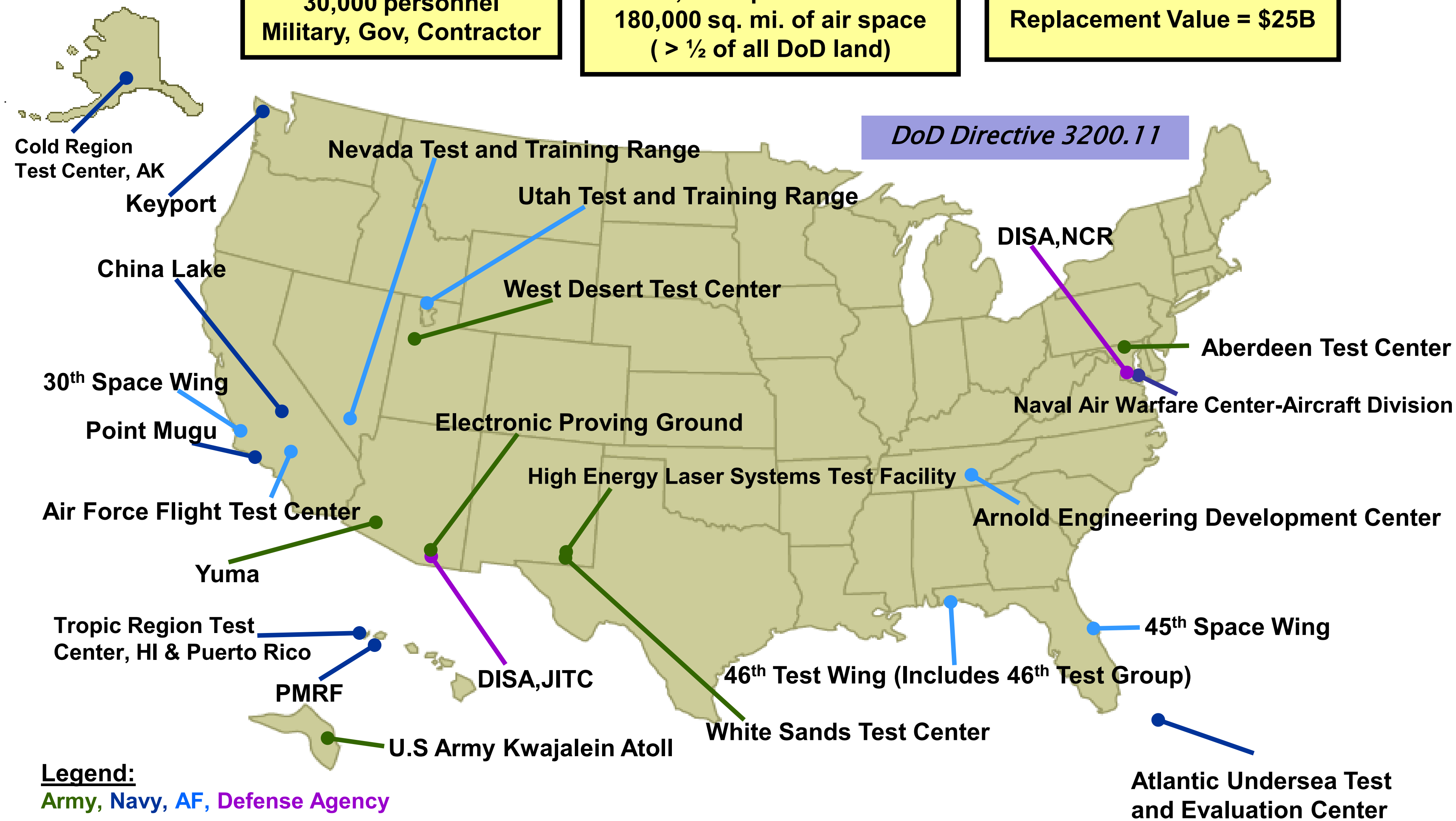
Major Range and Test Facility Base (MRTFB): The –Critical Core”

24 Sites: Army-9; Navy-6; Air Force-7; Defense Agency-2

30,000 personnel
Military, Gov, Contractor

18,000 sq. mi. of land
180,000 sq. mi. of air space
(> ½ of all DoD land)

Replacement Value = $25B



Synergy through Aligned Investment

Quadrennial Defense Review
Strategic Planning Guidance

Annual T&E Budget Certification*

DoD Strategic Plan for T&E Resources

Service T&E Needs and Solutions Process

TRMC Joint Investment Programs (FY10: $254M)

Risk mitigation needs
Technology shortfalls

Risk mitigation solutions
Advanced development

Requirements

Capabilities

CTEIP

JMETC

OSD

(6.3 Funding)

(6.4 Funding)

(6.5 Funding)

Transition

Service Modernization and Improvement Programs

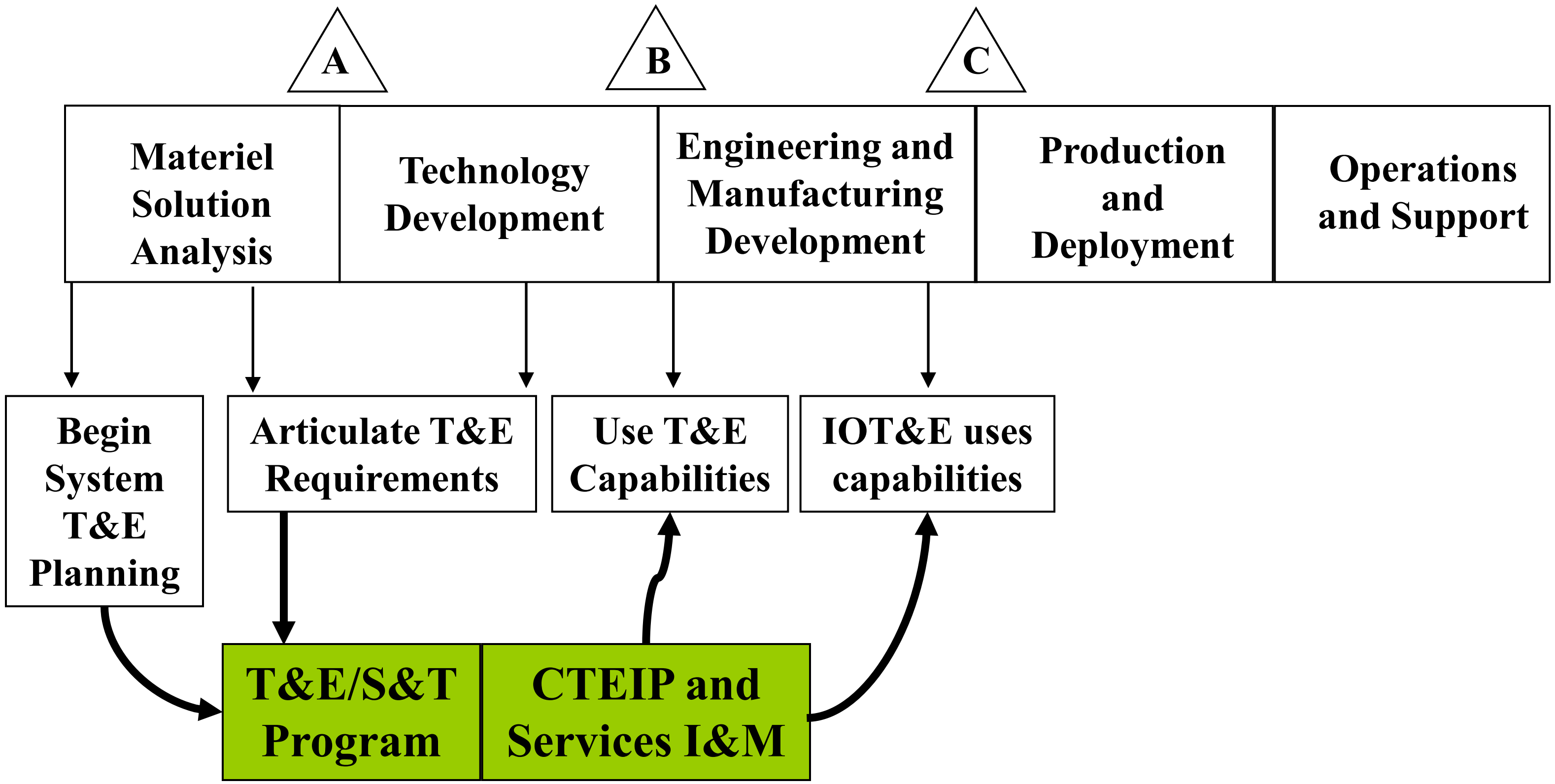
Acquisition Programs and Advanced Concept Technology Demonstrations

T&E Multi-Service/Agency Capabilities

DoD Corporate Distributed Test Capability

T&E Capability Development Cycle

Challenge: T&E Capabilities are available in time to provide useful insight to decision-makers and warfighters



Cycle for Test Capability Development Must Begin Early

T&E/S&T Program
Overview

Mission: Develop Technologies Required to Test Future Warfighting Capabilities

- Established in FY02
  - Joint DDR&E / DOT&E Initiative
  - Transitioned to TRMC in FY05
- RDT&E Budget Activity 3 funds
- Purpose
  - High Risk / High Payoff R&D for Testing
  - Foster technology transition to major DoD test ranges
  - Risk reduction for test capabilities developments

92 Active Projects

- Annual Broad Agency Announcements (BAAs)
  - Academia
  - Industry
  - Government Laboratories
- Tri-Service working groups
  - Validate requirements
  - Evaluate proposals
  - Facilitate technology transition
- Central Oversight – Distributed Execution

As of 15 April 2011

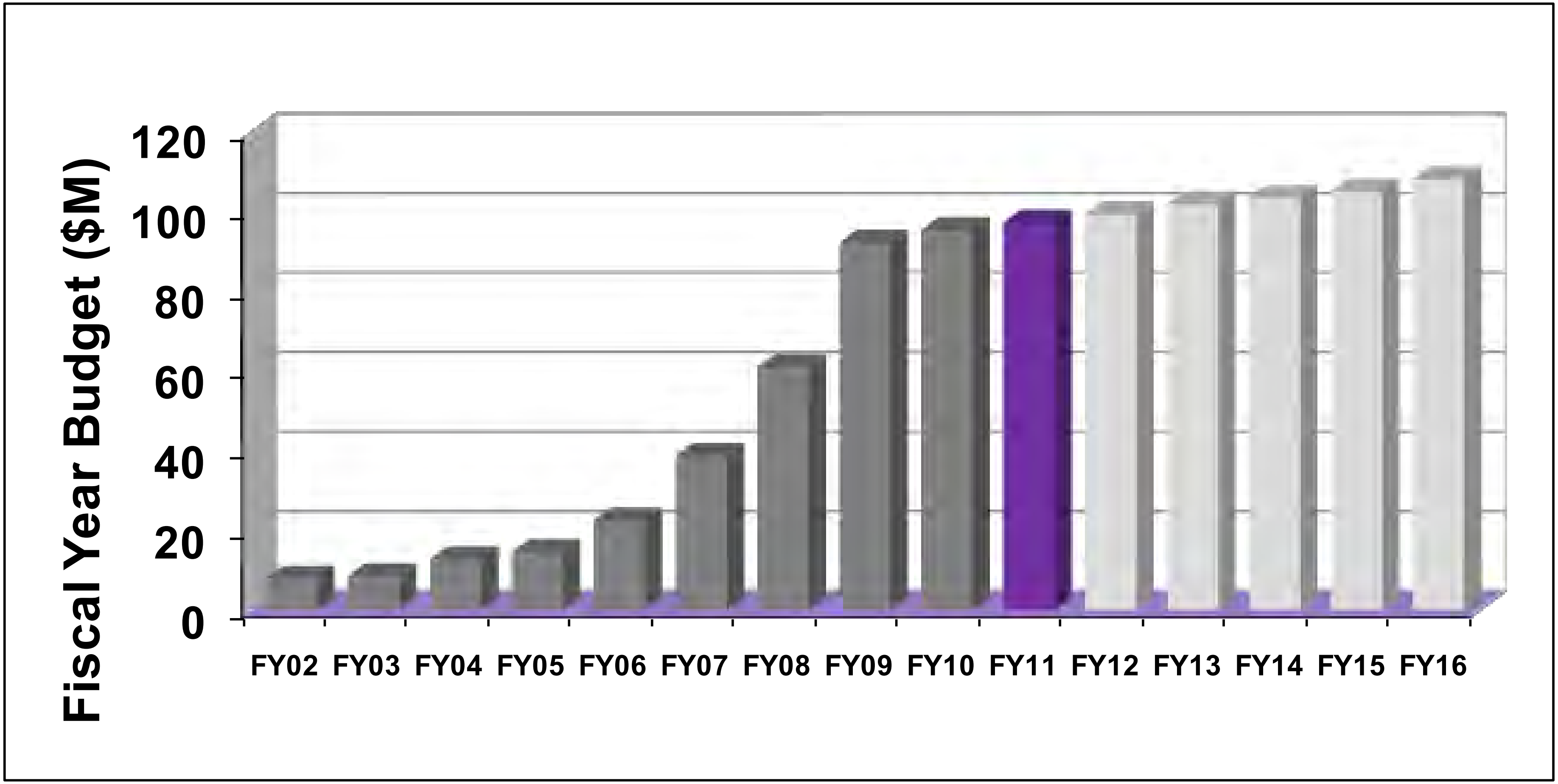
Seven Test Technology Areas

- Advanced Propulsion – 18 Active Projects
- Unmanned & Autonomous Systems – 5 Active Projects
- Advanced Instrumentation – 6 Active Projects
- Directed Energy – 22 Active Projects
- Spectrum Efficiencies – 13 Active Projects
- Multi-Spectral Sensors – 16 Active Projects
- Net-Centric Systems – 12 Active Projects

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
$95.7M	$97.6M	$99.6M	$102.2M	$103.7M	$105.4M	$108.4M

Shaping Technology into Tomorrow's T&E Capabilities

T&E/S&T Program Annual Budget
Historical (FY02) to Future Projection (FY16)



Top DoD S&T Priorities

- **SECDEF memo dated 19 April 2011**
- **Seven priority DoD S&T investment areas**

1) Data to Decisions
2) Engineered Resilient Systems
3) Cyber Science and Technology
4) Electronic Warfare / Electronic Protection
5) Counter Weapons of Mass Destruction
6) Autonomy
7) Human Systems

What will we need to <u>TEST</u> these technologies?

T&E/S&T Program
Overview

Mission: Develop Technologies Required to Test Future Warfighting Capabilities

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  - Transitioned to TRMC in FY05
- RDT&E Budget Activity 3 funds
- Purpose
  - High Risk / High Payoff R&D for Testing
  - Foster technology transition to major DoD test ranges
  - Risk reduction for test capabilities developments

112 Active Projects

- Annual Broad Agency Announcements (BAAs)
  - Academia
  - Industry
  - Government Laboratories
- Tri-Service working groups
  - Validate requirements
  - Evaluate proposals
  - Facilitate technology transition
- Central Oversight – Distributed Execution

As of 6 June 2011

Nine Test Technology Areas

- Advanced Propulsion — 18 Active Projects
- Unmanned & Autonomous Systems — 8 Active Projects (+3)
- Advanced Instrumentation — 11 Active Projects (+5)
- Multi-Spectral Sensors — 17 Active Projects (+1)
- Directed Energy — 26 Active Projects (+5, -1)
- Spectrum Efficiencies — 19 Active Projects (+6)
- Net-Centric Systems — 13 Active Projects (+1)
- Electronic Warfare — Re-aligning 6 projects from Multi-Spectral
- Cyber Test — Re-aligning 2 projects from Net-Centric

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
$95.7M	$97.6M	$99.6M	$102.2M	$103.7M	$105.4M	$108.4M

Shaping Technology into Tomorrow's T&E Capabilities

T&E/S&T Program
Test Technology Areas

Test Technologies for:

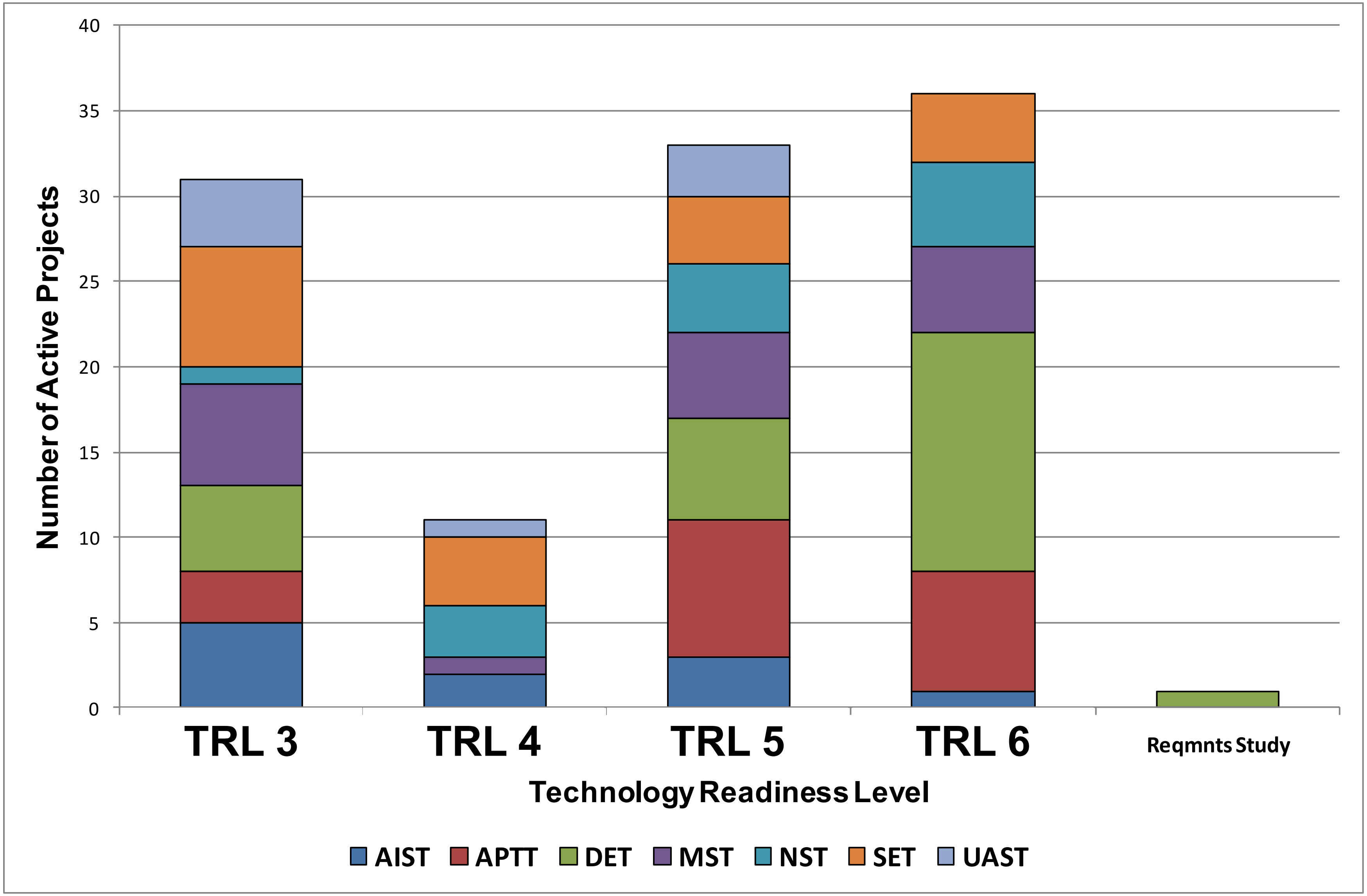
- **Enhanced Test Capabilities**
  - Advanced Instrumentation Systems
  - Spectrum Efficient Technology
- **Emerging Warfighting Capabilities**
  - Directed Energy Weapons
  - Hypersonic Vehicles
  - Multi-Spectral/Hyperspectral Sensors
  - Net-Centric Warfare Systems
  - Unmanned and Autonomous Systems
  - Electronic Warfare Systems
  - Cyber Operations

New Test Technology Areas

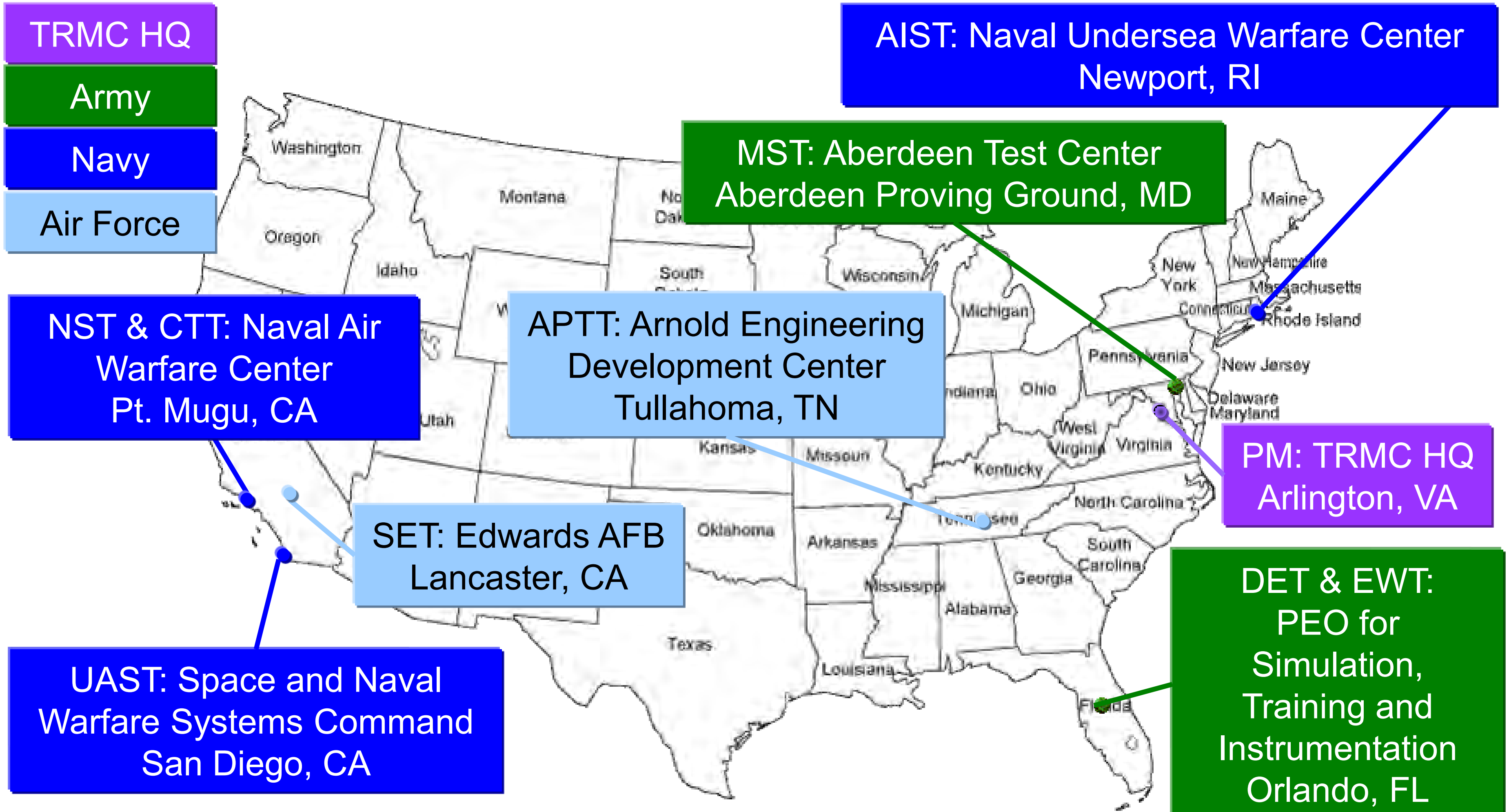
112 Active Projects

Each Test Technology Area has a Tri-Service Working Group with T&E and S&T participants

Technology Maturity by TTA
(Current T&E/S&T Portfolio of 112 Active Projects)



T&E/S&T Executing Agents



Central Oversight – Distributed Execution

T&E/S&T Executing Agents

Army

- **Minh Vuong, Army PEO-STRI**
  - Directed Energy Test (DET)
  - Electronic Warfare Test (EWT)
- **Frank Carlen, Army Aberdeen Test Center**
  - Multi-Spectral Test (MST)

Air Force

- **Ed Tucker, Air Force AEDC**
  - Advanced Propulsion Test (APTT)
- **Tom Young, Air Force AFFTC**
  - Spectrum Efficiency Technology (SET)

Navy

- **Gil Torres, Navy NAVAIR (Pt. Mugu)**
  - Net-Centric Systems Test (NST)
  - Cyber Test Technologies (CTT)
- **George Shoemaker, Navy NUWC (Newport)**
  - Advanced Instrumentation Systems (AIST)
- **Steve Koepenick, Navy SPAWAR**
  - Unmanned and Autonomous Systems Test (UAST)

T&E/S&T Program Industry / Academia Days 2011

- **18-20 October 2011 in Atlanta, GA**
  - Overview of the T&E/S&T Program
  - Overview of all Nine (9) Test Technology Areas
  - Preview of the T&E/S&T Broad Agency Announcement topics
  - Contracting and proposal requirements
  - Individual meetings with the T&E/S&T Program Manager and Test Technology Area Executing Agents

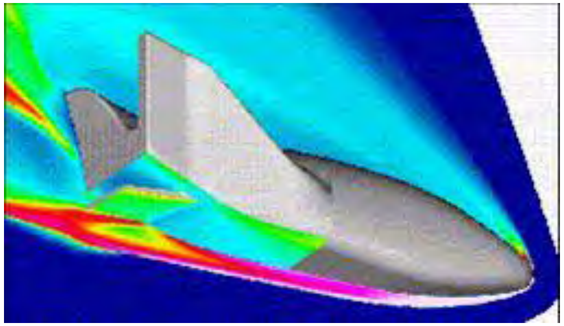
To request future announcements:

www.trmc-test.org/i-a_days

Determining Position of a System Under Test without Using GPS

- **Emerging challenges for Time-Space-Position Information (TSPI) instrumentation**
  - Test operations in GPS-denied environments (urban, caves, dense foliage, undersea)

  - Hypersonic vehicles in a plasma field
  - Micro autonomous systems
  - Large-scale System-of-Systems environments
  - Low Observable (LO) Systems that can not mount external instrumentation



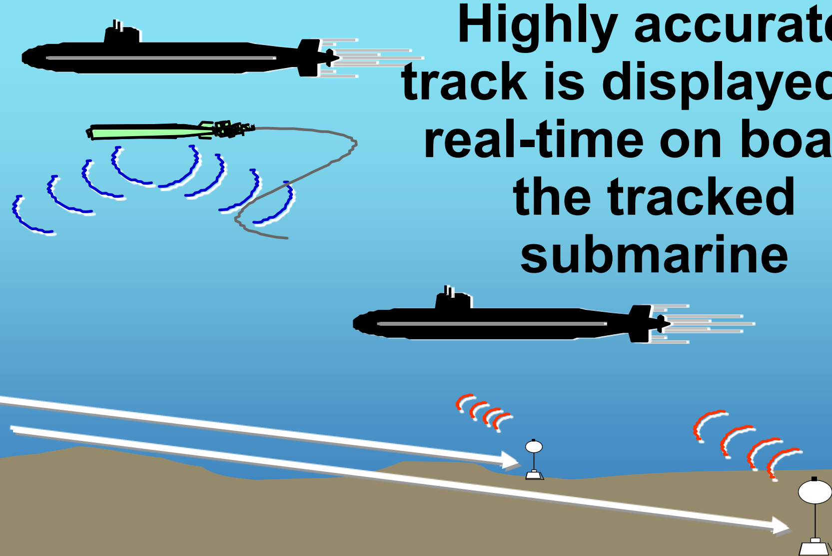
Improving Testing of Undersea Systems in a Realistic Operational Environment

Needs: Provide submarine undersea tracking during test events - without sub needing to ping!

