International S&T Strategy in DoD

13 February 2013

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Principal Deputy, DASD(Research)

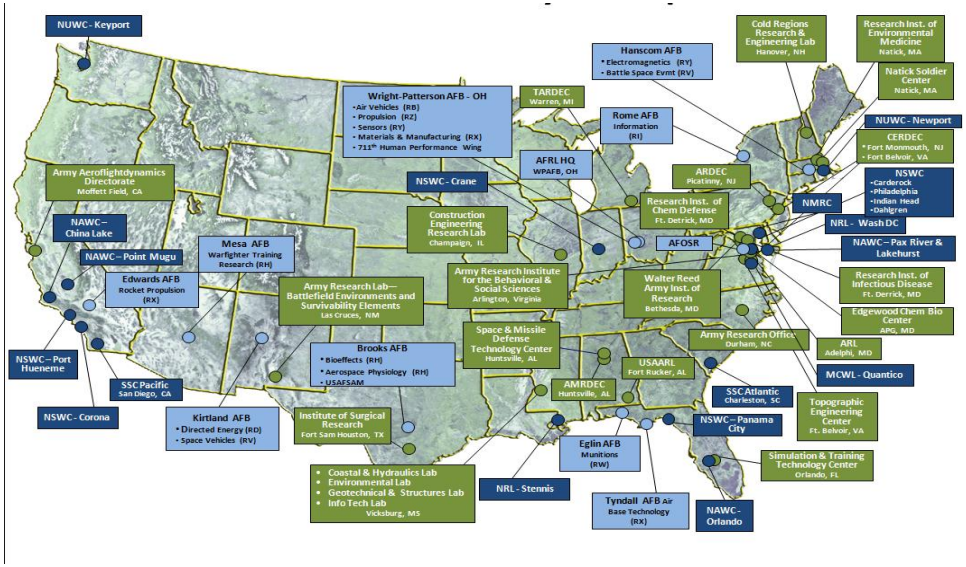
If I Were Sponsoring this Study …

… I would want to see:

- Ideas to enable sustained harvesting of international S&T advances by the broad DoD S&T workforce and by Defense Acquisition, especially primes
- Ideas for economical, yet effective, international exchanges at scale
- Identification of priority topics for collaborative international projects
- Ideas that promote DoD researcher timely visibility into international S&T advances, especially from private sector
- Ideas for how to engage international researchers in DoD-sponsored projects effectively
- Ideas for how DoD can take advantage of other Federal agency activities in international S&T

DoD Laboratory Enterprise

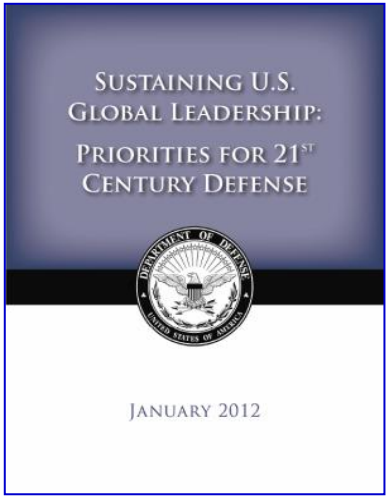
- **Provides special purpose facilities not practical for the private sector**
- **Responds rapidly in time of urgent need or national crisis**
- **Supports the user in the application of emerging technology and introduction of new systems**
- **Avoids technological surprise and ensure technological innovation**

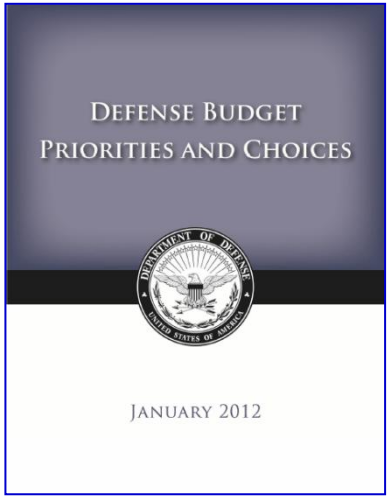


- 62+ Service and DoD-owned Laboratories and ~37,000+ Scientists and Engineers
- ~$30B / year in Total Funds Executed (RDT&E, Proc, O&M, MilCon)
- Diverse S&T capabilities and infrastructure mix (Lasers, Night Vision, Aero, Energetics, Armor, etc)
- Extended national technical footprint (DOE Nat'l labs, FFRDCs, UARCs, etc)

Making the cutting edge a reality

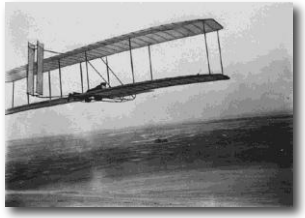
Key Elements of Defense Strategic Guidance

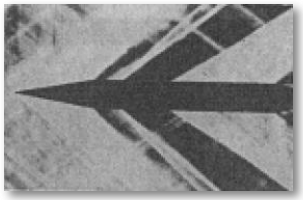




- **The military will be smaller and leaner, but it will be agile, flexible, ready and technologically advanced.**
- **Rebalance our global posture and presence to emphasize Asia-Pacific and the Middle East.**
- **Build innovative partnerships and strengthen key alliances and partnerships elsewhere in the world.**
- **Ensure that we can quickly confront and defeat aggression from any adversary – anytime, anywhere.**
- **Protect and prioritize key investments in technology and new capabilities, as well as our capacity to grow, adapt and mobilize as needed.**

National Defense Capabilities are Critically Dependent on Science & Technology


Powered flight

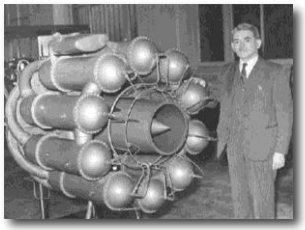

Supersonic flow

Communications

Global positioning

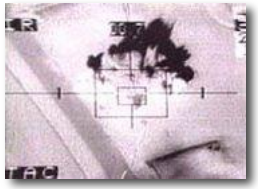
Stealth / LO

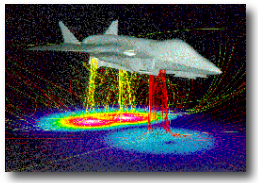
Long-endurance ISR


Gas turbine engine

Night attack

ICBMs


Precision strike


Computer simulations

High-power lasers

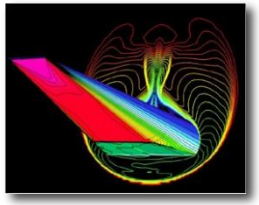
Aerial refueling

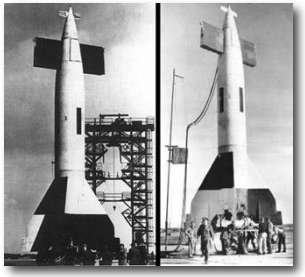
High-speed flight

Space ISR

Space launch

Directed energy


Hypersonics

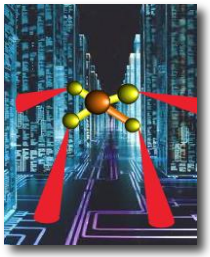

Rocket flight

Long-range radar

5th-gen fighters

Blended wing-body