DARPA-developed chip scale atomic clock

Key issues: Maintain clock accuracy, operate week+ without update

Insertion into undersea pingers



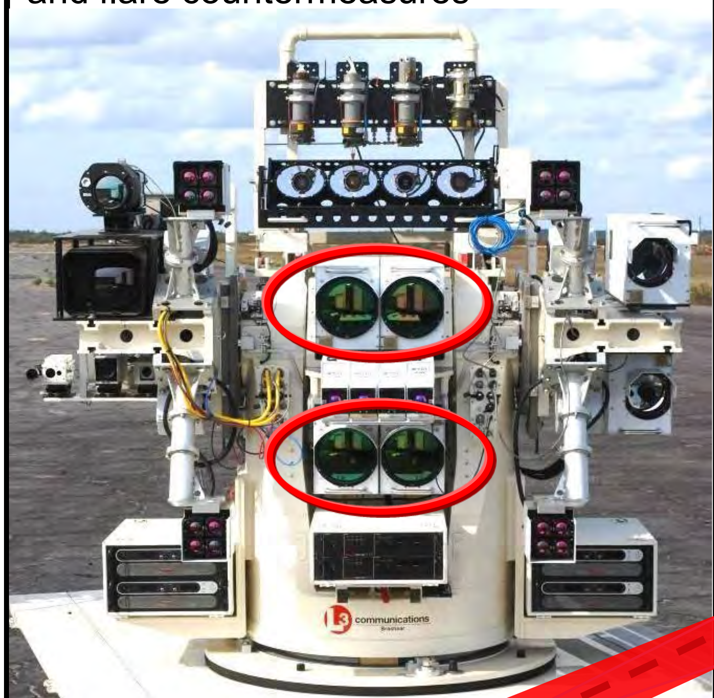
Highly accurate track is displayed in real-time on board the tracked submarine

T&E/S&T – CTEIP transfer: Providing critical test needs, validate crucial warfighting systems

OT for Common Broadband Advanced Sonar System (CBASS) Torpedo

Improving Testing of IRCM Systems

JMITS "paints" UV & IR signatures on IRCM systems and characterizes laser and flare countermeasures



Both Units Delivered Directly to Test

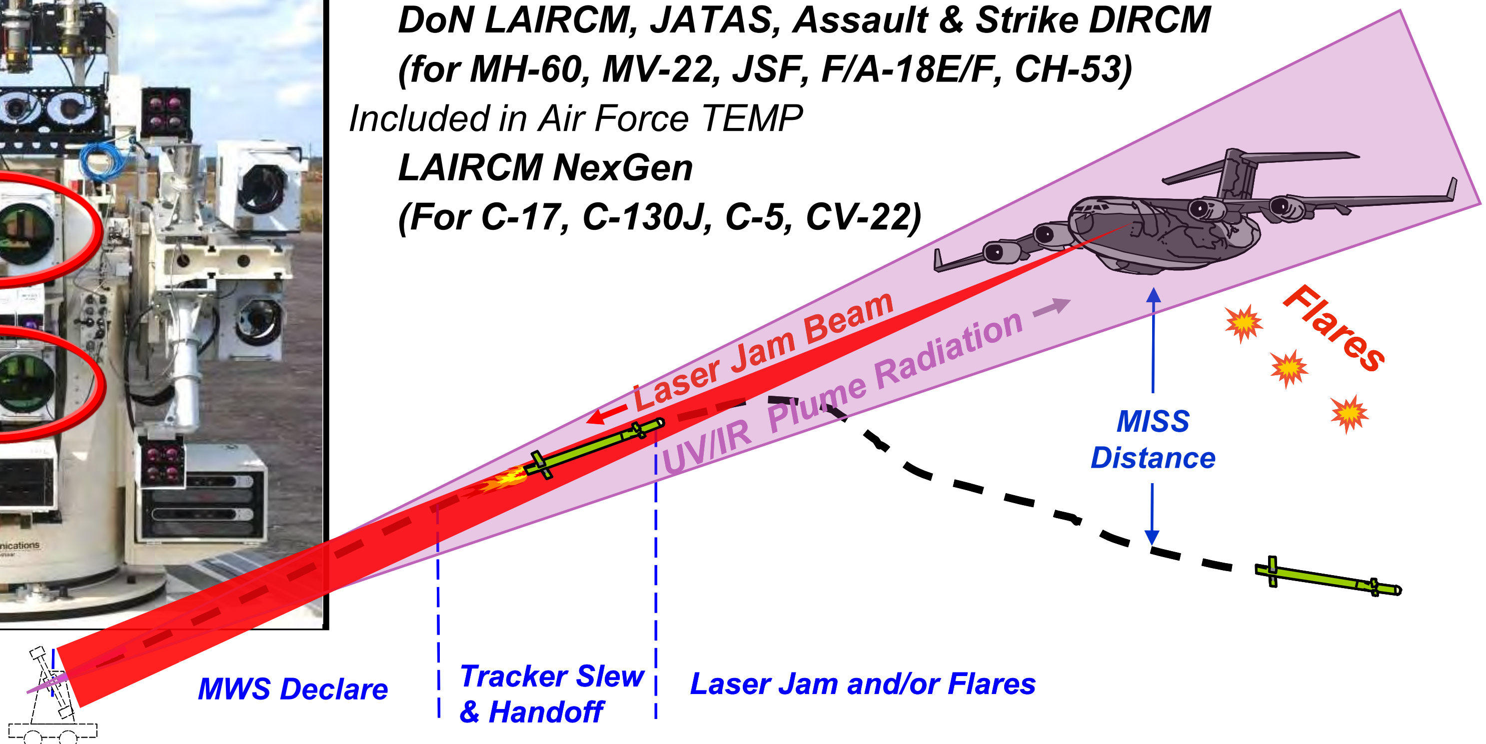
- ***Eglin AFB (DoN LAIRCM Testing on Navy CH-46)***
- ***China Lake (LAIRCM Testing on AFSOC CV-22)***

Included in Navy TEMPs

- ***DoN LAIRCM, JATAS, Assault & Strike DIRCM (for MH-60, MV-22, JSF, F/A-18E/F, CH-53)***

Included in Air Force TEMP

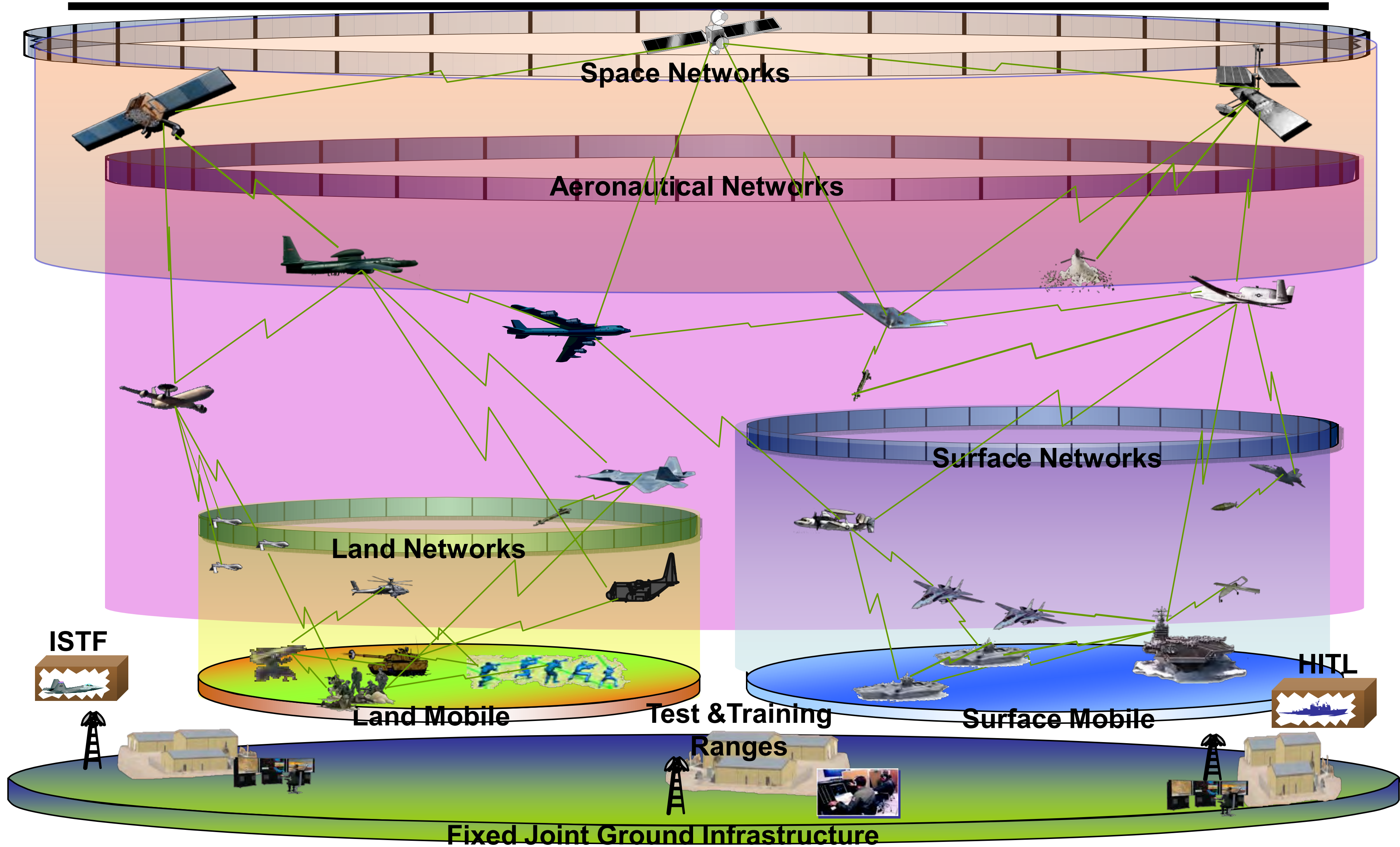
- ***LAIRCM NexGen (For C-17, C-130J, C-5, CV-22)***



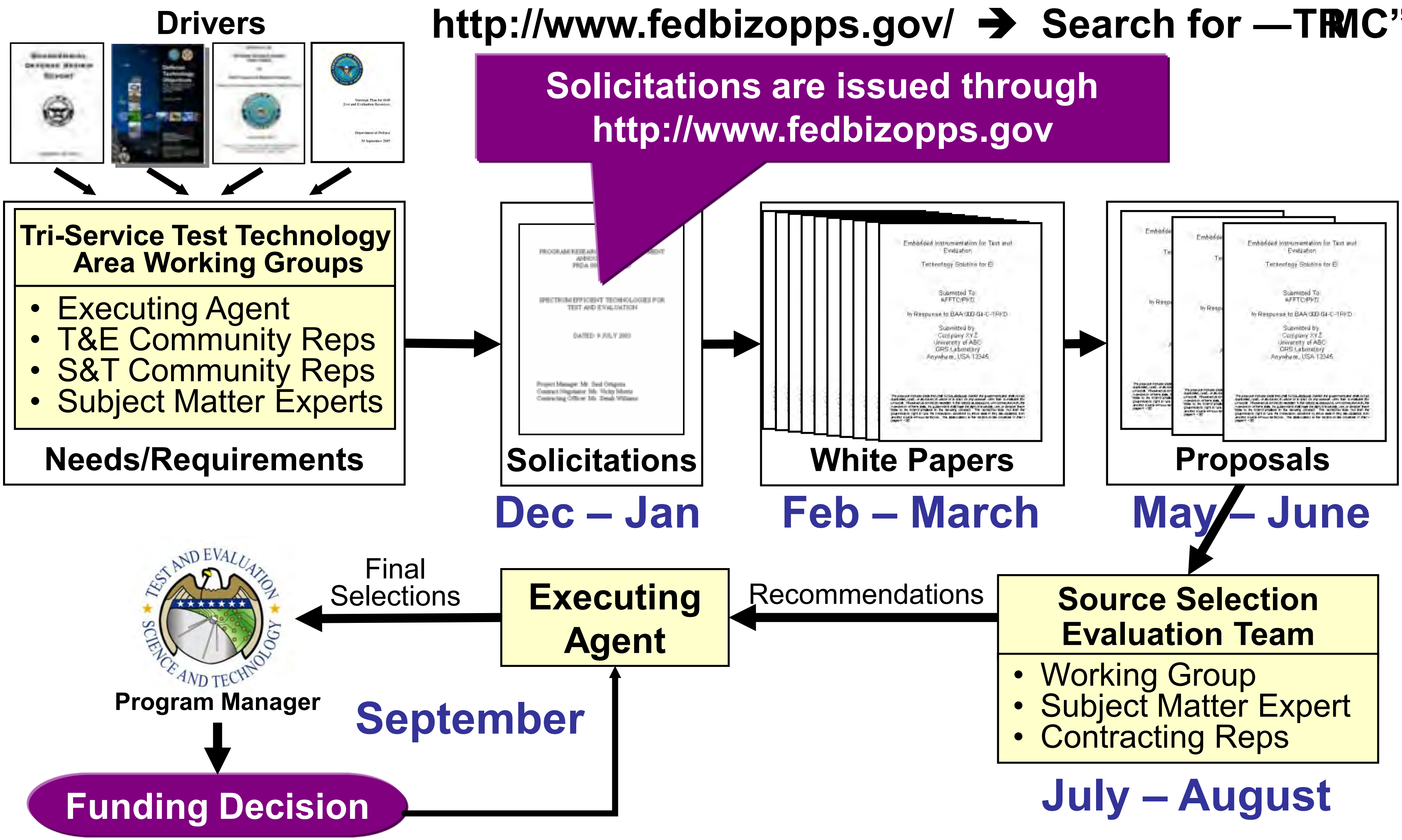
Required T&E/S&T Development for Higher Power Continuous Wave Infrared Sources

- **To simulate long range shots within MANPAD operational envelopes**
- **To simulate longer range RF SAMs during multi-spectral testing (RF & IR)**
- **Two Colors (IR-Red & IR-Blue)**

Improving Real-time Data Throughput Across the Test Environment



T&E/S&T Program
Project Selection Process



The Proposal — Key Criteria

- **Meets a T&E Need**
- **Requires S&T work**
- **High Payoff**
- **Broad application** (more than one DoD test activity)
- **High potential for transition to development of a test capability**

T&E/S&T Program
Summary

- **T&E/S&T Program initiated to address critical T&E needs tied to S&T drivers**
  – Advancing the state of the art in T&E technologies
- **The only DoD S&T program dedicated to T&E**
- **Annual Call to Industry, Academia, and Government Laboratories to address test capability needs**
- **Competitive technology developments to get the best technologies possible to the test community**
- **Focused on transition into needed test capabilities**

Looking Ahead, Responsive, and Agile

Questions?

Please stop by our booth in the exhibit hall

Contact Information:

Mr. George Rumford

Test Resource Management Center
T&E / S&T Program

George.Rumford@osd.mil

United States Special Operations Command

Science and Technology Capabilities to the SOF Operator

Ms. Lisa Sanders
Deputy Director,
Science and Technology
Directorate (SORDAC-ST)
June 2011

Our World Has Changed…

"Our strategic focus has shifted largely to the south... certainly within the special operations community, as we deal with the emerging threats from the places where the lights aren't…."

ADM Eric T. Olson

Commander's Guidance & Direction for USSOCOM S&T / S&T Vision

- Develop a coherent capability-based research and development effort focused on placing new capabilities in the hands of SOF operators
- Conduct technology discovery, coordinate research and development activities, rapidly integrate technology developments, and rapidly insert new capabilities for equipment and techniques across the force

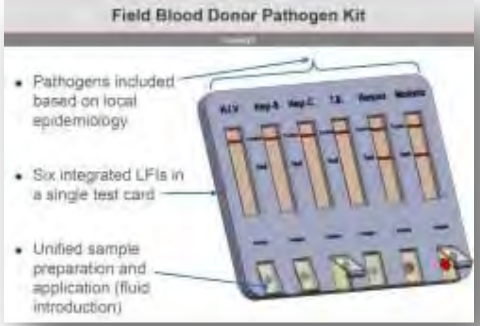
A Special Operations force, empowered with the newest technologies and capabilities, able to operate in any environment, work effectively with partners, and defeat all adversaries

USSOCOM
S&T Integrated Priority List (STIPL)

- **STIPLs focus on SOCOM S&T needs while complementing the SOCOM IPL**
- **FY13-17 S&T Priorities (Not in Order)**
  - Extended duration incapacitation
  - Comprehensive signature management across electromagnetic spectrum
  - Understand and Exploit the Battlefield
  - “Own the Night”

S&T Funding Sources

- **Two Traditional Sources:**
  - **BA2 (Special Operations Technology Development)**
    - TRL 3-5
    - Studies, early lab hardware, software development models
  - **BA3 (Special Operations Special Technology)**
    - TRL 5-7
    - Prototypes, Demonstrations
- **Rapid Exploitation of Innovative Technologies for SOF (REITS)**
  - Developmental Effort with potential to transition to field in 6-12 months (no more than 18 months)
  - High Risk, High Payoff Projects

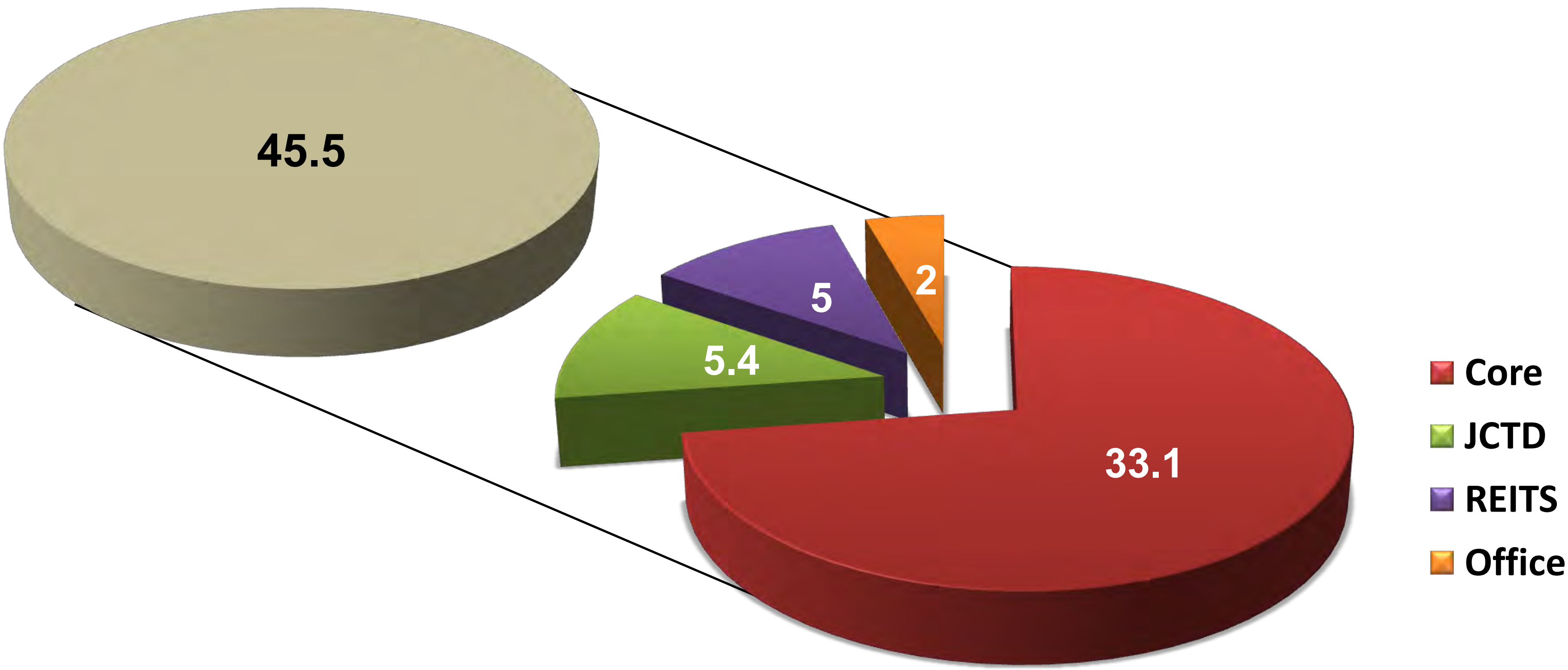


Funding Sources (Cont)

- **Small Business Innovative Research**
  - Phase 1: Competitively Awarded Topics, $100k for feasibility studies
  - Phase 2: Sole Source to Phase 1 contractors, approx $1M per contractor
  - Phase 3: Sole Source, Requires Program Funds, no $ limit

- **Leveraging**
  - OSD, Service Research Labs, DARPA, Dept of Energy, OGA

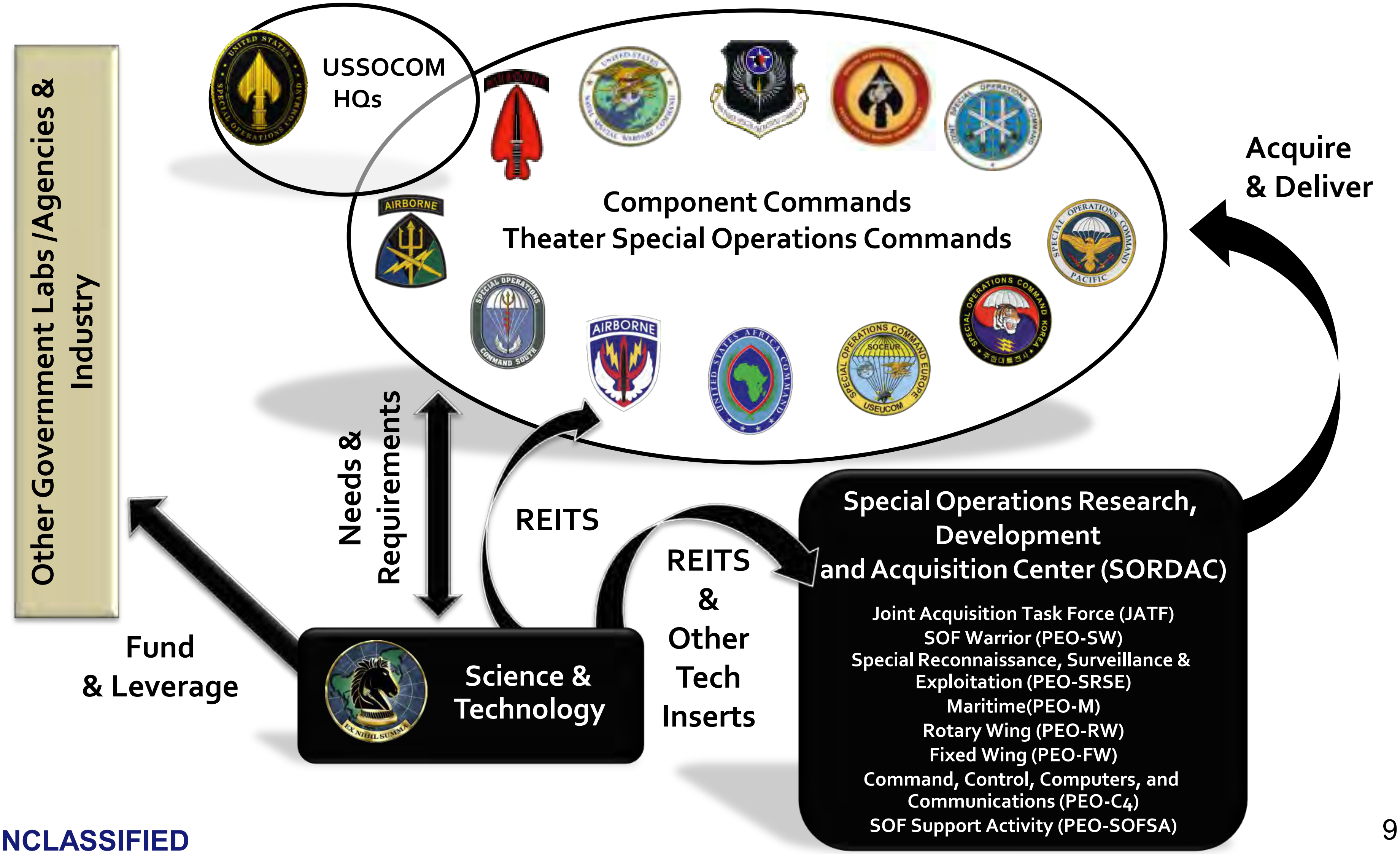
FY2011 S&T Funding ($M)



USSOCOM
S&T Commodity Alignment

- **Four Primary Commodities**
  - Soldier Systems
  - Mobility & Classified
  - RF & Antennas
  - Power & Energy
- **Two Cross-Commodities Focus Areas**
  - Experimentation & JCTDs
  - SBIR Management

S&T Capabilities to the SOF Operator



SOCOM Unique Authorities
National Defense Authorization Act of 1986

A Unified Combatant Command…

- Command of All U.S. Based SOF
- Plan and Synchronize DoD Activities in the Global War on Terrorism
- Deploy SOF to Support Geographic Combatant Commanders
- As Directed, Conduct Operations Globally
- Plan and Execute Pre-Crisis Activities

…With Service & Military Dept-like Responsibilities

- Organize, Train, Equip SOF
- Develop Strategy/Doctrine/Tactics
- Program and Budget
- Procure SOF-peculiar Equipment
- Monitor SOF Personnel
- Ensure Interoperability

Working with USSOCOM
Technology and Industry Liaison Office (TILO)

- The TILO provides USSOCOM and Industry a means to rapidly identify, track, and assist with the efficient transition of emerging and needed technologies and capabilities to the SOF warfighter
- Mr. Chris Harrington (USSOCOM Director, Office of Small Business Programs and TILO)
- tilo@socom.mil
- TILO Hotline (813) 826-3200


Questions?

Army Science & Technology

12th Annual Science & Engineering Technology Conference / DoD Tech Exposition

Providing Technology Enabled Capabilities

Dr. Marilyn M. Freeman
Deputy Assistant Secretary of the Army
for Research and Technology

June 22, 2011

We have been at War for 10 Years…

What have we Learned?

It's all about the Soldier – Basic Human Needs

It's all about the Soldier –
Expeditionary Maneuver / Tactical Force Projection

It's all about the Soldier – Force Protection


In Action - Collective


On the move


In Action - Individual


At "rest"

It's all about the Soldier – Expeditionary Basing

It's all about the Soldier – Cognitive, Physical & Social Performance

It’s all about the Soldier – Spiritual, Cultural, Social Needs

It's all about the Soldier – Cultural, Spiritual & Social Connectedness

It's all about the Soldier

This is What We Learned – It's all about the Soldier and …

"In the past the small unit was built around the fighting system. Today and for the future, the fighting system must be built around the small combat unit."

— MG(R) Robert Scales*

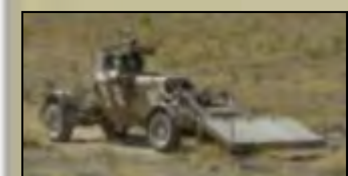
*Ground Combat Vehicle CONOPS - Concept paper dated Dec 2, 2010

Army S&T Raison d'Être

Foster invention, innovation, maturation, and demonstration of technologies to enable Future Force capabilities while exploiting opportunities to transition technology enabled capabilities to the Current Force

Current Force

Modular Protective Systems



IED/Mine Detection Ground Penetrating Radar

Unattended Transient Acoustic MASINT System

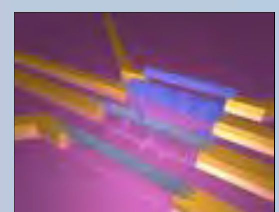
MRAP Expedient Armor Program

Enabling the Future Force

Enhancing the Current Force

Future Force

Immersive Training

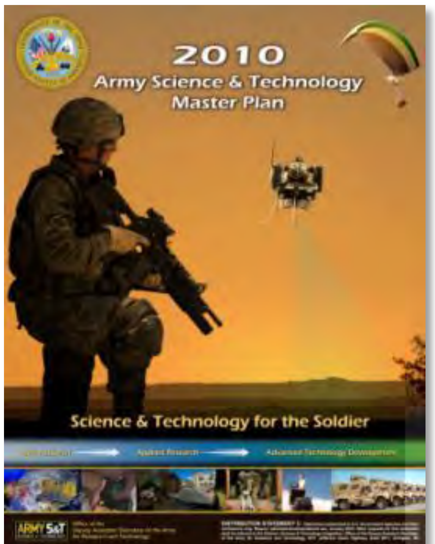


Virus-based Self-Assembling Electrodes

Regenerative Medicine

Autonomous Materiel Handling System

DASA (R&T) Responsibilities



- **Advise Army Leadership and the Acquisition Community on scientific and technical matters**
- **Maintain balanced S&T portfolio responsive to Warfighter needs—advocate and defend Army S&T investments**
- **Provide policy and guidance to the S&T Enterprise**
- **Promote technological innovation throughout the acquisition process**
- **Laboratory Management—improve/maintain health of Army labs/centers**
- **Assess technology readiness and facilitate transition to systems**

Principal Proponent and Accountable Senior Official for Army Science, Technology and Engineering

The Army S&T Workforce

Total Civilian Manpower: 18,640

- 10,949 Scientists & Engineers
- 1,443 S&E's are supervisors
- Approximately 9% new hires in FY10

Level of Education

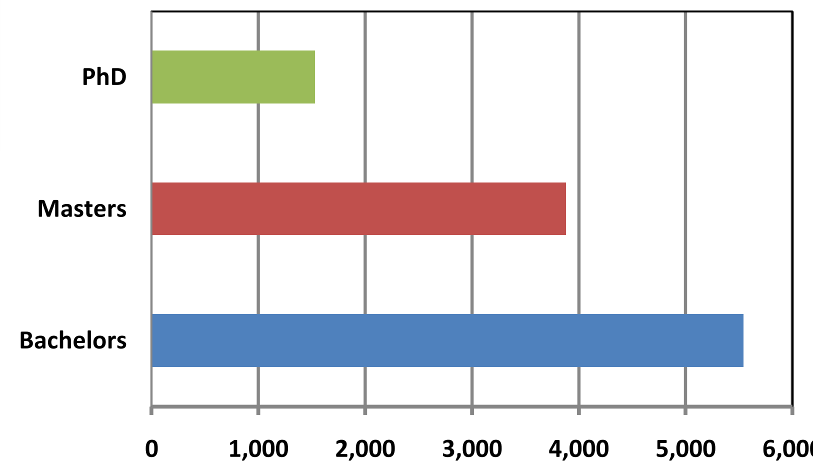
- 37% of new hires from Tier 1 schools
- 35% of S&E have MS
- 14% of S&E are PhD

Expertise Across Lifecycle

- **Deployable Employees:**
  - field-deployable scientists, engineers, technicians and operators
- **Matrixed support to JPEO/PEO offices**
- **Military personnel**

Critical and Unique Research Competencies and Facilities:

- Sensors, Electronics, and Materials
- Human Performance and Behavioral Science
- Clothing and combat feeding
- Medicine and clinical research
- Infectious diseases and battlefield medicine
- Munitions and warheads
- Threat agent chemistry and biochemistry
- Biology and environmental sciences
- Geospatial
- Sensor technology for space applications
- Network, cybersecurity, and information fusion



Degrees Held by Civilian S&E Workforce

DASA(R&T)'s Problem & Challenge

- **The Problem**
  - It takes too long to get technology enabled capabilities to the field
  - Army S&T is perceived as irrelevant

- **Fixing the Problem requires:**
  - New comprehensive strategy
  - Changing the culture
  - Restoring confidence in Army S&T
  - Building a strong Partnership with Leadership
  - Motivating the workforce towards results

We have been working on this for a year – and we are on the path to fixing it!

Strategy for Change
Value Proposition for Army S&T

Vision
Provide technology enabling capabilities that Empower, Unburden and Protect our Soldiers and Warfighters in an environment of Persistent Conflict

Strategic Perspective for Success
Timely delivery of capabilities fostered by effective partnerships in synchronization with Army Force Generation and fiscal processes in accordance with the priorities of the Chief of Staff and Secretary

Respond Rapidly to Technological Evolution

New Metrics for Value of Army S&T:

- The technical capabilities we provide to Warfighters
- The data and information we provide to decision makers
- The quality of the research, development, and engineering conducted in our laboratories and centers
- The contributions of our subject matter experts who participate in decision making activities
- The number of times we are called upon to provide innovative solutions to big Army/ DoD problems
- Our ability to effect positive change

New Strategic Goals for Army S&T

"World Class" Science & Technology

Timely Transition of the Right Technologies

Recognized Leader in Defense Development and Engineering

Strong Internal & External Partnerships

High Quality, Relevant Facilities and Capabilities

A Balanced Investment Portfolio

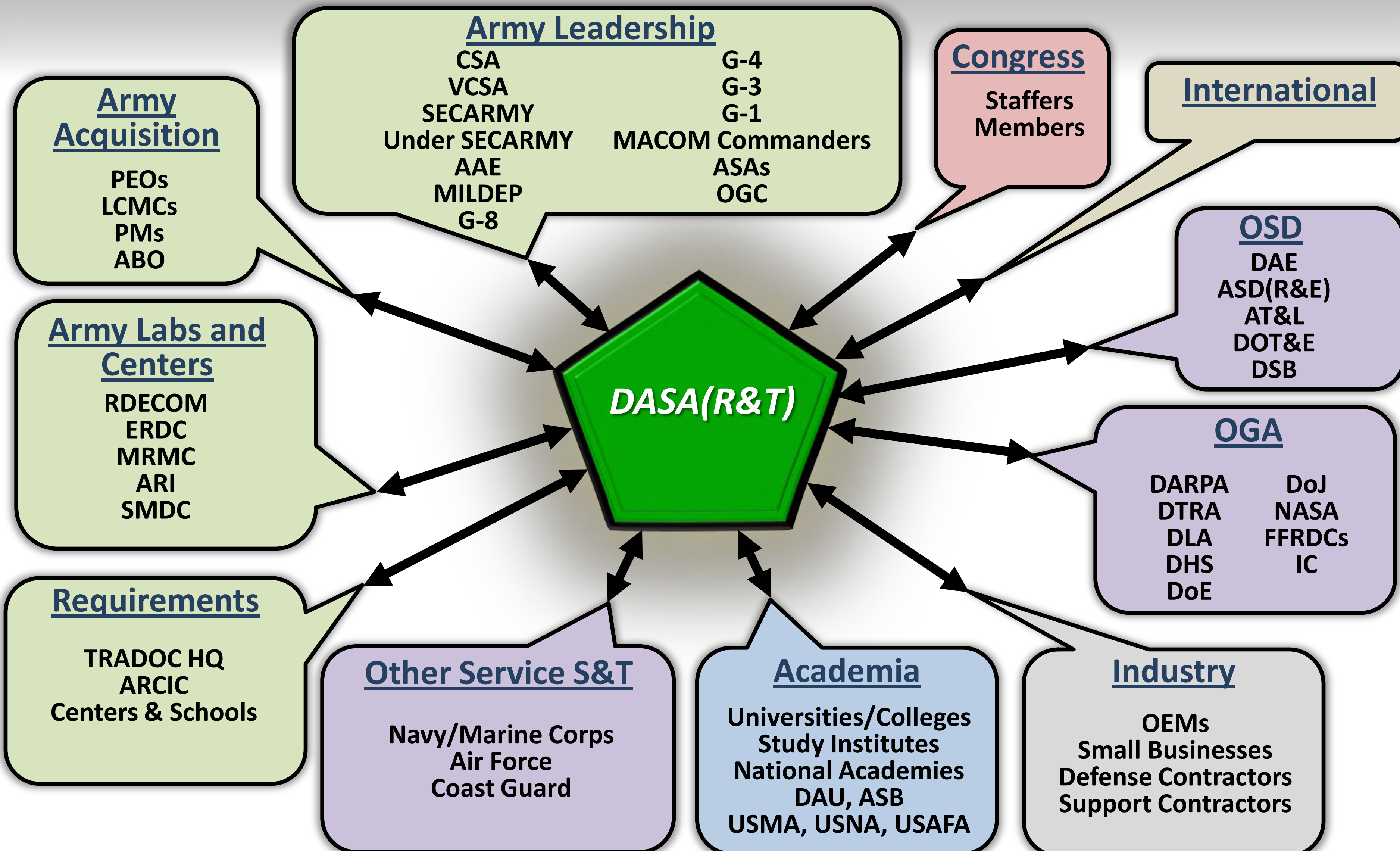
Highly Skilled, Motivated Workforce that Exemplifies our Core Values

Effective, Efficient, & Adaptable Processes

Government and Public Understanding of Our Value

Overarching Goal: To be the Army Senior Leadership's "Go-To" place for all Science & Technology and Engineering issues

Building Partnerships Across the Enterprise



DASA(R&T) – The New Organization

Army Chief Scientist

OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF THE ARMY (RESEARCH AND TECHNOLOGY)

- Exec Director, Strategic Plans & Program Planning
- Exec Director, Programs & Technology Transition
- Director for Warfighter Technology Implementation

Portfolios

- Director for Soldier Systems S&T
- Director for Ground Systems S&T
- Director for Air Systems S&T
- Director for C^3 Systems S&T

Director for Basic Research

Functions

- Director for Lab Management & Educational Outreach
- Director for Business & Operations
- Director for Studies, Analyses & Assessment

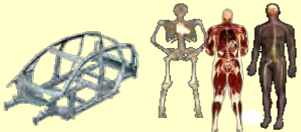
Army S&T Alignment—Soldier Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Human Dimension:

- Soldier Leader Training
- Equipment designs which reduce physical and cognitive burden during training, operations and reset
- Cultural Awareness

Soldier Load & Protection:



- Offloading technologies
- Lightweight, threat tailored, ballistic and blast components for Soldier mobility & survivability
- High density and efficient energy sources
- Decision aides for mission equipment planning
- Lethality assets that are lighter & environmental friendly
- Low-cognitive user interface technologies

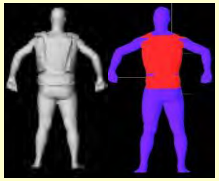
Mission Command:

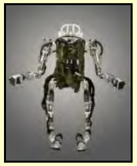
- Dismounted Mission Command Technologies
- NSA approved wireless protocol & novel Soldier personal area network architectures
- Technologies with allow freedom of maneuver across battlespace
- Distributed information & situational awareness

Health Promotion:

- PTSD and TBI treatments
- Suicide Prevention Study
- Psychological Resetting After Combat Deployment
- Nutrition Sustainment
- Fatigue Interventions

Combat Casualty Care:





- Regeneration of Damaged Tissue
- Ocular and Maxillofacial Trauma
- Musculoskeletal Injury
- Regenerative Medicine to Reduce and Repair Burn Injury
- Blood Products Research
- Wound Infection Countermeasures

Army S&T Alignment—Ground Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

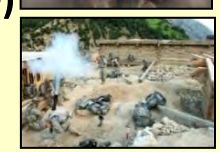
Ground Vehicle Power and Mobility:
- High temperature power electronics
- Fuel cell for silent watch
- Prime Propulsion


Survivability:
- Occupant Centric protection systems
- Light-weight, multi-hit and multi-functional integrated armors
- More effective and compact KE defeat APS

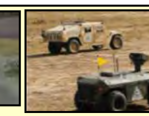
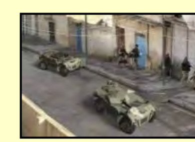



Intelligent Ground Systems:
- Fully autonomous leader/followers
- Tactical formation
- Human Machine Interface


Deployable Force Protection:
- Integrated, lightweight protection technologies for small bases (<300 people)
- Line-of-sight and non-line-of-sight detection
- Organic active and passive defense
- Robust and resilient systems

Unmanned Ground:
- Virtual testing of UMS
- Autonomous mobility performance in complex environments
- Soldier/robot and robot/robot teaming
- Autonomous Robotics Systems
- Indirect Vision Technologies
- Unmanned Systems Technology Development
- 360°Situational Awareness Technologies
- Soldier Machine Interfaces


Army S&T Alignment—Air Systems
6.2 and 6.3 FY12

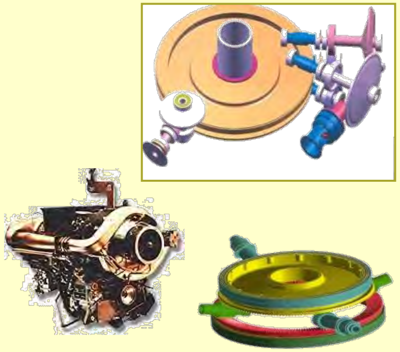
1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Platform Technologies:

- Joint Multi-Role Technology Demonstrators
- Rotorcraft Airframe Technology
- Platform Durability & Damage Tolerance
- Air Vehicle Structures & Dynamics Technology
- Aviation Weapons Integration

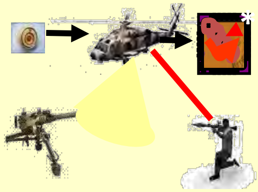
Operations and Support:

- Propulsion and Drive Trains
- Increased Fuel Efficiency
- Lighter Weight Components
- Small Heavy Fuel Engine
- Improved Reliability and Durability
- Reduced Weight/Vibration



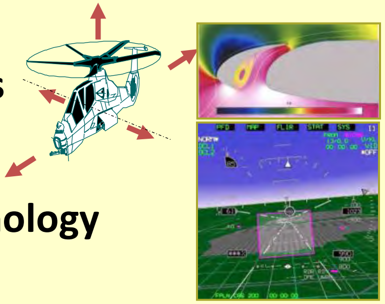
Survivability:

- Integrated ASE Architecture
- EO/IR Countermeasures
- Hostile Fire Warning & Visual Cueing
- Affordable Directional IR Jamming
- Increase Survivable Crash Envelope



Rotors & Flight Controls:

- Active Rotors and Controls
- Future Rotary Wing Concepts
- Advanced Rotor System Development
- Reconfigurable Vehicle Technology
- Reconfigurable Rotors



Unmanned Air:

- Autonomous Behaviors
- Unmanned Cargo Resupply
- Manned-Unmanned Teaming
- Video from Unmanned Aerial Systems for Interoperability Teaming (VUIT)
- Bi-Directional Remote Video Terminal (BDRVT)

Army S&T Alignment—Command, Control, and Communications Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Intelligence & Electronic Warfare:

- Fusion for timely, accurate SA
- Networked EW assets for simultaneous and autonomous detection, classification, and geo-location of modern emitters/threats in all terrains
- Surgical disruption and/or neutralization of C4ISR nodes and RCIEDs

Communications:

- GIG voice/data connectivity for dismounted Soldiers
- Tactical access to military Smartphone applications
- Intrusion Detection Systems to detect/protect and reduce network downtime from cyber threats
- Cross Domain Solution for bi-directional info sharing
- Affordable phased-array antennas for OTM Satcom

Mission Command:

- Mission-aware data mining and reasoning software agents for decision making and communications utilization
- Custom C2 applications from existing software components and services
- Mission Command software services – able to plan, deploy and manage unmanned missions
- Software for Collaboration Services and Decision Support Software Products

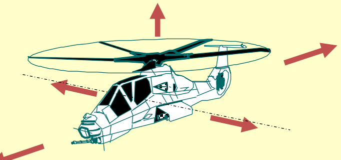
Sensors:

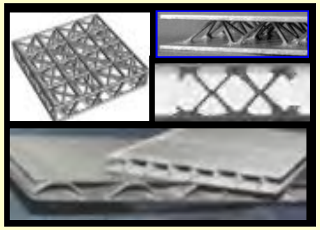
- New growth methods and structures enabling lower cost, large format IR FPAs:
  - Superlattice & Barrier ("nBn") detectors
  - Novel digital readout integrated circuit (ROIC) technology
- Radar technologies for 360 Degree Hemispherical Coverage
- Standoff capability to characterize urban structures

Army S&T Alignment—Basic Research
6.1 FY12

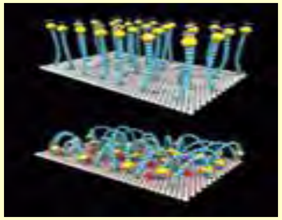
UARCs:
- Soldier Nanotechnology
- Collaborative Biotechnology
- Creative Technology
- Electromagnetics & Hypervelocity Physics

Centers for Enduring Needs:
- Vertical Lift Research
- Materials Research
- Automotive Research
- High Performance Computing
- HBCU/MI



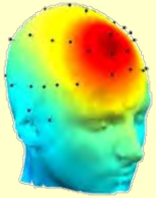


University Initiatives:
- Single Investigators
- MURI
- DURIP
- PECASE



Collaborative Technology Alliances:
- Micro Autonomous Systems Technology
- Robotics
- Cognition & Neuroergonomics
- Network Science

Inhouse Research:
- Core Programs
- ILIR



Army Basic Research Focus Areas

1. Nano Science and Engineering
2. Cognitive Neuroscience
3. Quantum Systems
4. Engineered Materials
5. Modeling of Human Behavior
6. Synthetic Biology

Quantum Effects

Generate advances in quantum sciences that will enable revolutionary approaches to information processing, cryptography, information assurance, and communication

Nanotechnology

Discover and create new materials with properties that will revolutionize military technology and make Soldiers less vulnerable to the enemy and environmental threats

Network Science

Research in human-engineered and biologically-evolved networks to improve performance, increase reliability & enhance network-centric mission effectiveness

Neuroscience

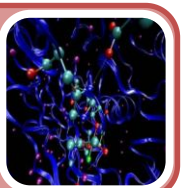
Research in learning, decision models and the functional brain to improve training techniques, human-machine interface design, and to more fully understand the decision-making process

Immersive Technology

Revolutionize military training and mission rehearsal through the development of technology and art for simulation experiences and the development of virtual human technology

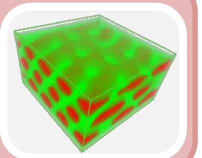
Biotechnology

Research to understand biological construction of novel materials, structures and processes to develop biologically-inspired materials, sensing systems, information processing and power & energy



Materials Modeling

Research to develop fundamental science principles at & across scales and develop underpinning, cross-cutting, and transferrable physics-based modeling capabilities



Autonomous Systems

Discover, develop and exploit robotic devices and systems with highly sophisticated sense, response and processing systems approaching that of biological systems to dramatically enhance Soldier survivability

Strategy: Follow the Path to Become Scientists and Engineers

Science Introduction – Grades K-5
NSC

Competitions and Experiences!

Competition – Grades 6-9
eCybermission, Junior Solar Sprint
Up to $7,500 in savings bonds

Lab Experiences – Grades 6-9
GEMS, Near Peer Mentor
Up to $250 stipend a week!

Competition – Grades 9-12
JSHS, IMO, ISEF
Up to $50,000 in cash & prizes!

Mentor Programs – Grades 9-12
UNITE, REAP, SEAP, HSAP/UAP
Up to $5,000 a summer!

College Programs
SEAP-CQL, WISP, CREST, CRFP, SMART
Full scholarship and up to $45,000 a year!

http://www.usaeop.com

Executing the Strategy

The Current Basis (going in)

OSD FY 2013-17 Priority Areas
- Data to Decisions
- Engineered Resilient Systems
- Cyber S&T
- Electronic Warfare/Protection
- Counter WMD
- Autonomy
- Human Systems

Army S&T Priority Challenges !!!

Army FY 2013-17 Warfighter Outcomes
- Training
- Mission Command
- Power and Energy
- Counter IED and Mine
- Human Dimension

(156 supporting outcomes)

PLUS Unified Quest Data

Operational Experiences from 10 Years of War

ASTAG/ASTWG Process

WORKSHOP

Army FY 2014-18 Army S&T Challenges to Close High Priority Gaps*

- What: Goals , Objectives & Metrics
- When 2-3 year deliverables
- Why : Addresses high priority Army needs or new capability
- Application: Targeted Mission Areas
- Defined Capability Gap: Provides enhanced or new capability

Guidance to S&T Community

Program Building

5-10 Yr Programs 6.1/6.2

planning, vetting, identification of enabling technologies, utility analysis, identification of milestones, timing , and resourcing

Army FY 2014-18 Technology Enabled Capability* Demonstration Programs

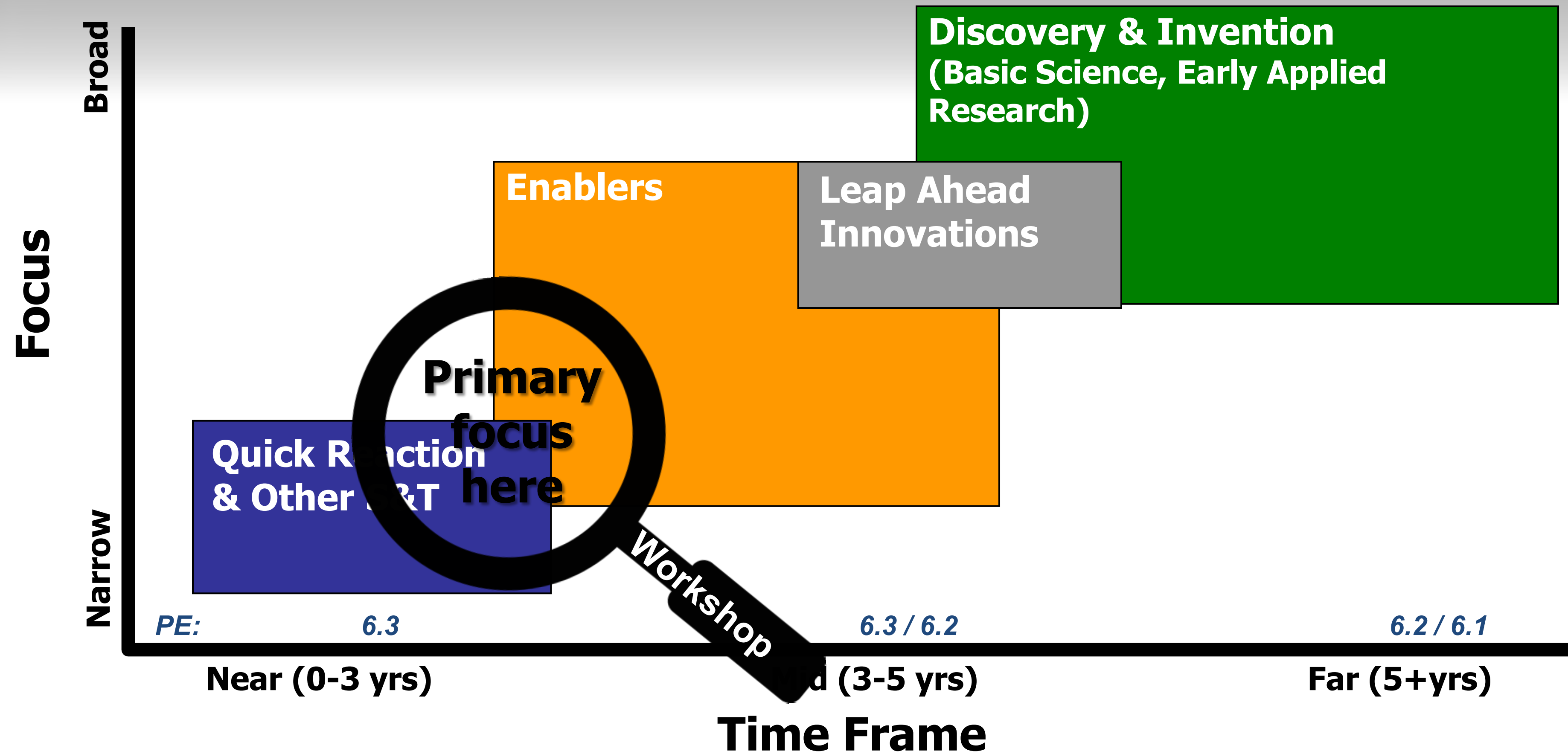
2-3 Yr Programs 6.2/6.3

Workshop focus

*For the first time, the Army will have Senior Leadership buy-in to Army S&T priorities

Big Challenge Action Plan

Balanced S&T Portfolio



Quick Reaction

- Tech Solutions
- Rapid insertions
- Experimentation
- JUON solutions

Enablers

- Applications research for specific military problems
- Tech insertion, integration & transition
- Componeents, subsystems, models,

Leap-Ahead Innovations

- Skunkworks, integrated evaluations, concepts & wargaming
- Innovative alternative generation, assessment, demonstration and evaluation

Discovery & Invention

- Basic & Early Applied Research
- Education Outreach
- Knowledge for uncertain future

Technology-Enabled Capability Demonstrations (TECDs)

- **Definition: A technology or set of technologies that either measurably enhance performance and effectiveness of an existing capability or enable a new and necessary capability for the Warfighter - focus on solving near term challenges that are priorities for the Army**

- **TECD Considerations**
  - **TECDs require collaborative program planning (typically cross-organization)**
  - **TECDs focus on transitioning a capability to meet an agreed upon goal at an agreed upon time**
  - **Failure of a component technology within a TECD does not necessarily equate to TECD failure**
  - **Risk management/mitigation strategies take on a new significance within the S&T community – achieving overall capability goal is key**

In Summary…

- **We are changing the Army S&T business model to be an enduring, sustainable, successful enterprise model**
- **We are aligning our strategic planning to the budget processes so that we are more efficient and able to achieve "top-down" S&T leadership investment focus**
- **We are identifying critical Army problems that we can solve in the near and mid-term, using the best talent and skills wherever they exist**
- **We are enhancing visibility of Army S&T priorities to provide partnering opportunities to jointly solve problems and enhance our Warfighter capabilities**

The better we understand our needs and priorities –
the better able our enterprise will be to give us capability solutions

My Challenge to You

- **Assist us in providing our Soldiers a decisive edge**
- **Engage in the discussions at this conference**
- **Strengthen your partnership with the Army**

You can help define the architecture, concepts, components and technology to enable the Soldier and small combat unit to achieve the capabilities needed in an environment of persistent conflict and full spectrum operations.

Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

ARMY S&T
SCIENCE & TECHNOLOGY

Science and Engineering

Technology Conference/DoD Technology Expo

Jim Smerchansky

Deputy Commander, Systems Engineering, Interoperability, Architectures and Technology (SIAT)

22 June 2011

Our Priorities

Continue to provide the best trained and equipped Marine units in Afghanistan

Rebalance our Corps and posture it for the future

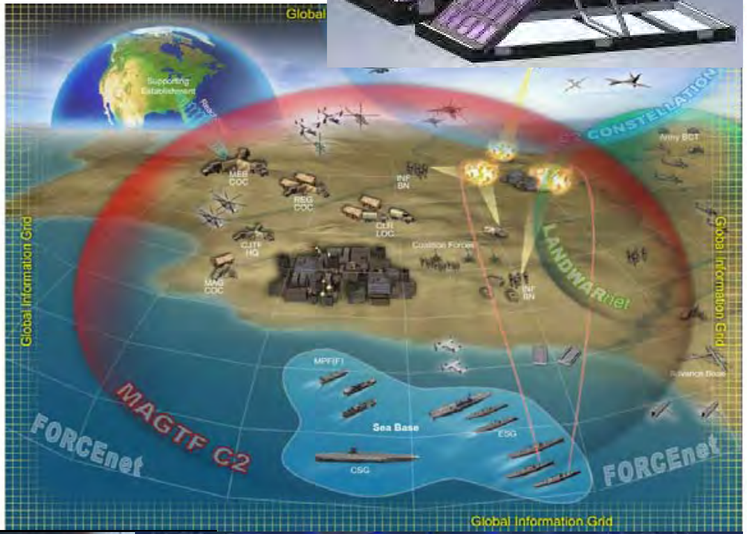
Our Priorities

Better educate and train our Marines to succeed in complex environments

Keep the faith with our Marines, our Sailors, and our families

Technology Needs

- **Energy**
- **Vehicles/Protected Mobility**
- **Lighten the MAGTF**



Energy

Energy

At the Tactical Edge Water is the Problem

Data Source CLB-8 period June 13 – September 11 2009

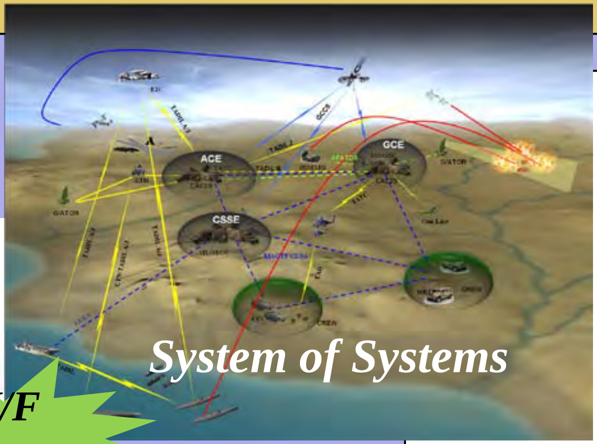
Vehicle Survivability

Vehicle Mobility

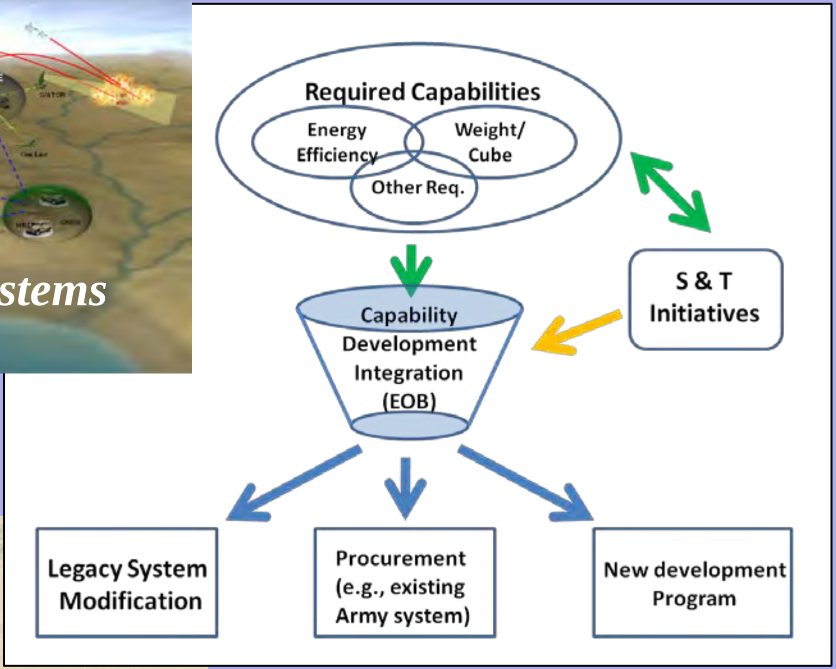
Lighten the MAGTF

"We will rebalance our Corps, posture it for the future and aggressively experiment with and implement new capabilities and organizations."

The Challenge



Affordability / Technology



Capability Solutions

Create the Middleweight MAGTF within Affordability Constraints

UNCLASSIFIED

Issue: Increasing Power Consumers

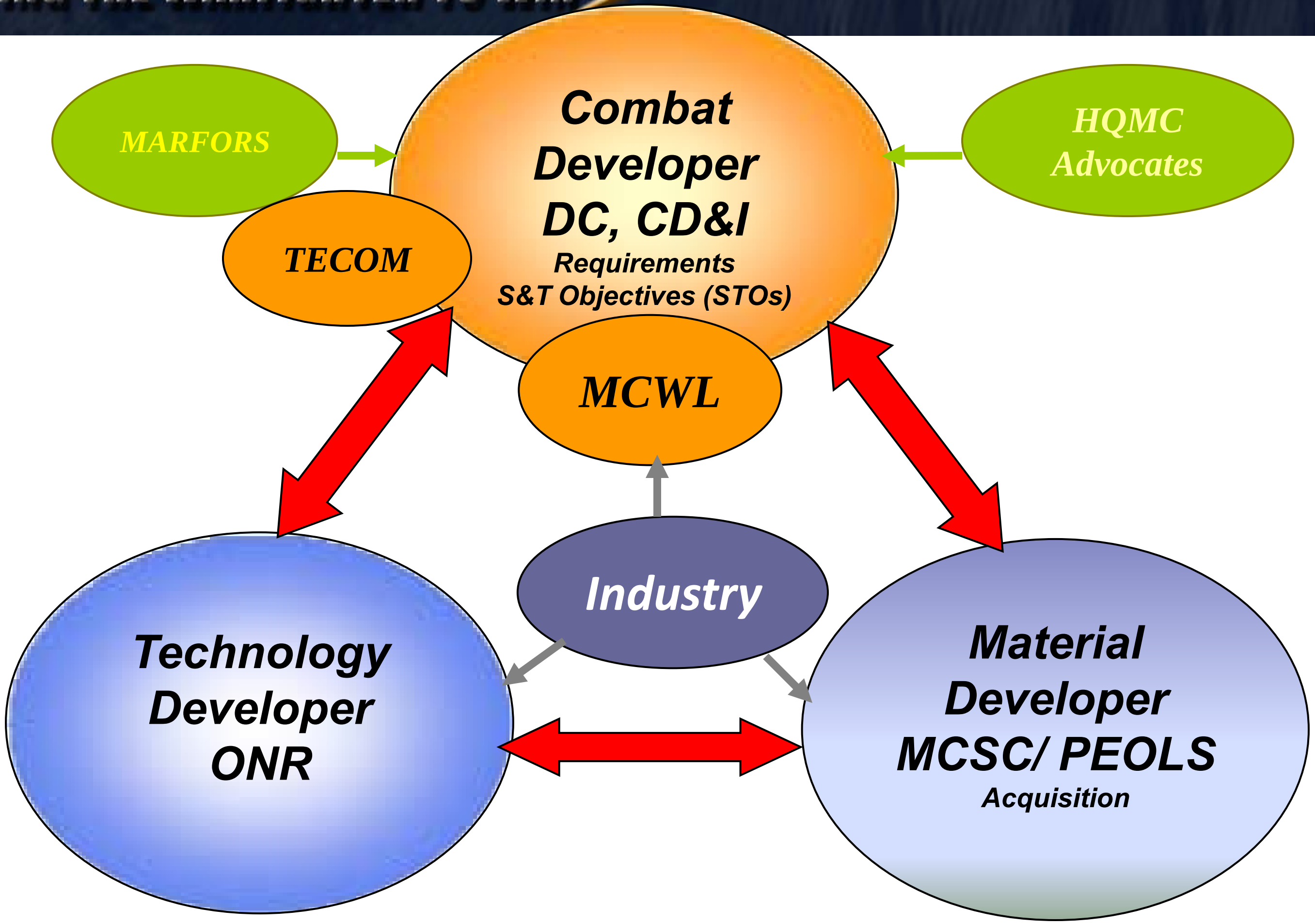
Individual Marine Power Requirements

Dismounted Weight

MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

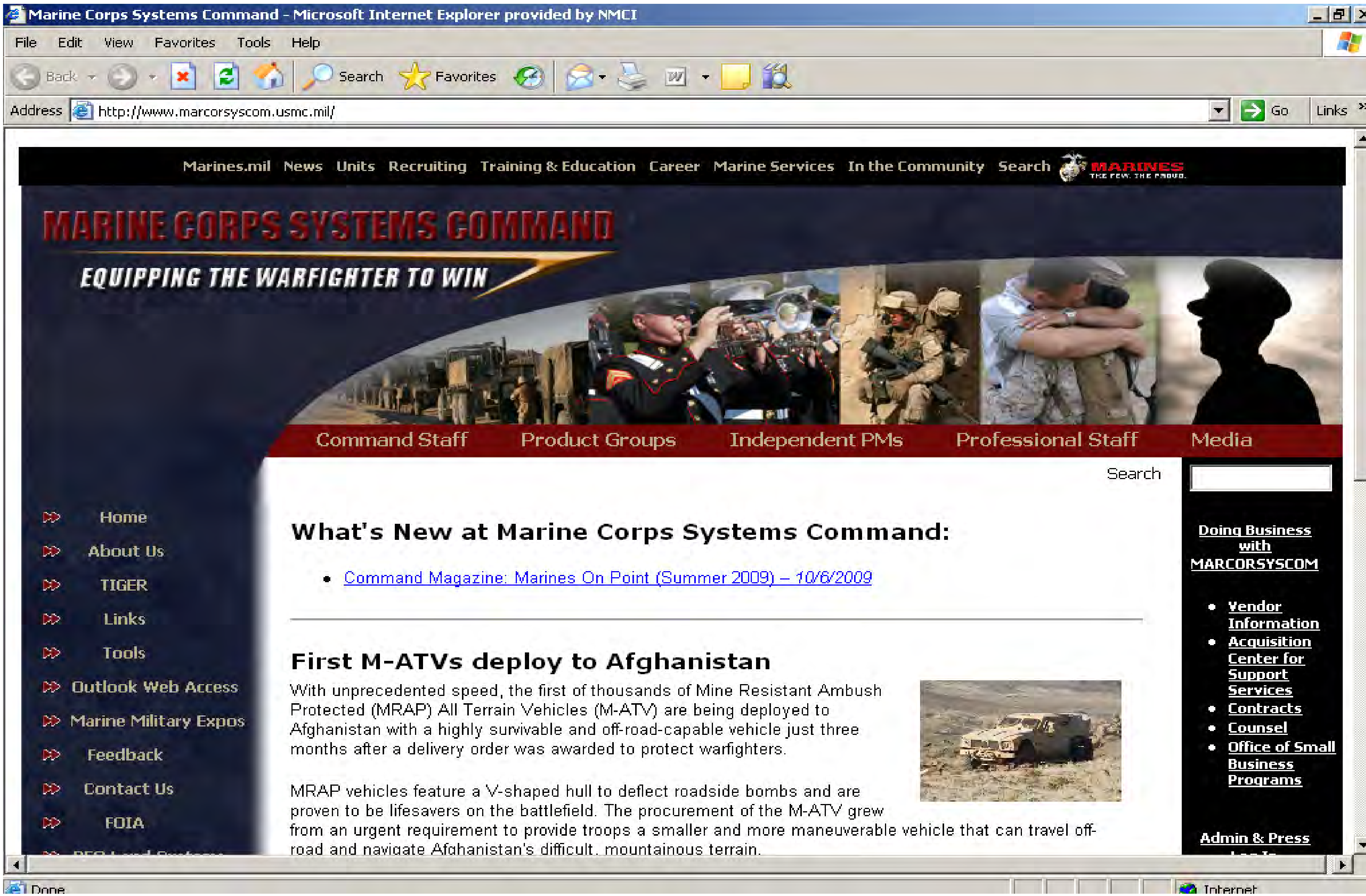
Doing Business with the Marine Corps



http://www.marcorsyscom.usmc.mil

- *POCs*
- *S&T Strategic Plan*
- *Technology Needs*

Doing Business with MCSC



Points of Contact

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- Armored Vehicles & Fire Support Systems (PG14): Bryan Freeman
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- Ground Transportation, Engineer Systems & Electrical Power (PG15): Scott Story William.story@usmc.mil 703-432-3695
- Combat Equipment & Support Systems (PG16): John O'Donnell
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- MCTSSA: Mike O'Neil mike.oneil@usmc.mil 760-725-2502
- Counter IED: Maj Brian Stamps brian.stamps@usmc.mil 703-432-3921

These POCs match technology to Program Needs

"There is little that will sober an enemy more surely than the knowledge that somewhere, just over the horizon, lies a force of well-trained, well-equipped Marines in competently manned ships capable of delivering a stunning amphibious blow at a point and time of their own choosing."

Lieutenant General, Victor Krulak, United States Marine Corps

U.S. European Command Technology Requirements

Stephen L. Spehn, Deputy Science Advisor

23 June 2011

Mission

- Defend the Homeland forward and support U.S. strategic interests
  - Maintain ready forces for global operations
  - Secure strategic access and enable global freedom of action
  - Enhance trans-Atlantic security through support of NATO
  - Promote regional stability
  - Counter terrorism

Building Partner Capacity is essential
to all our efforts

Technology Solutions

- EUCOM needs innovative technology solutions to emerging and persistent security concerns
- These solutions may involve non-traditional partnerships executing on accelerated schedules
- These partnerships will need to include:
  - Government agencies with equities in the problem
  - Prime contractors with success in DoD acquisition
  - Small technology providers that are adaptive and agile
  - A coordinating entity to bring it all together

Technologies of Interest (1 of 8)

- Building Partner Capacity
  - Multi-modal collaboration tools using non-proprietary software that adheres to internationally recognized open standards and is free of ITAR restrictions
  - Cross-language tools that support mixed-mode collaboration
  - Portable, renewable power generation, storage, and distribution to self-configuring grids

Technologies of Interest (2 of 8)

- Information Sharing
  - Cross-domain VTC
  - Dynamic language translation for chat and HTML sites
  - Advanced modeling for decision-support of environmental areas of regional interest
- Socio-Cultural and Regional Awareness
  - Large data-volume collection and visualization capability across all classifications and specified taxonomies, with modeling & simulation to project alternative futures

Technologies of Interest (3 of 8)

- Non-Lethal Weapons (NLW)
  - Halt or disable personnel out to 300 meters
  - Halt or disable
    - Ground vehicles up to 500 meters
    - Surface maritime vessels up to 850 meters
  - Enhance high energy lasers and high powered microwaves to provide NLW capability
    - Smaller size
    - Lower weight
    - Less power

Technologies of Interest (4 of 8)

- Biometrics
  - High-volume, multi-national biometrics matching capability providing firewalled query access to participating nations' biometrics databases with broad category match indications
  - Advanced biometric identification capability to include: facial; voice; iris; and long-distance, high-speed DNA
  - Infrastructure for sharing biometric information

Technologies of Interest (5 of 8)

- Persistent ISR
  - Low cost
  - Small logistics tail
  - Minimal operational manpower
  - Expendable equipment
  - Day/night and all-weather
  - Automated processing
  - In-theater tasking

Technologies of Interest (6 of 8)

- Enhanced Logistics Capabilities
  - Point of Need Delivery
    - Reduced requirements for supporting infrastructure
    - Reduced dependence on foreign oil
  - Hybrid Airships
    - Green efficiency
    - Heavy Lift
    - Avoid logistics choke points
    - Outsized cargo
    - ISR capabilities

Technologies of Interest (7 of 8)

- Cyberspace Domain Awareness
  - Enhanced ability to monitor and influence network operation
  - Increased cyber intelligence, surveillance, and reconnaissance
  - Greater information assurance
  - Reduced reaction time

Technologies of Interest (8 of 8)

- Technology Enablers
  - Low-cost, configurable, multi-purpose small satellites
  - Low-cost small satellite launch platforms
  - Long-life, high-density power storage and management at all levels: from individual soldier through theater
  - Precision location and navigation independent of GPS

Contact

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- Phone: +1.256.961.7095

U.S. SOUTHERN COMMAND

Opportunities, Challenges, and Required Capabilities in the Americas

Ricky O. Stuart
Science & Technology Program Manager

23 June 2011

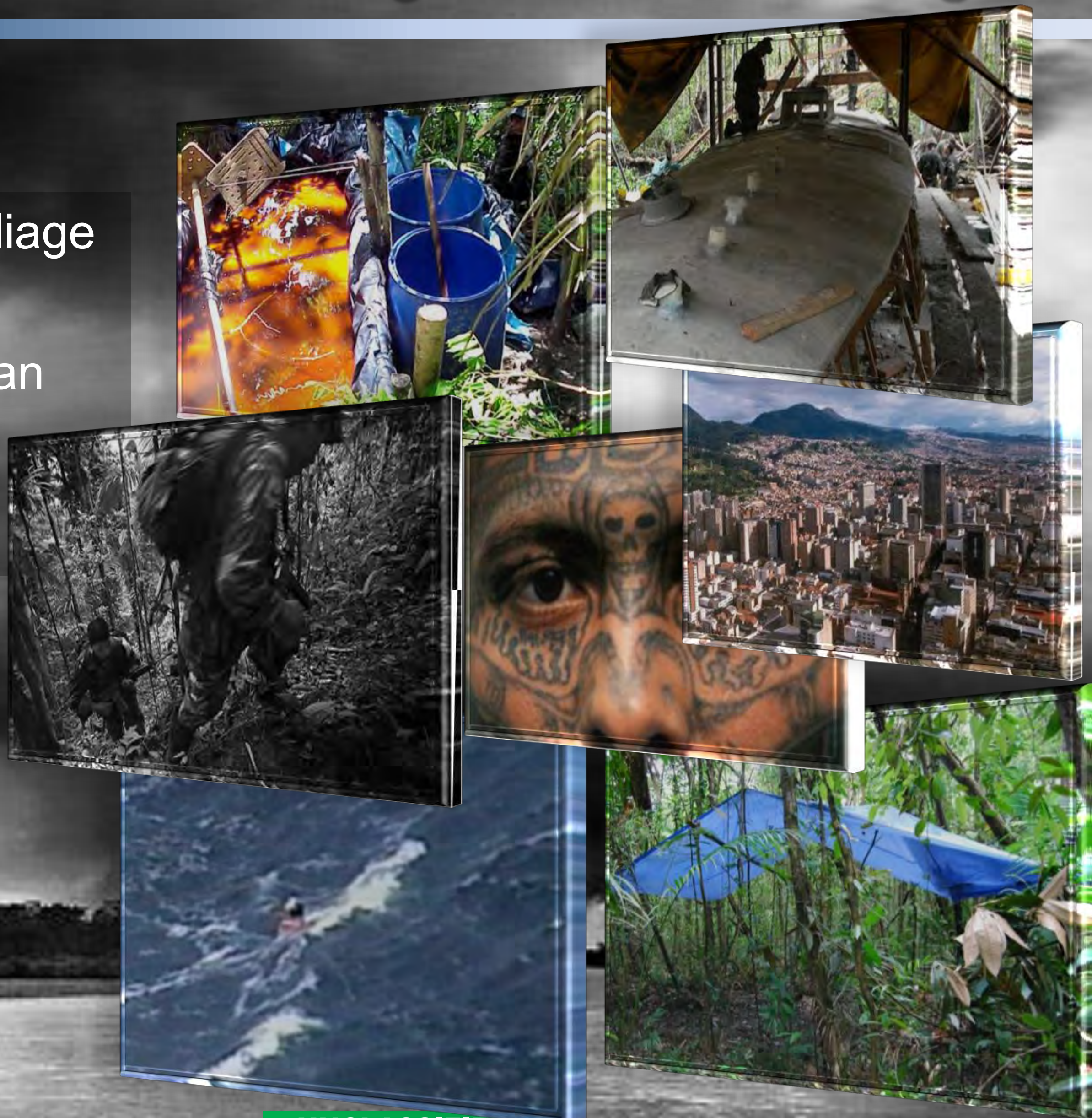
UNITED STATES SOUTHERN COMMAND
PARTNERSHIP FOR THE AMERICAS

Key Missions – S&T Focus

- Countering Illicit Trafficking
- Humanitarian Assistance and Disaster Relief
- Peace Support Operations

Illicit Trafficking – The Challenge

- Dense Jungle Foliage
- Riverine Basin
- Broad Open Ocean
- Littoral Areas
- Urban Centers



Countering Illicit Trafficking: Source Zone

Countering Illicit Trafficking: Transit Zone

- Vast Ocean
- Limited Capacity
- Emerging Targets of Interest

Countering Illicit Trafficking: Transit Zone

- Vast Ocean
- Limited Capacity
- Emerging Targets of Interest

Humanitarian Assistance / Disaster Relief: Supporting Regional First Responders

- Renewable Water and Energy
- Communications
- Situational Awareness
- Logistics

Humanitarian Assistance / Disaster Relief: Supporting Regional First Responders

- Renewable Water and Energy
- Communications
- Situational Awareness
- Logistics

Peace Support Operations

- Information Sharing
- Regional Cooperation
- Interoperability

Discussion

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

Next Generation Space Access

Bruce Thieman

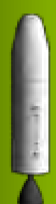
Responsive Space Access Capability Lead & Hypersonics Area Planner

Overview

- **USAF Vision for Assured Space Access**
  - Near Term: Responsive Reusable Booster Stage
  - Far Term: Technology Challenge

AF Responsive Space Access

Expendable Solids & Liquids



Small Launch Vehicle (SLV)

Reusable First Stage

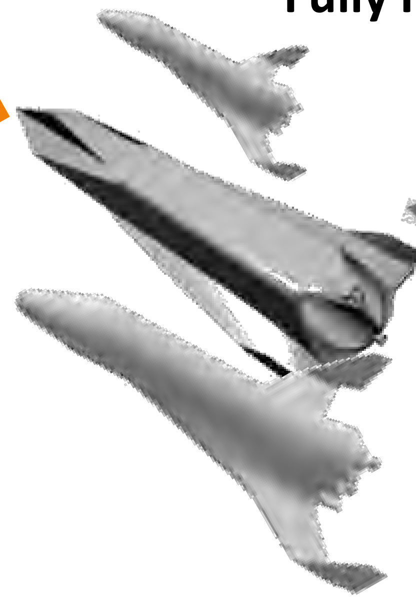
RBS Flagship

Hybrid

Reusable 1st Stage Vertical Takeoff

15K lbs to Low Earth Orbit

Fully Reusable

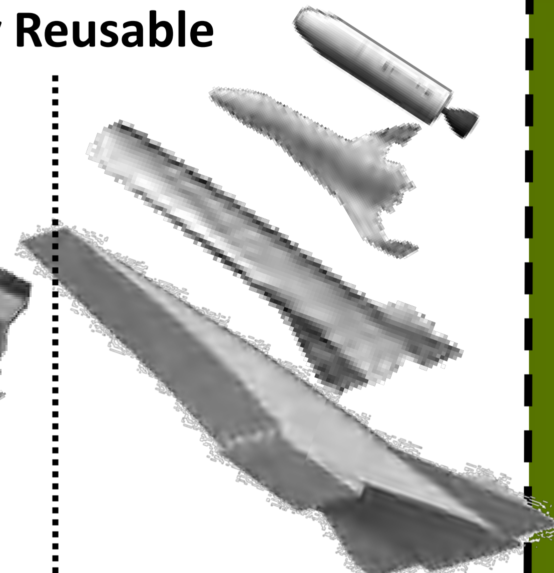


Reusable 2nd Stage

Fully Reusable

Payoff – +40% payload incr.

Ex: Reusable Rocket & Rocket-Scramjet Based Combined Cycle

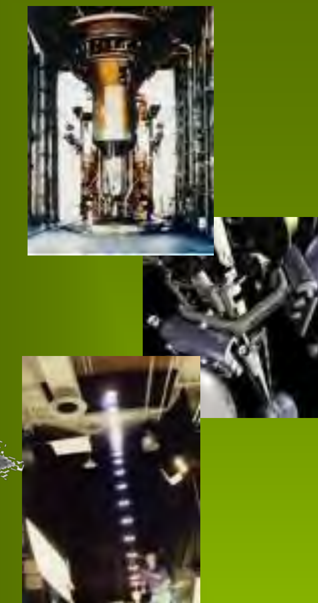


Reusable Horizontal Takeoff 1st Stage

Payoff – Flexible Basing

10K lbs to Low Earth Orbit

Ex: Turbine-Scamjet Based Combined Cycle

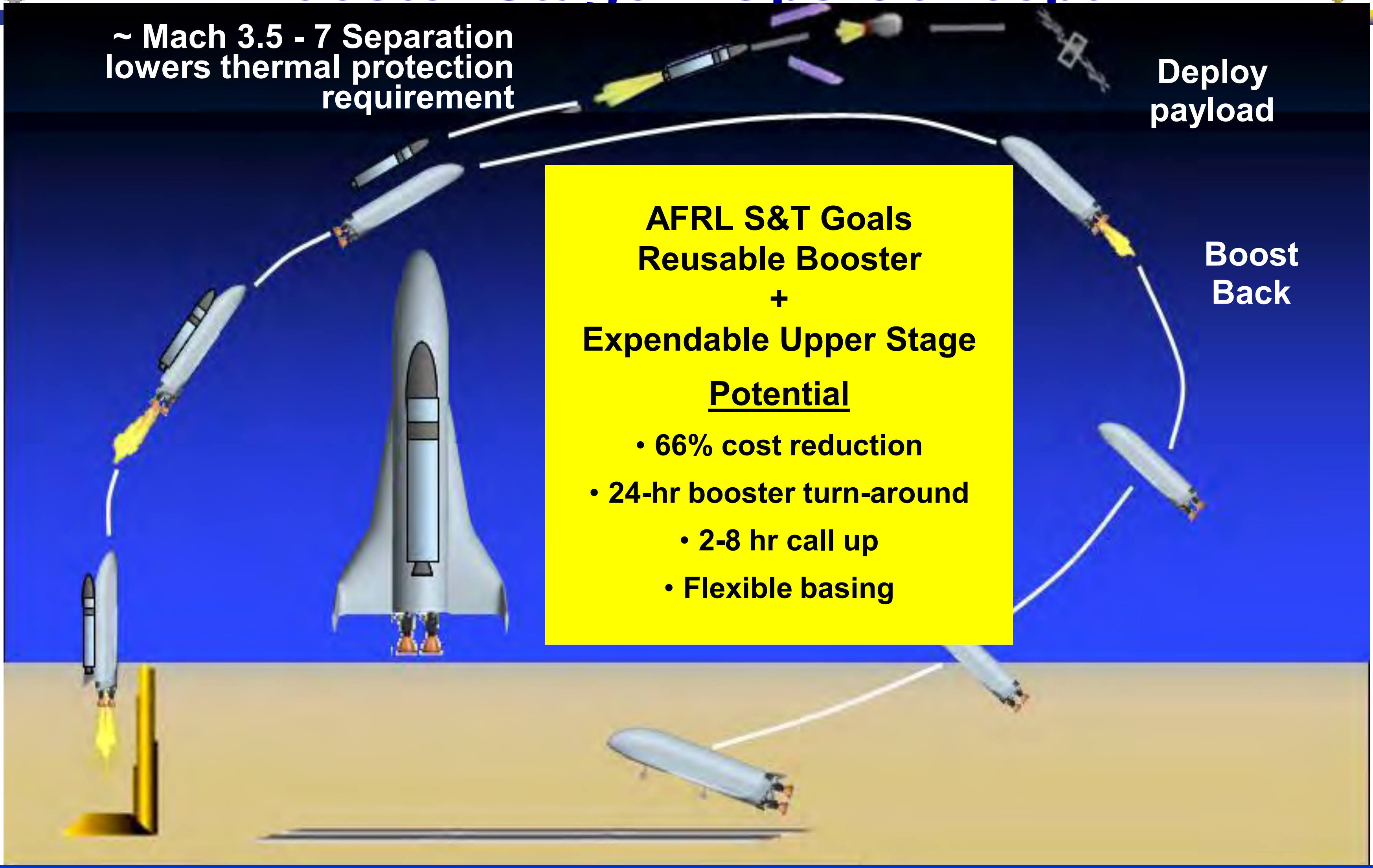


Advanced Concepts

New Paradigms

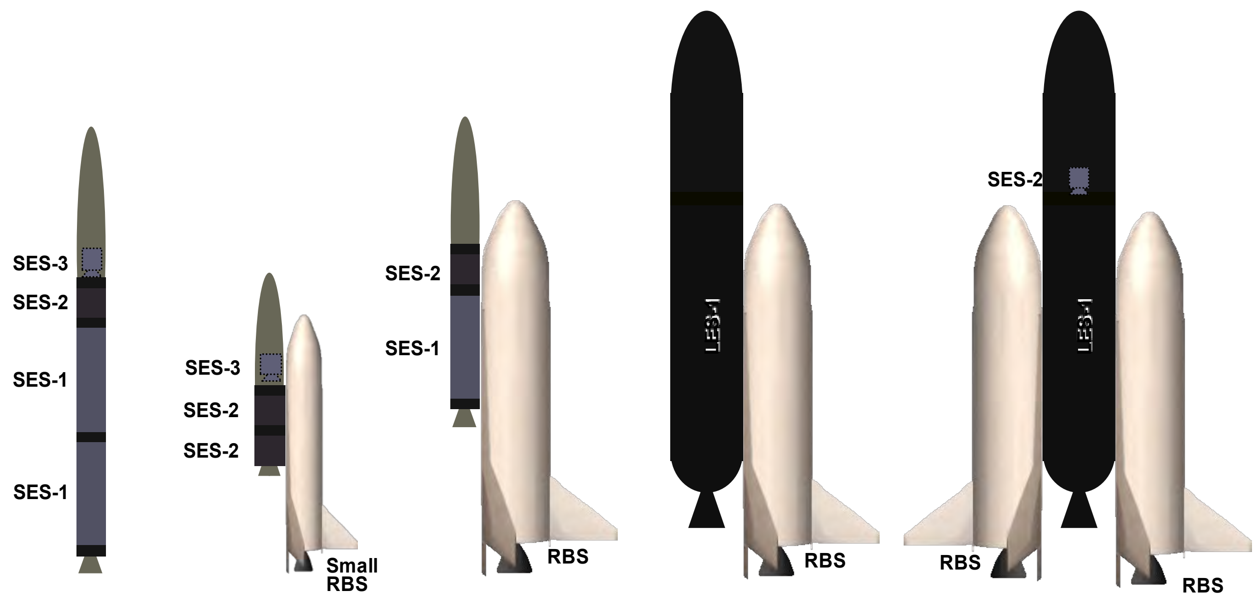
2010	2017 - 2020	~2025	~2030	2035+

RBS: Responsive, Lower Cost Booster Stage – Ops Concept



Concept stretches S&T Gamut of Possible Solutions

Next Generation Launch System
Near Term

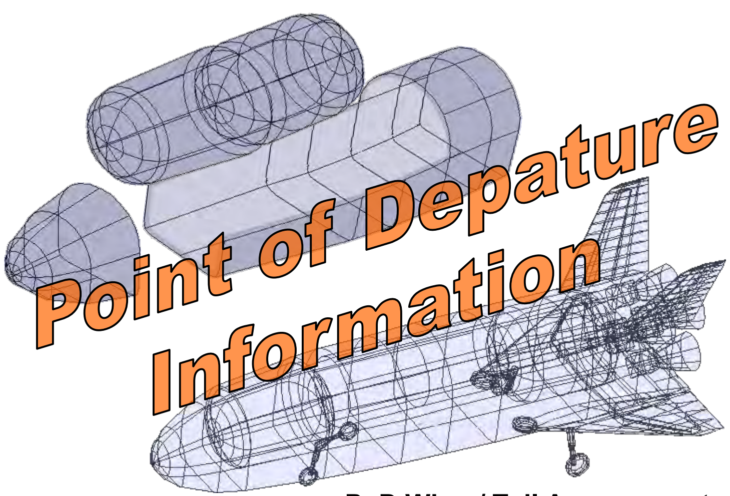


	Small	Small	Med-Lite	Medium	Heavy
Lb to LEO	5,000	5,000	16,500	50,000	64,000
Cost savings	0	~33%	~50%	~50%	~50%
Approx IOC	2015-2020	2019	2025	2025	2030

What is RBS Flagship?
- Built Upon Small and Affordable Experiments -

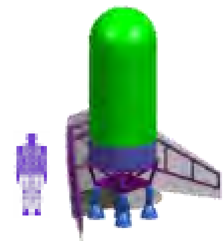
Point of Departure (PoD) Design	
Propulsion	4 Chase-10s
Length	~ 45 ft
GLOW	~ 60K lbm
Dry Weight	~ 16K lbm
Stage PMF Goal	~ 73%

PoD Fuselage Structural Concept



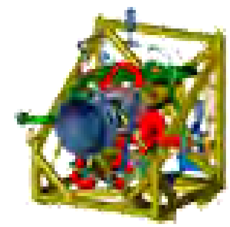
PoD Wing / Tail Arrangement

- **Step 1** – Ground experiments



Airframe Experiment

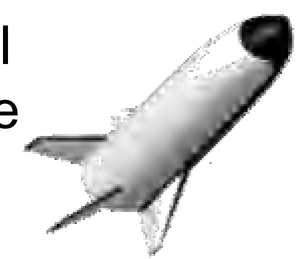
Propulsion Options



Subsystems Experiment(s)

- **Step 2** – Prove Rocketback

- **Step 3** – Incremental flight test of X-vehicle



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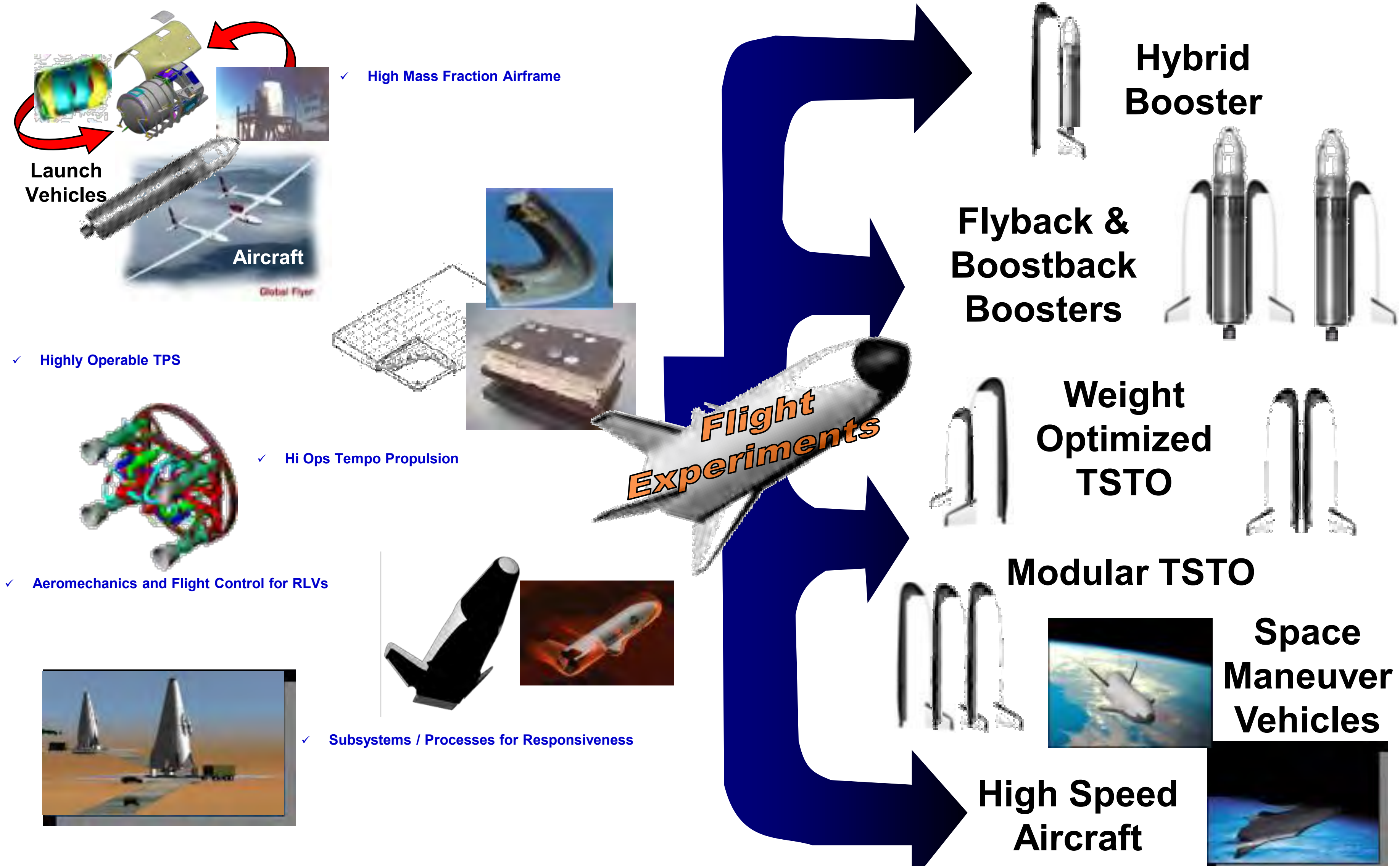
RBD Flight Experiment

- Technology for Multiple Future Flight Systems -



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Broad Spectrum of Technologies for Responsive Space Access

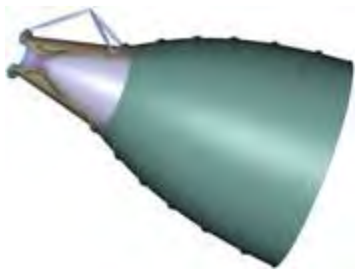
Materials

Propellant Tanks

Leading Edges

Thermal Management

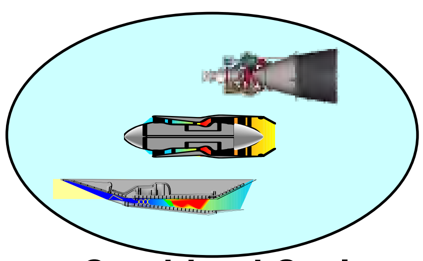
Propulsion



OMS, RCS

HC Boost Engine

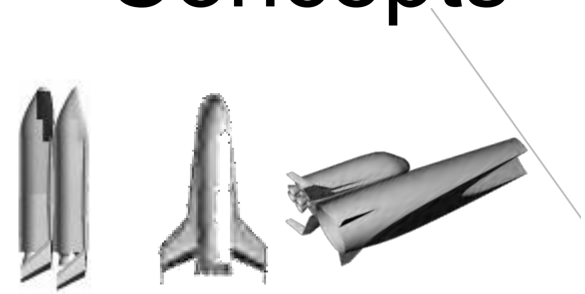
Solids



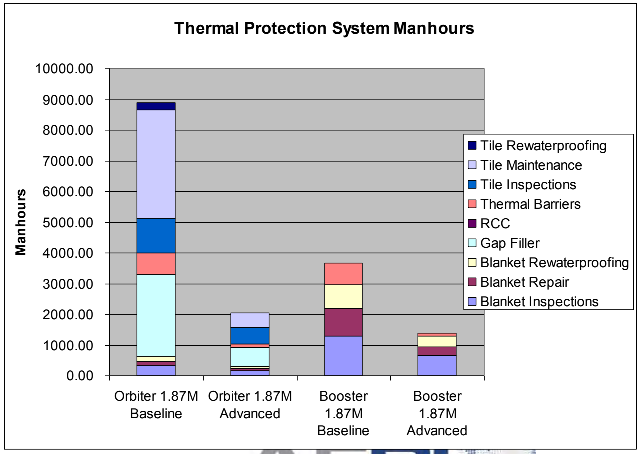
Combined Cycle Engines

Upper Stage Engine

Vehicle Concepts

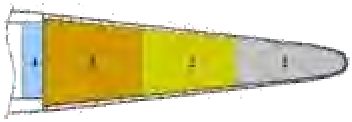


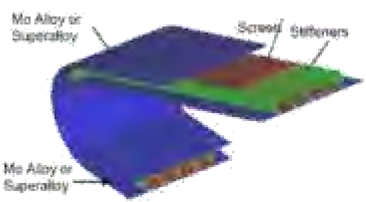
System Trades & Tech Assessment



Broad Spectrum of Technologies for Responsive Space Access

Structures



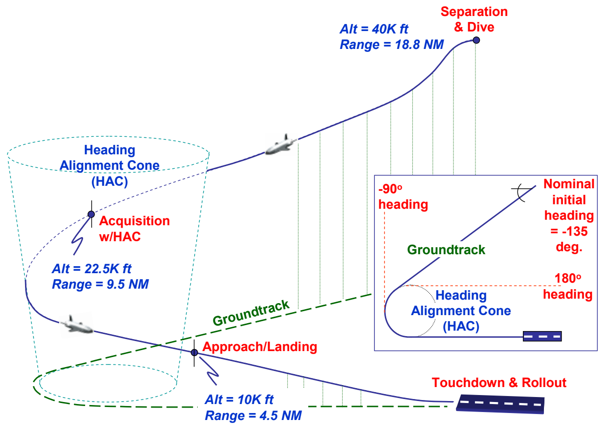


Leading Edges

Hot Structures

TPS

Guidance & Control



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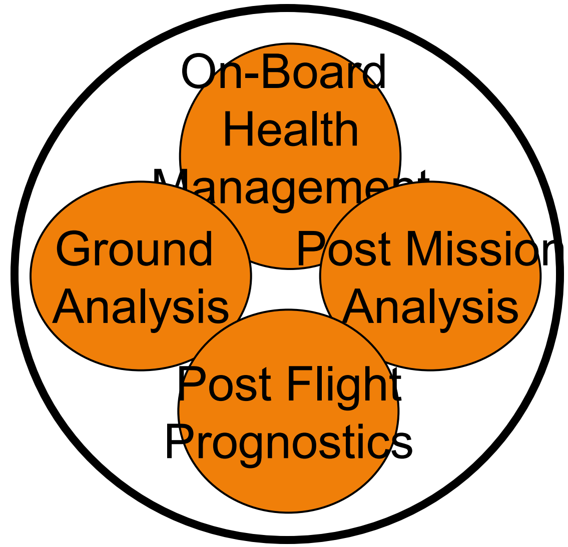
Vehicle Health Management



Architecture & Hardware

RBS Operations

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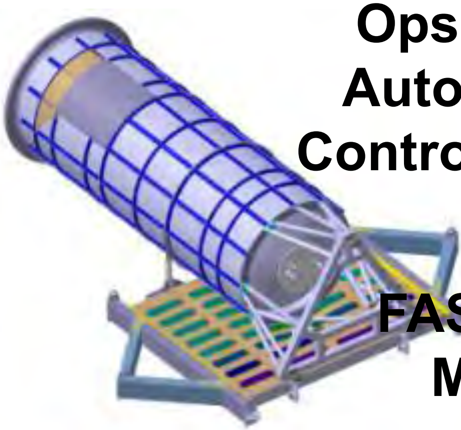
AFRL

RBS Demos

Pathfinder CONOPS and Rockeback flight demo 2014

Rocket Engine Rapid Remove and Replace 2010 & TPS R&R 2011

Ops Control Center, and Autonomous Guidance & Control Ground Experiments 2011



FAST Airframe and Health Management Ground Experiments 2013

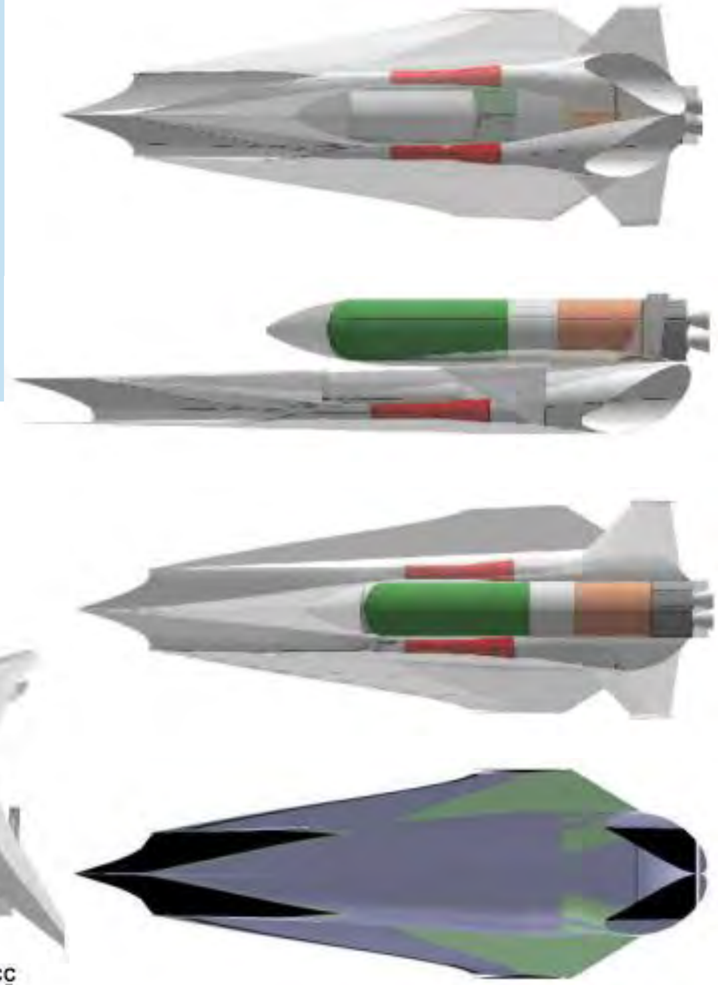
Hydrocarbon Boost 250K lbs thrust Brassboard 2019

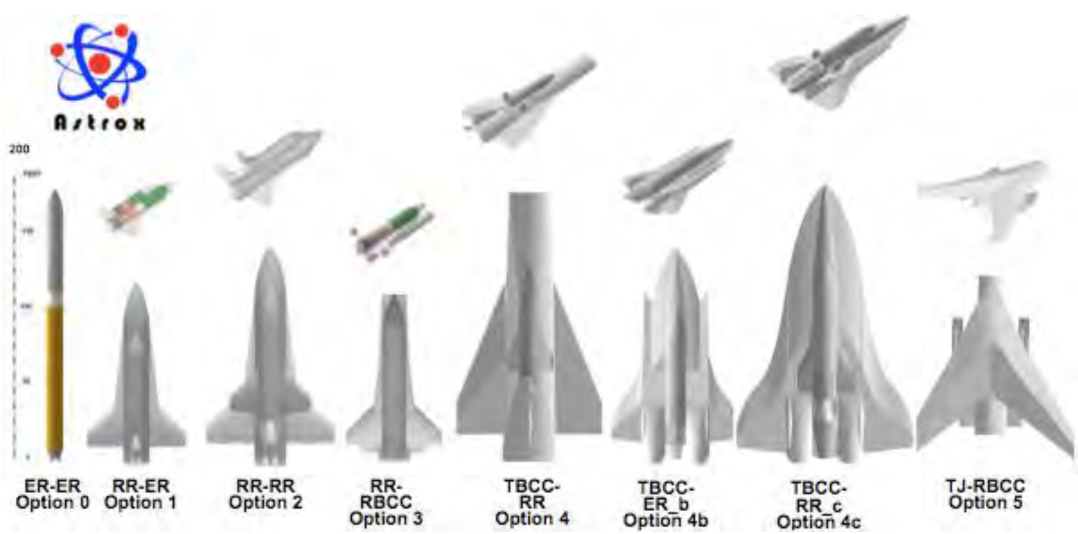
Overview

- **USAF Vision for Assured Space Access**
  - Near Term: Responsive Reusable Booster Stage
  - Far Term: Technology Challenge

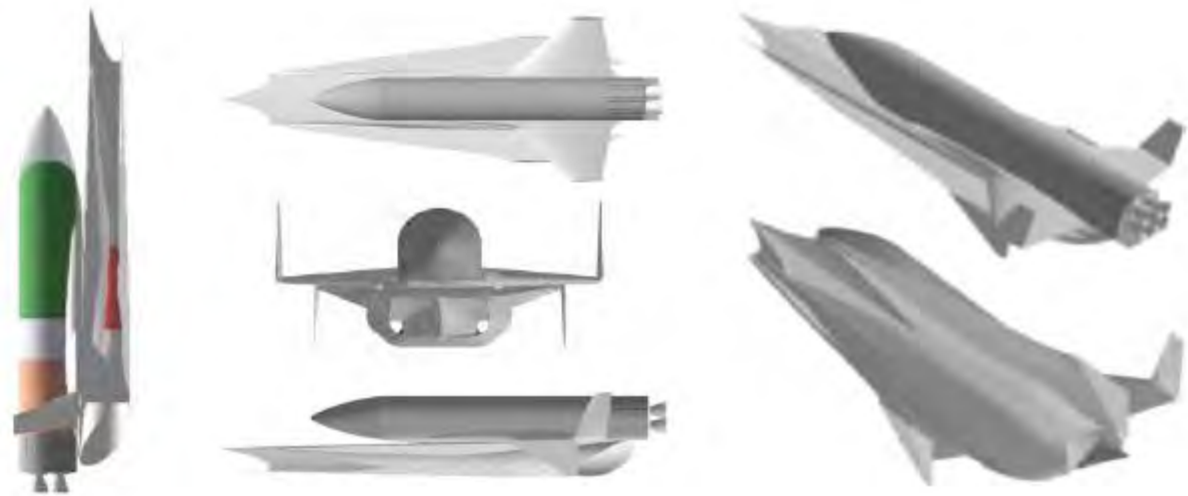
Airbreathing Two-Stage-to-Orbit (TSTO) Access to Space Vehicles

- Airbreathing systems offer enormous advantages for TSTO access-to-space; reusable space access with aircraft-like operations
- Air Force / NASA conducting joint configuration option assessments using Level 1 & 2 analyses
- Reusable rockets (RR), turbine-based (TBCC) and rocket-based (RBCC) combined cycles





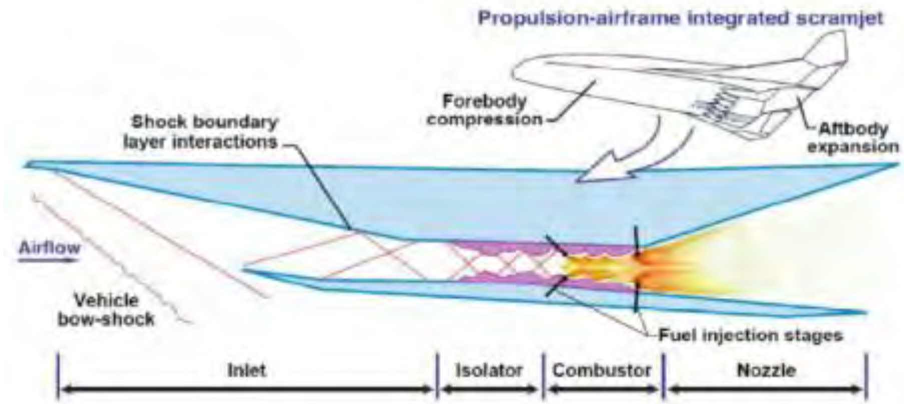
Tech Horizons - 2.26. Reusable Airbreathing Access-to-Space Launch

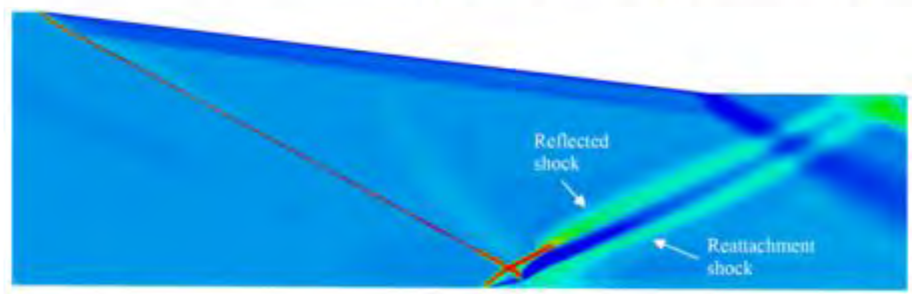


Airbreathing two-stage-to-orbit (TSTO) systems are based on a rocket-based combined-cycle upper stage in which scramjet propulsion eliminates the need to carry a large oxidizer mass, enabling a substantial reduction in the cost per unit mass brought to low Earth orbit.

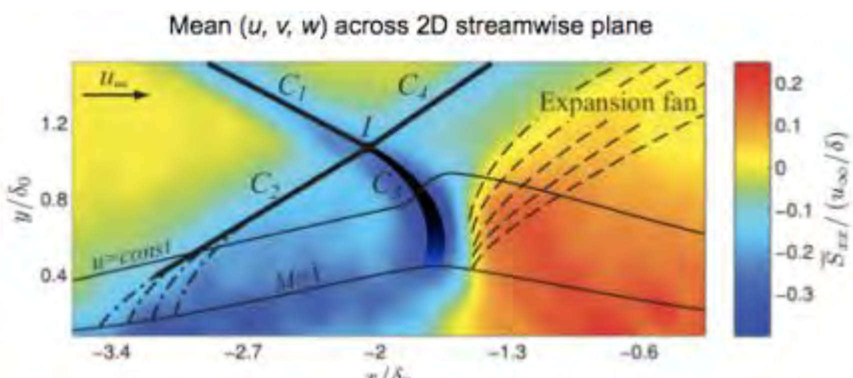
Supersonic Inlets: Shock-Boundary Layer Interaction (SBLI) Control

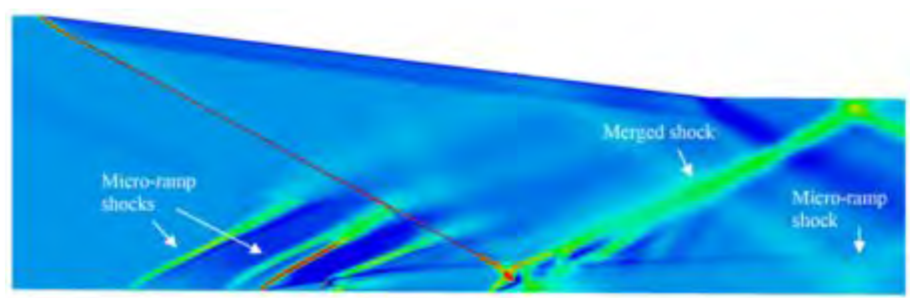
- Bleedless mixed-compression inlets need methods to avoid BL separation
- Maximize inlet pressure recovery
- Shock-boundary layer interaction (SBLI) can trigger separation at or after shocks
- AFRL using experiments and numerical simulations to develop suitable control
- Passive sub-boundary layer vortex generator micro-ramps
- Alternative passive control elements





Simulations of passive control of shock-boundary layer interaction control using micro-ramps (Galbraith et al. 2009)

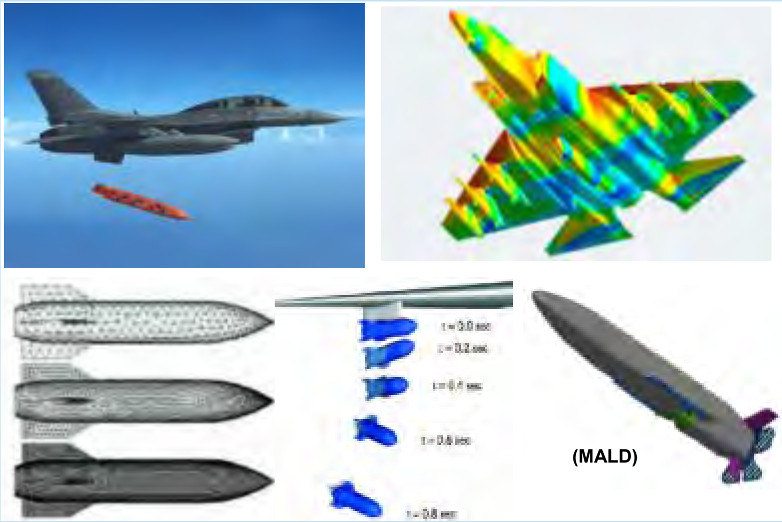




Computational Modeling & Simulation (M&S) to Support Air Force Needs

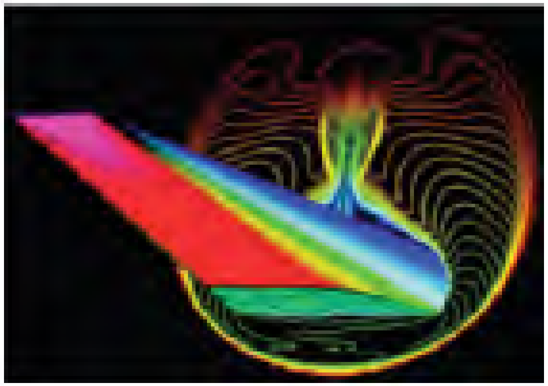
- Properly integrated M&S can give large reductions in cost of physical testing
- Continued improvements needed in CFD methods (incl. numerics and physics)
- E.g., USAF RBS use of CFD to assess payload separation
- 6-DOF time-accurate trajectory codes using dynamic offset grids
- Platform/staging configurations exceed what can be tested directly

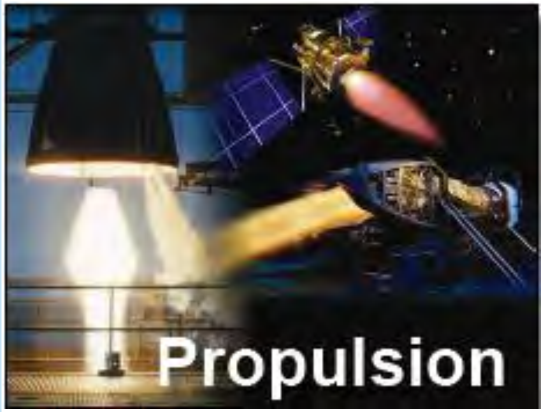
Computational aeromechanics support to Air Force aircraft/stores compatibility and weapons integration



Responsive and Reusable Booster Stage & Two-Stage-to-Orbit Payload Separation

Hypersonic Aerothermal Laminar and Turbulent Flow

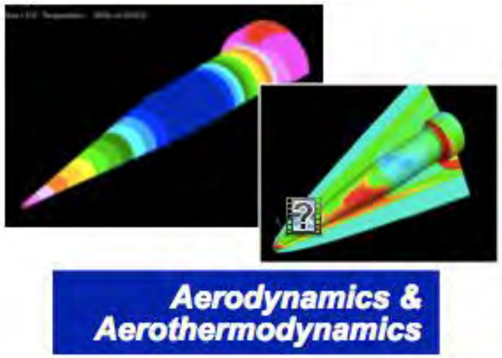


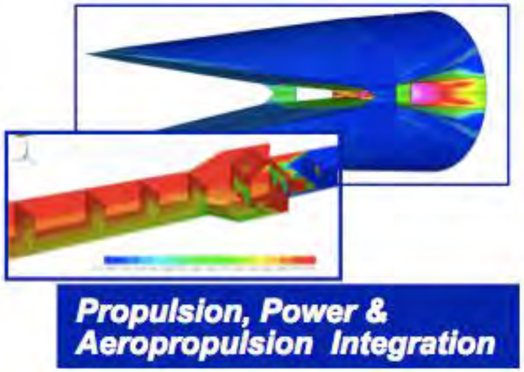


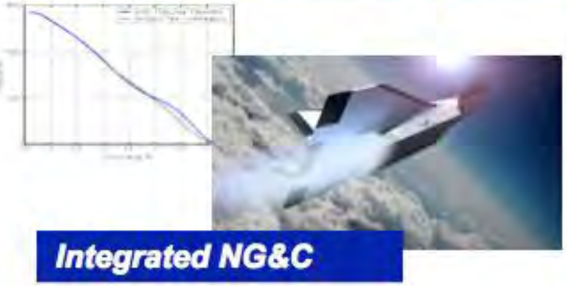
Supersonic & Hypersonic Flowpaths

Hypersonic International Flight Research and Experimentation (HIFiRE) Program

- HIFiRE flights use sounding rocket descent trajectories to explore fundamental hypersonics technologies
- AFRL and Australian DSTO with NASA; rocket flights at Woomera, White Sands, and Pacific Missile Range
- Primary focus on aerosciences and propulsion areas; also stability & control and sensors & instrumentation
- Propulsion experiments on Flights 2 (US), 3 (AUS), and 6-9 (US/AUS)
- Scramjet fueling/combustion, integration, performance

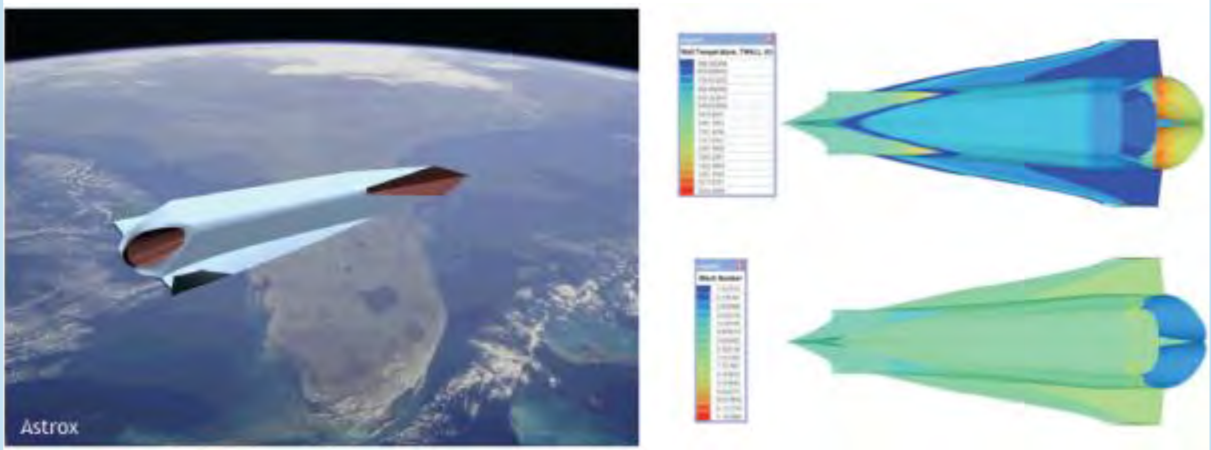






Hypersonic Global ISR Vehicles

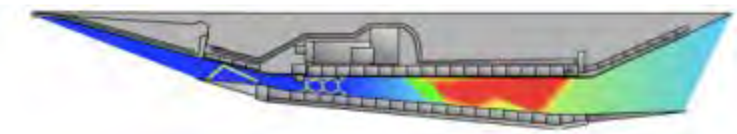
- JP-fueled scramjet propulsion system could potentially enable a medium-size rapid-response ISR vehicle having operationally relevant range capability
- Mach 6 limit avoids complex thermal management penalties at higher Mach
- Vertical takeoff / horizontal landing (VTHL) enables single-stage rocket-based combined-cycle (RBCC) system having 5000 nmi range with 2000 lbs payload
- Integral rocket boost to Mach 3.5 with ram-scram acceleration to Mach 6
- Resulting notional vehicle is 80 ft long with 42,000 lbs empty weight

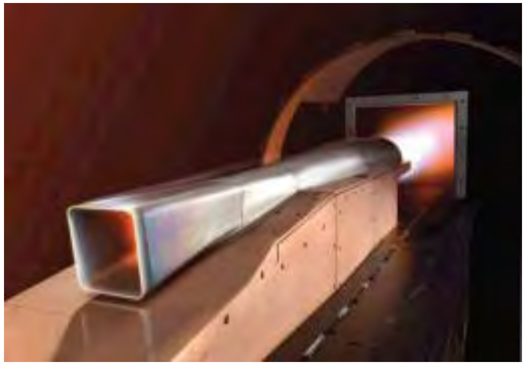


Notional Mach 6 single-stage reusable VTHL ISR vehicle with 5000 nmi range (Astrox)

Scramjet Engine Development

- Hydrocarbon-fueled dual-mode ram/scramjet combustor allows operation over Mach range
- Thermal management, ignition, flameholding
- GDE-1 was flight weight hydrocarbon fuelcooled but with open-loop fuel system
- GDE-2 was closed-loop hydrocarbon fuelcooled system intended for NASA X-43C
- SJX61-1,2 were closed-loop HC fuel-cooled development/clearance engines for X-51A





Ground Demo Engine (GDE-2)

SJX61-1 Development Engine

SJX61-2 Flight Clearance Engine

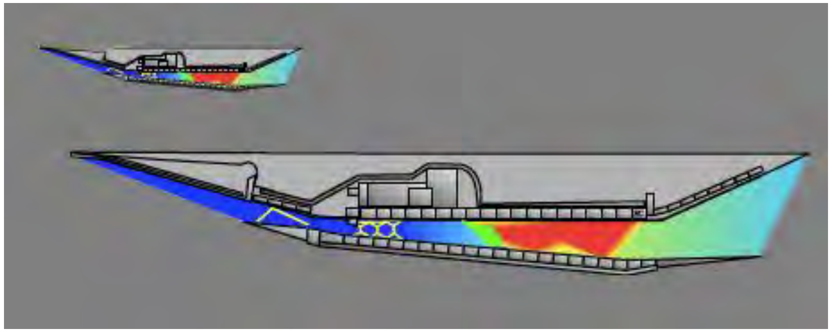
Supersonic Propulsion Integration: Combined-Cycle Scramjet Systems

AEDC APTU tests under FaCET of common turbo-ramjet/scramjet flowpath

Robust Scramjet Scale-Up Program

X-51A uses small-scale combustor

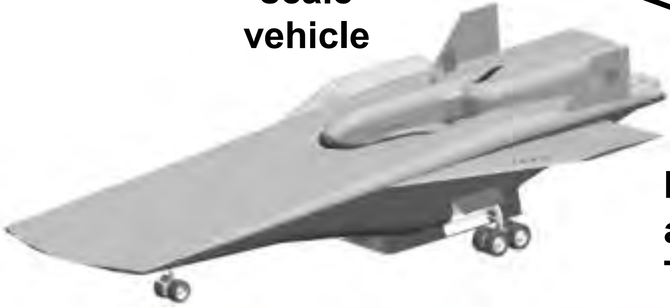
Possible follow-on flights to test navigation and inert strike on target



AFRL Robust Scramjet program

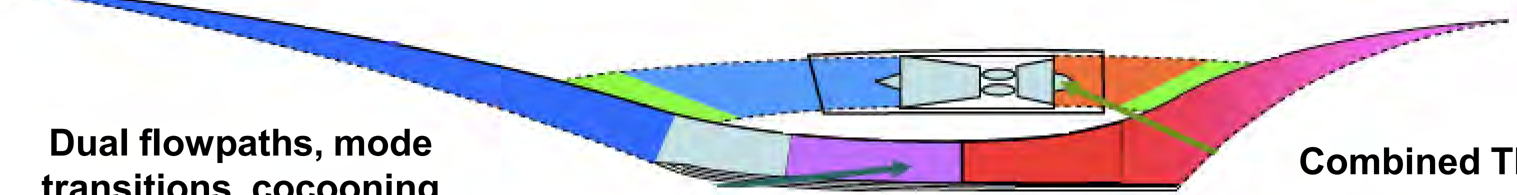
Scale-up and combustor reconfiguration for 3X, 10X, 100X scales?

Large-scale vehicle



Possible ISR or global strike vehicle

Potential step to a future airbreathing TSTO access-to-space system



Dual flowpaths, mode transitions, cocooning

Combined TBCC nozzle

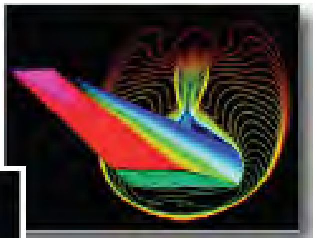
Vision…

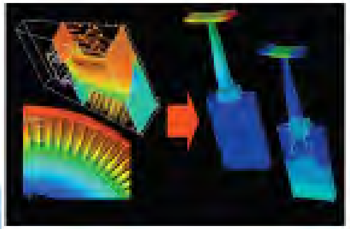
A 21st Century of
Diverse, Routine, Reliable & Affordable Space Access!

BACKUPS

Supporting Technology Directorates for Responsive Space Access

Aerothermal Dynamics

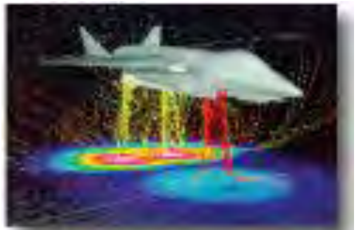




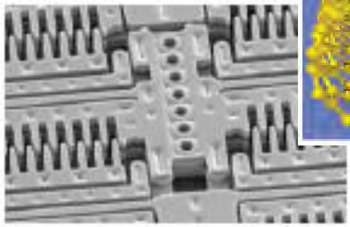
Advanced Hypersonics

Perpetual Simulation

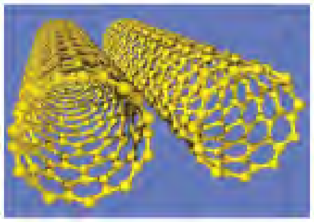
Unmanned Systems



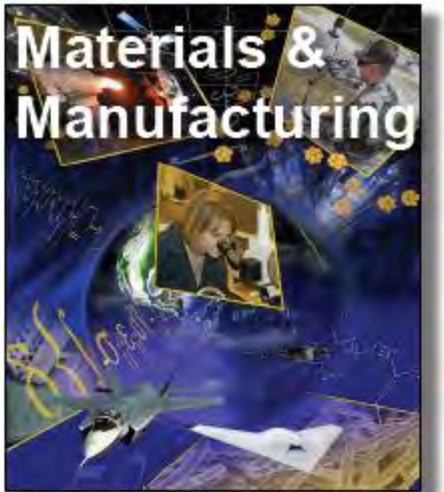
Computational Simulation



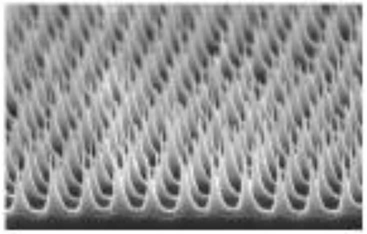
Micro-Mechatronics



Nano-tailored Materials



Man-as-machine systems



Nanostructured Surfaces

United States Strategic Command

Mr. David W. Tyner

Capability and Resource Integration Directorate – J8

23 June 2011

UNCLASSIFIED

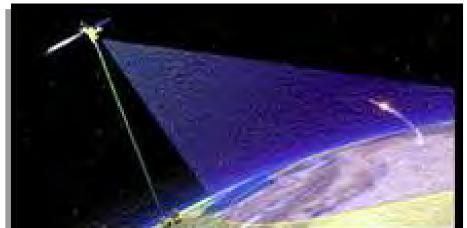
USSTRATCOM Responsibilities

Plan and Execute

- Strategic Deterrence & Nuclear Operations
- Space
- Cyberspace
- Global Strike
- Combating WMD

Plan, Integrate & Synchronize

- Missile Defense
- Intelligence, Surveillance, & Reconnaissance
- Information Operations



Geographically Distributed Component Commanders

Component and Task Force Structure

HQ USSTRATCOM

Service Components

Components

- *JFCC GS* (Global Strike) Offutt AFB, NE
- *JFCC SPACE* (Space Ops) Vandenberg AFB, CA
- *USCYBERCOM* (Cyber Ops) Fort Meade, MD
- *JIOWC* (Info Ops) Lackland AFB, TX
- *JFCC ISR* (Intel, Surveillance & Recon) Bolling AFB, DC
- *JFCC IMD* (Missile Defense) Schriever AFB, CO
- *SCC WMD* (Combating WMD) Fort Belvoir, VA

Nuclear Task Forces

- *ICBMs* TF 214 E Warren AFB, WY
- *Bombers* TF 204 Barksdale AFB, LA
- *Tankers* TF 294 Scott AFB, IL
- *TACAMO* TF 124 Tinker AFB, OK
- *PAC SUBS* TF 134 Pearl Harbor, HI
- *LANT SUBS* TF 144 Norfolk, VA

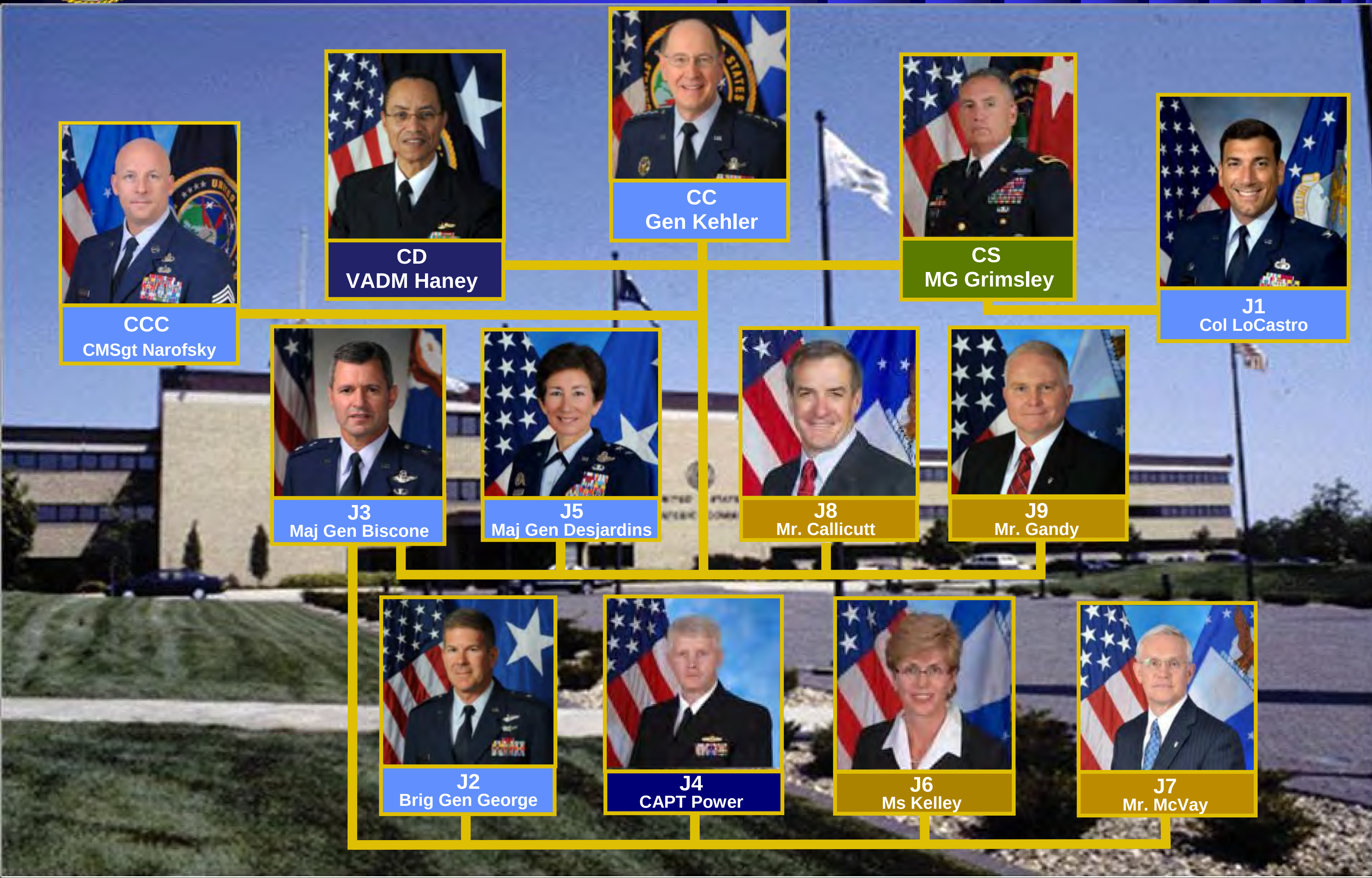
How We Are Organized

USSTRATCOM Task Forces

- **Aerial Refueling/Tankers (TF 294)**
  - USAF refueling aircraft enhance Command's capability to conduct global combat and reconnaissance operations
- **Airborne Communications (TF 124)**
  - Navy E-6B aircraft provide a survivable communications link between national decision makers and the nation's strategic forces
- **Ballistic Missile Submarines (TFs 134/144)**
  - Navy ballistic missile submarines provide launch capability from around the globe--most survivable leg of US strategic forces
- **Strategic Bomber & Reconnaissance Aircraft (TF 204)**
  - USAF aircraft deploy globally to project air power and support Command's reconnaissance mission
- **Land-Based ICBMs (TF 214)**
  - USAF ICBMs, dispersed in hardened silos, provide a quick-reacting and highly reliable component of US strategic forces

Task Forces Enable Command Mission Execution

Headquarters Organization



USSTRATCOM Operations/Activities Snapshot

Strategic Deterrence/Nuclear Ops

24x7 Deterrence Operations

Nuclear Enterprise Leadership

Nuclear Command & Control

Space Operations

SSA Ops: Tracking 22,000+ Objects

Conjunction Analysis: 1,100 Satellites

20+ SSA Sharing Agreements

Monitoring Space Weather

Cyberspace Operations

Operation BUCKSHOT YANKEE

Defense of the GIG

Cyber Ops As Directed

Missile Defense

Synchronize Global MD Planning

Coordinate Global MD Asset Management

TD-2 Launches: Support GCCs

Surveillance & Reconnaissance

Global Force Management of ISR Assets

Support to GCCs

Information Operations

Training Support to GCCs

Support to Other COCOM Ops

Combating WMD

Synchronize Global CWMD Planning (Global Sync Conf)

Establishing SJFHQ-E of WMD

Cross Mission Area

Support to PACOM: Operation TOMODACHI

Support to AFRICOM: Operation ODYSSEY DAWN

Support to CENTCOM: STRATCOM Forward Integration Teams (SFIT)

Operation BURNT FROST

Exercises & Training

GLOBAL THUNDER

AUSTERE CHALLENGE (EUCOM)

GLOBAL LIGHTNING

BULWARK DEFENDER

Integrated Trans-Regional Operations: Supporting & Supported

Process to Monitor New & Emerging Technologies

S&T Enterprise Management Board

S&T Outreach Process Goals

- **Identify relevant new technologies earlier**
  - Keep abreast of emerging Blue/Red Team technologies
  - Socialize new technologies throughout Command
- **Inform Labs of USSTRATCOM mission needs**
  - Current Operations & Projected Capability Gaps
  - “National Labs” → DoD Labs, FFRDCs/DOE Labs, UARCs, Defense Research Agencies (e.g., DARPA)
- **Leverage existing Command-Lab relationships; forge new ones**
- **Implement S&T Battle Rhythm around S&T IPL Process**

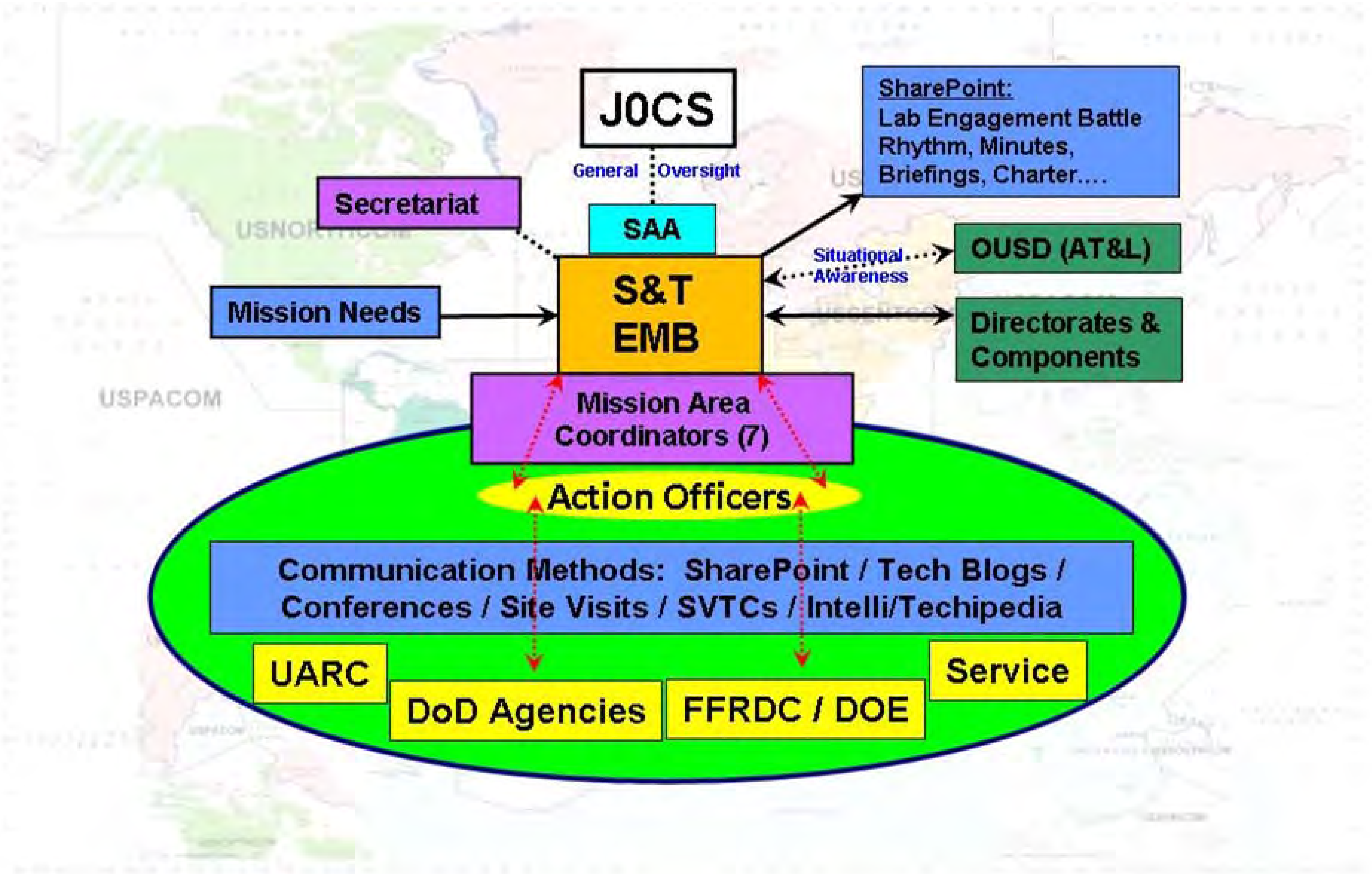
Become USSTRATCOM’s “One-Stop” S&T Venue

S&T Outreach Process Overview

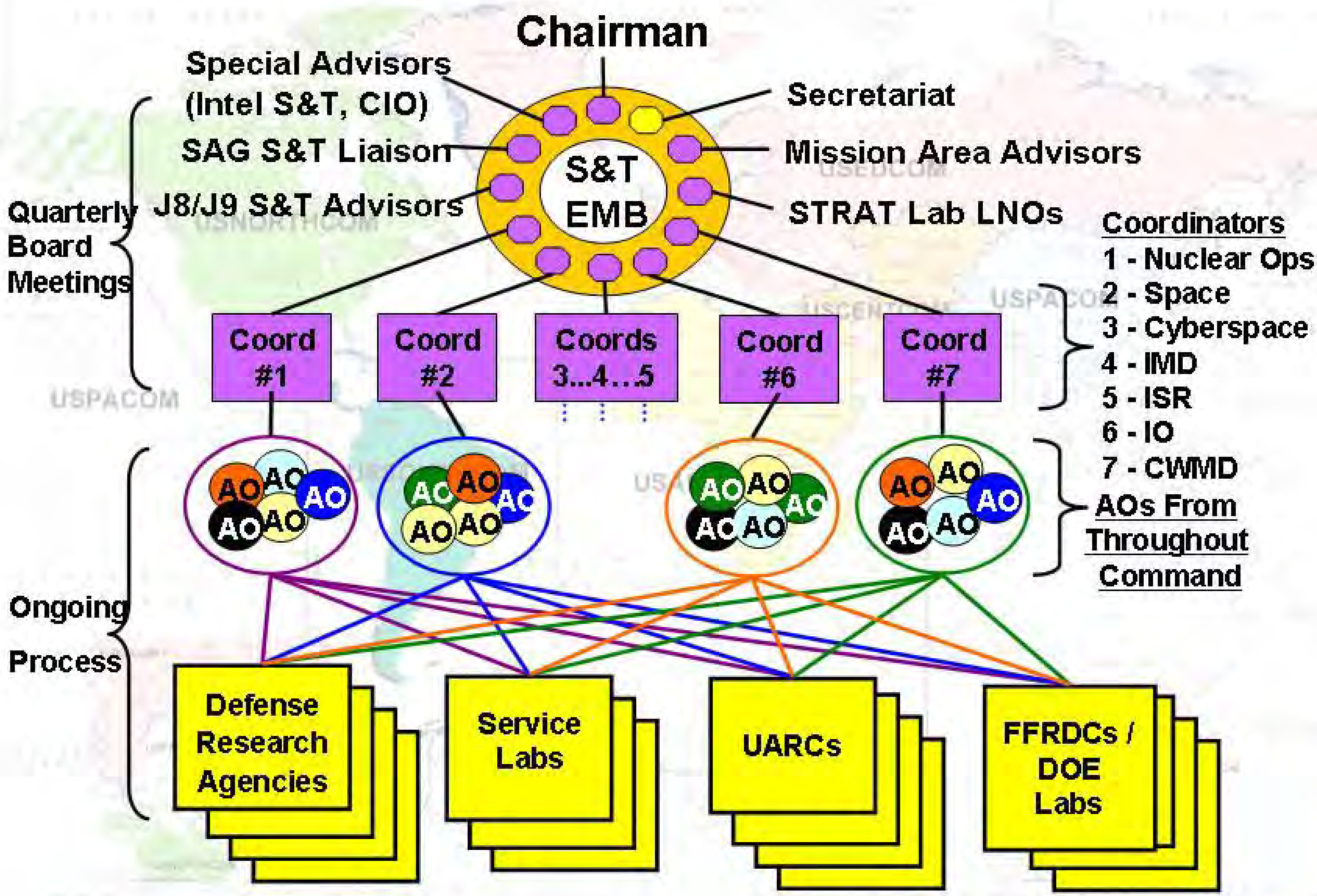
- **S&T Enterprise Management Board (EMB)**
  - Chaired by Senior Analytic Advisor, assisted by Secretariat
  - Formalized with a Charter
  - Comprised of Coordinators Aligned With 7 Mission Areas
    - Nuclear, Space, Cyber, CWMD, IMD, IO, ISR
  - Other Members: SAG/Lab LNOs, S&T Reps, Special Advisors
- **Coordinators / AOs / LNOs**
  - Coordinators act as information brokers between AOs/EMB
  - AOs interface with Labs as requested by EMB or directed by J-Directorates/Components
  - Lab LNOs/Advisors facilitate communication and support EMB

Command-Wide Participation in S&T Process

S&T Outreach Process Scope



S&T Outreach Process Coordination



S&T Outreach Process Deliverables

Gap: No formal Command process to monitor relevant new technologies at the Labs

- **Through a Lab Engagement Strategy, the S&T EMB will:**
  - Regularly <u>collect new technology</u> developments from the Labs
  - Forge new opportunities to <u>convey mission needs</u> to the Labs
- **S&T EMB Deliverables**
  - ***<u>Technology Updates</u>*** – Disseminated throughout Command
  - ***<u>S&T IPL Recommendations</u>*** – Input to OSD/AT&L
  - ***<u>Annotated Mission Area Interest List (MAIL)</u>*** – Feedback to S&T Community

Link new technologies with Command Mission Needs

S&T / Experimentation Branch

Branch Chief: Mr. Chuck Hutchison (402) 232-5347

- **S&T Team**
  - Dr. Mark Brown (402) 232-4114
  - Mr. Eric Dernovish 294-0447
  - Mr. David Beberwyk 294-5472
  - Mr. Brian Liesveld 232-1422
  - Mr. Tim Fowler 232-1421
- **Experimentation Team**
  - Mr. Bill Delaney (402) 294-7650
  - Mr. Monty Hoskinson 232-9872
  - Mr. Ray Varney 294-7523
  - Mr. Brian Shook 232-8617

Command-Wide Participation in S&T Process

United States Strategic Command

Questions?

USSTRATCOM Operations/Activities 2008-2011

Operation BURNT FROST: Intercepted inop NRO satellite

Operation BUCKSHOT YANKEE: Response to 2008 cyber attack

Taepo-Dong 2 Launch: Response to N. Korea missile tests

<u>Recurring Events:</u>

GLOBAL THUNDER: Exercise focused on nuclear command and control, mission execution

AUSTERE CHALLENGE: USEUCOM full-spectrum operations exercise, USSTRATCOM supported

BULWARK DEFENDER: Joint cyber defense exercise

Ongoing Support to Overseas Contingency Operations….

Global Integrated Operations

The Classification of this Brief is:
UNCLASSIFIED

NORAD and USNORTHCOM
Science and Technology

Dr. Susanne T. Wirwille
Director, Science and Technology

NORAD & USNORTHCOM Missions

- **North American Aerospace Defense Command (NORAD)**
  - **Bi-national Command established between the Governments of the U.S. and Canada in 1958**
  - **Three Regions: Alaskan NORAD Region (ANR), Canadian NORAD Region (CANR), and Continental NORAD Region (CONR)**
  - **Conducts aerospace warning, aerospace control, and maritime warning in the defense of North America**
- **United States Northern Command (USNORTHCOM)**
  - **Unified Command established in 2002**
  - **Subordinate Commands: Joint Force HQ National Capital Region, Joint Task Force (JTF) Alaska, JTF Civil Support, JTF North, Army North, Air Force North**
  - **Conducts homeland defense, civil support, and security cooperation to defend and secure the United States and its interests**

Two Commands … Working Together

…Across a Range of Operations…

Homelands Defense

- Aerospace Warning
- Aerospace Control
- Maritime Warning

Security Cooperation

Civil Support

- Air
- Missile Defense
- Maritime
- Land

- Canada
- Mexico
- The Bahamas

- Disaster Relief
- CBRN Incident
- Civil Disturbance
- Special Events

…With a Host of Partners…

International

TRANSPORT CANADA

PUBLIC SAFETY CANADA

SEDENA
SECRETARÍA DE LA DEFENSA NACIONAL

SEMAR
SECRETARÍA DE MARINA

SEGOB
SECRETARÍA DE GOBERNACIÓN

SALUD
SECRETARÍA DE SALUD

Department of Defense

Interagency

U.S. Immigration and Customs Enforcement

DHS/Science & Technology

DHS/Intelligence & Analysis

DHS/Office of Infrastructure Protection

DHS/Transportation Security Administration

DHS/TSA Federal Air Marshal Service

National Voluntary Organizations Active in Disaster

American Red Cross

Business Executives for National Security

PACIFIC DISASTER CENTER
Fostering Disaster-Resilient Communities

Approximately 60 People Representing More Than 50 Agencies

NORAD and USNORTHCOM Focus Areas

- **Counter-Terrorism and Force Protection**
- **Transnational Criminal Organizations**
- **Defense Support of Civil Authorities**
- **Chemical, Biological, Radiological, Nuclear Consequence Management**
- **Maritime Warning and Control**
- **Aerospace Warning and Control**
- **Missile Defense**
- **The Arctic**

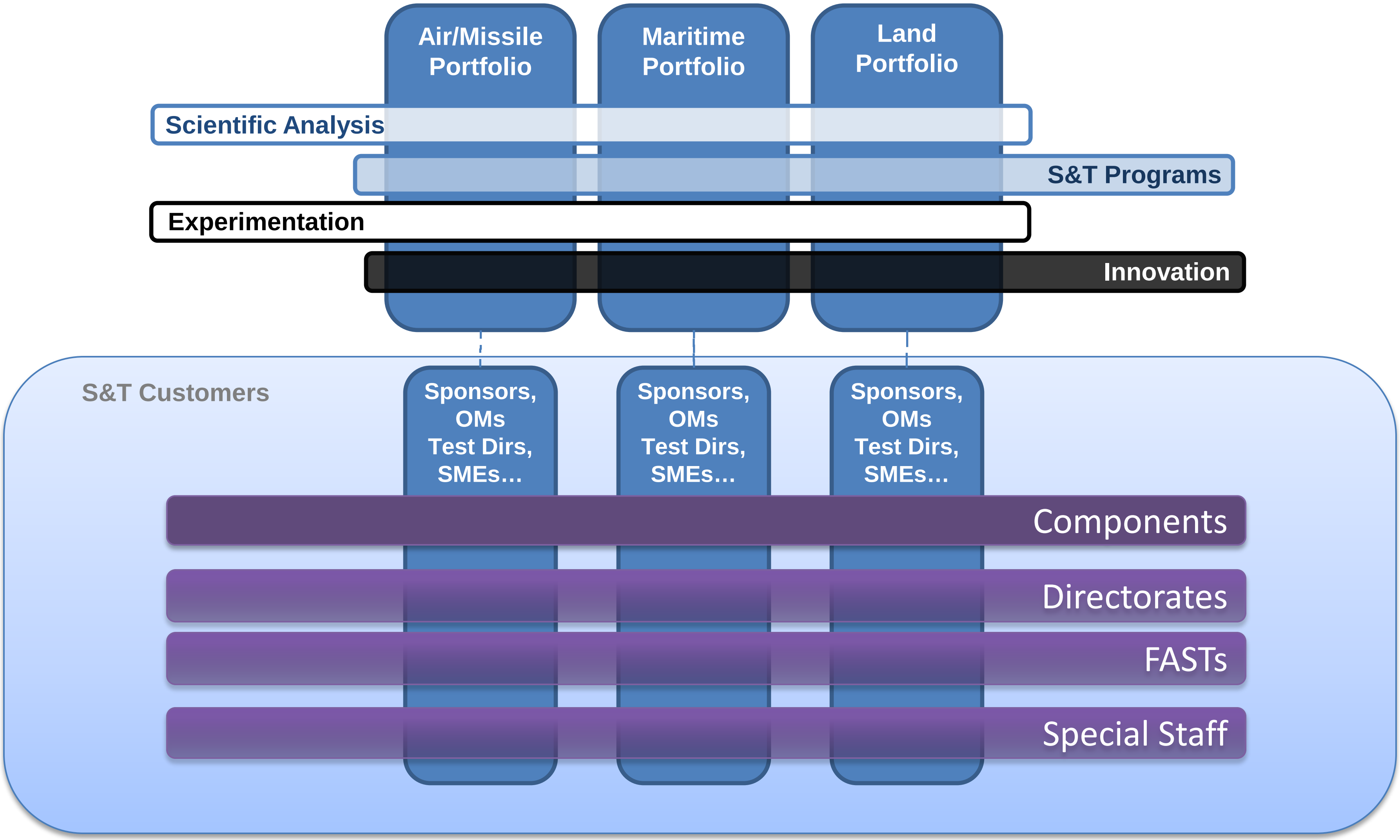
Cross-cutting Focus Area: Technical Opportunities

N-NC/S&T Mission and Functions

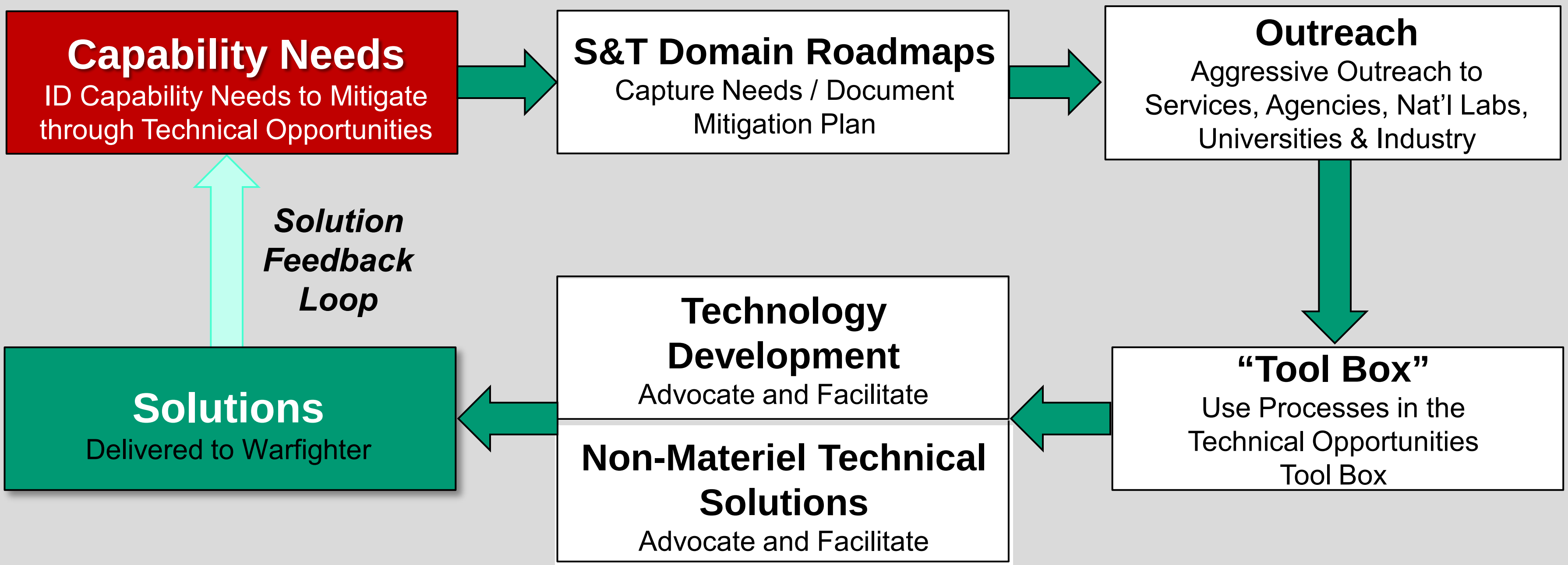
- Advises CDR, NORAD and USNORTHCOM and Deputy Commanders on all S&T matters
- Creates and executes strategies and supporting plans to exploit and develop innovative processes, technology and prototypes to respond to the needs of NORAD and USNORTHCOM
  - Leads studies, innovation, experimentation, enabling technologies, technology demonstrations, military utility assessments, and Joint Tests
  - Performs US and Canadian outreach efforts to identify, assess and integrate potential solutions for identified capabilities and requirements
  - Articulates needed capabilities with R&D organizations
- Critically reviews and eliminates unpromising programs and projects
- Synchronizes S&T activities across NORAD and USNORTHCOM staffs
- Focus is 6 months out to 15 years with innovation cycles of 6 - 36 months

S&T provides leadership and oversight of science, innovation and future capability initiatives in order to improve homeland defense, defense support of civil authorities, theater security cooperation, and other NORAD and USNORTHCOM mission capabilities

S&T Functional Organization



Technical Opportunities



NORAD and USNORTHCOM

Defending our

Homelands


NORAD
SM
TRACKS SANTA
Welcome to
NORAD Tracks Santa
Santa has completed his flight this year.
Come back next December to see him fly
again!

Rapid Fielding
Portfolio, Strategies & Opportunities

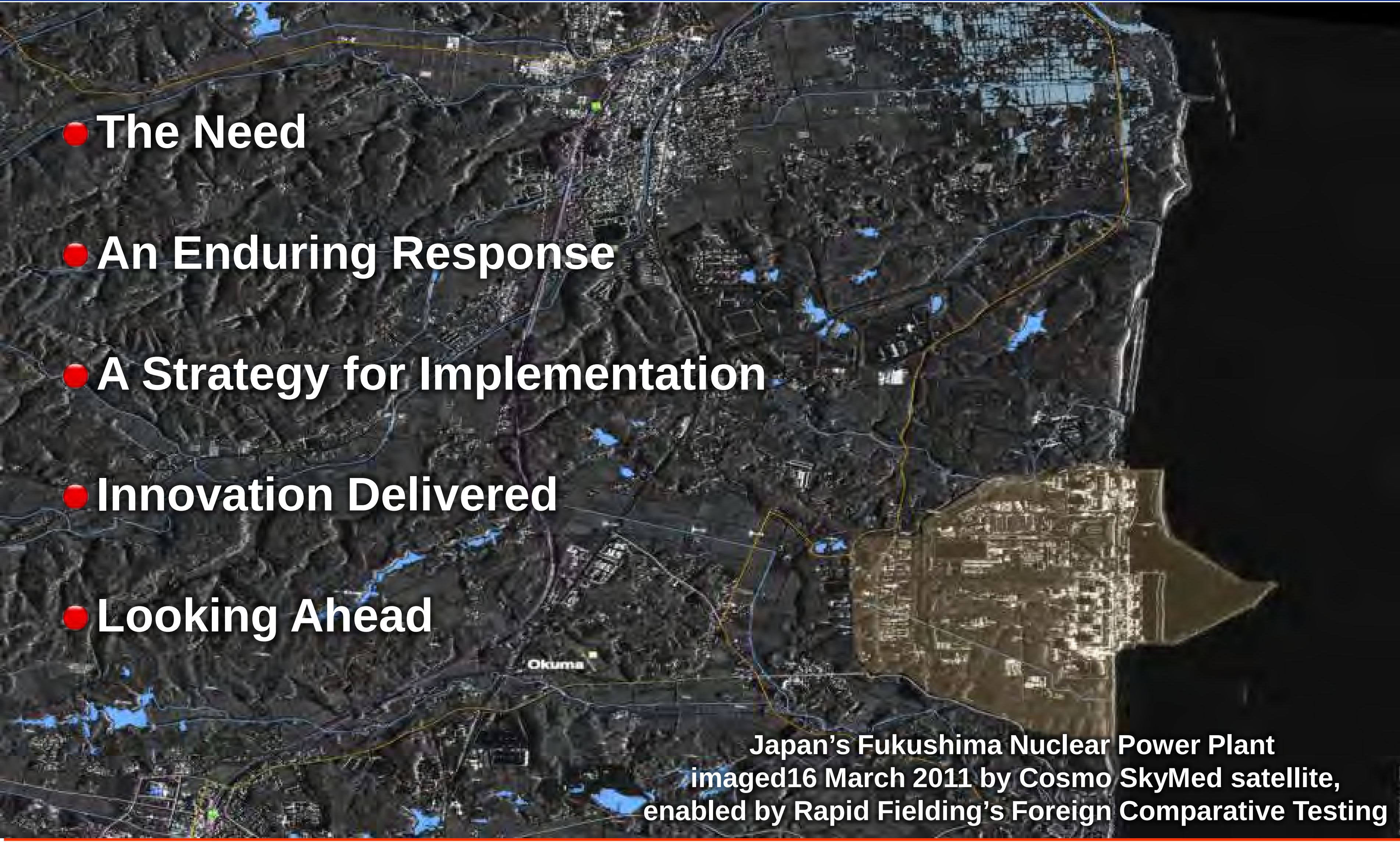
Earl Wyatt

Deputy Asst Sec of Defense, Rapid Fielding

OASD(R&E)

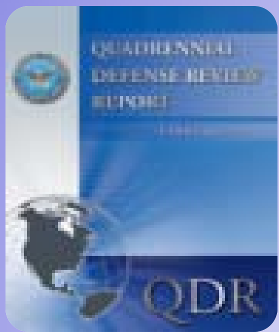
Topics

- The Need
- An Enduring Response
- A Strategy for Implementation
- Innovation Delivered
- Looking Ahead



Japan's Fukushima Nuclear Power Plant imaged16 March 2011 by Cosmo SkyMed satellite, enabled by Rapid Fielding's Foreign Comparative Testing

The Need



"….the Department needs a means to quickly prioritize and quantify requirements and to insure that the resources are available to enable rapid fielding of capabilities inside of the Department's Planning, Programming, Budgeting and Execution System (PPBES) cycle" <u>Quadrennial Defense Review 2010</u>

"We must rapidly react to warfighting needs with new technology from commercial sources, prototyping or accelerated maturation of technology from the Science and Technology base."
<u>Sec. Gates, Jan 09</u>

"Rapid fielding requires rapid performance from the entire AQ team, including the test and evaluation community … without delaying our response to these urgent requirements …"
<u>Dr. Carter, Mar 09</u>

An Enduring Response

- ***USD AT&L – Established a senior integration team to prioritize, resource and provide senior-level oversight of urgent operational needs***

- ***ASD(R&E) – Established the ODASD(Rapid Fielding)***
  - ***Accelerate technical capability to win the current fight***
    - ***Support and engage in JUONs resolution***

  - ***Build an enduring rapid demonstration, assessment and fielding model for DoD that invests in near horizon concepts and rapidly transitions them for time sensitive operational needs***
    - ***Shape Quick Reaction Special Projects, Joint Capability Technology Demonstration, Foreign Comparative Testing, Biometrics S&T and Emerging Capabilities program elements to achieve the rapid fielding objective***

A Strategy for Implementation

- **Identify, Develop and Demonstrate Concepts and Capabilities Providing a Competitive Advantage**
  - Identify existing solutions capable of satisfying new JUONs within 12 months, or
  - Work with the R&E Enterprise (e.g., Services, Labs, etc.) to develop solutions for JUONs that can be resolved within 24 months

- **Ensure Responsive Processes**
  - Resource efforts that support continuous COCOM engagement
  - Conduct continuous review of acquisition related processes (needs validation, acquisition priorities, resourcing, utility assessments)

- **Conduct Anticipatory Efforts to Positively Impact Operational Readiness**
  - Engage stakeholders to help identify technology trends, potential vulnerabilities and disruptive threats
  - Expand problem/solution space to include interagency, non-kinetic, human social culture, and dual use technologies

- **Make Efficient Use of the Instruments at our Disposal**
  - Employing the use of fieldable prototypes (organically / industrially);
  - Providing operationally representative integration venues (JERC, Stiletto, Thunderstorm, etc.); and,
  - Expanding supplier base to include to non-traditional performers

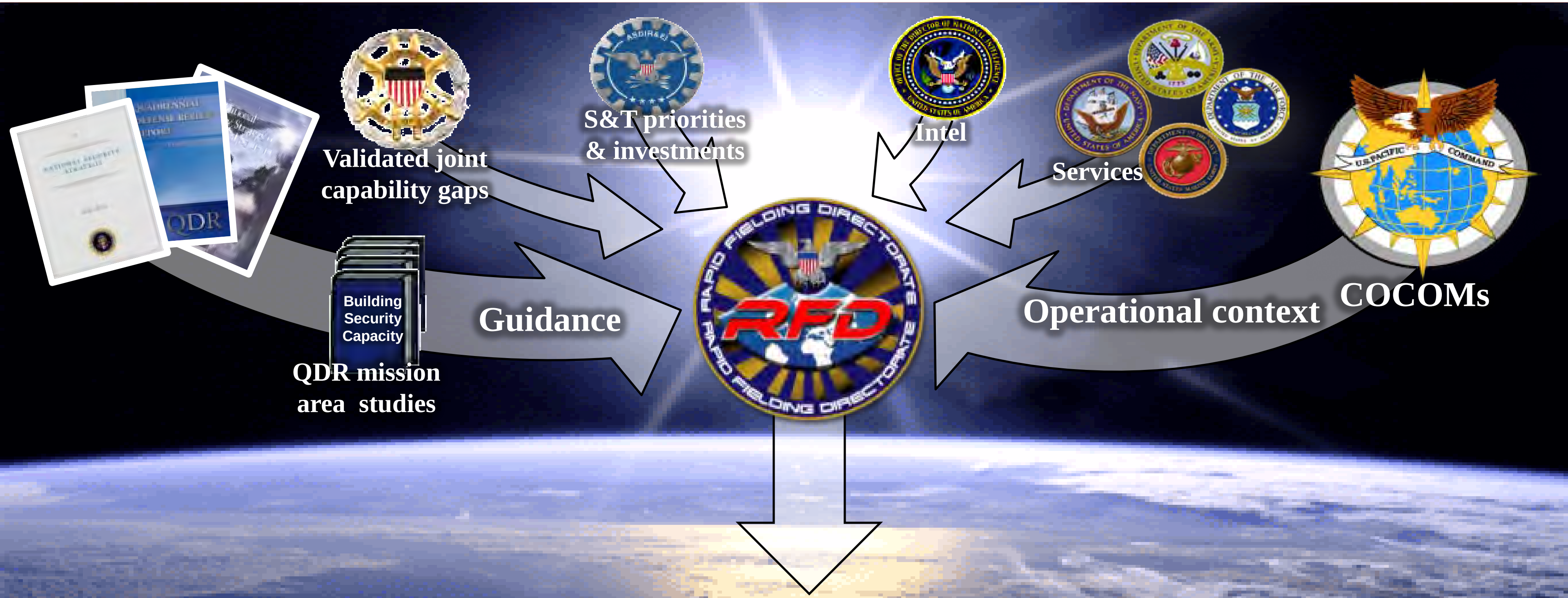
Implementation Partners

- **Identify, Develop and Demonstrate Concepts and Capabilities Providing a Competitive Advantage**
  - Combatant Commands, Services, Defense Agencies (e.g., NSA, DTRA, DISA, DARPA)
  - Other Federal Agencies (e.g., DHS, DoS, NASA)
  - Industry, with particular emphasis on small business, and the OSBP
- **Ensure Responsive Processes**
  - Congressional Defense Committees
  - OSD Policy and OSD OSBP
  - OSD General Counsel
  - OUSD(AT&L)
    - OASD(R&E)
    - Joint Rapid Acquisition Cell (JRAC)
    - Defense Procurement and Acquisition Policy (DPAP)
- **Conduct Anticipatory Efforts to Positively Impact Operational Readiness**
  - Combatant Commands
  - Services
  - Defense Agencies (e.g., NSA, DTRA, DISA, DARPA)
  - Other Federal Agencies (e.g., DHS, DoS, NASA)
  - Industry, with particular emphasis on small and non-traditional businesses, and the OSBP

Heavy equipment recovery with the Joint Recovery and Distribution System JCTD in Afghanistan. Conducted in partnership with US Transportation Command, US Army and industry

- **Make Efficient Use of the Instruments at our Disposal**
  - R&E Enterprise (Labs, FFRDCs, Coalition Partners, GIFs, Non-Traditional Suppliers)

Innovation Delivered



Identify, Develop, and Demonstrate Innovative Solution Options for Joint Capability Areas

Force Protection

- Airborne Tac Extraction (FCT)
- Enhanced Mortar Tgt Sys (ECTD)
- Nat'l Technical Nuclear Forensics (JCTD)
- Hostile Fire Detection Sys (QRSP)
- Persistant Grnd Surveillance System (JCTD)

Battlespace Awareness

- Rapid Reaction Tunnel Detection (JCTD)
- XFC Submerged launch UAV (QRSP)
- Eagle Vision (FCT)
- Project SHIVA (QRSP)
- Thunderstorm Test Venue (ECTD)
- Stiletto Maritime Test Platform (ECTD)

Command & Control

- Mobile Modular C2 (QRSP)
- Nat'l Senior Leadership Decision Support Services (JCTD)
- Theater Information Sharing Sharing (JCTD)
- Tactical Edge Data Solution (JCTD)

Logistics

- PEAK (JCTD)
- Critical Runway Assessment & Repair (JCTD)
- Submersible Multi-Fuel Outboard Engines (FCT)
- Deployable Rigid Wall Shelters (FCT)
- Project Pelican (ECTD)

Looking Ahead

Rapid Fielding Points of Contact

- **Efficiently Develop/Demonstrate Concepts & Capabilities that Provide Competitive Advantage**
  - Shape JCTD, QRSP, FCT, Biometric/Forensics/ECD PEs
    - Points of Contact: Wyatt/Riley (via CAPT Wright – lewin.wright@osd.mil)
- **Ensure Responsive Processes**
  - Resource efforts that support continuous COCOM engagement
    - Points of Contact: Vogt (chris.vogt@osd.mil)/ Fogg (glenn.fogg@osd.mil)
  - Conduct continuous review of acquisition related processes (needs validation, acquisition priorities, resourcing, utility assessments)
    - Points of Contact: Cundiff (dan.cundiff@osd.mil)/ Purdy (ellen.purdy@osd.mil)
- **Conduct Anticipatory Efforts to Positively Impact Operational Readiness**
  - Engage stakeholders to help identify technology trends, potential vulnerabilities and disruptive threats
    - Point s of Contact: Fogg (glenn.fogg@osd.mil) / Vogt (chris.vogt@osd.mil)
  - Expand problem/solution space to include interagency, non-kinetic, human social culture, and dual use technologies
    - Points of Contact: Riley/Fogg (glenn.fogg@osd.mil)
- **Make Efficient Use of the Instruments at our Disposal**
  - Employing the use of fieldable prototypes (organically / industrially)
    - Point of Contact: Purdy (ellen.purdy@osd.mil)
  - Providing operationally representative integration venues (JERC, Stiletto, Thunderstorm, etc.);
    - Point of Contact: COL Kelleher (pat.kelleher@osd.mil)
  - Expanding supplier base to include to non-traditional performers
    - Point of Contact: Cundiff (dan.cundiff@osd.mil)

Questions ?

US Marines demonstrate water purification system in Honduras in the Pre-positioned Expeditionary Assistance Kits JCTD

Technology Transition Paths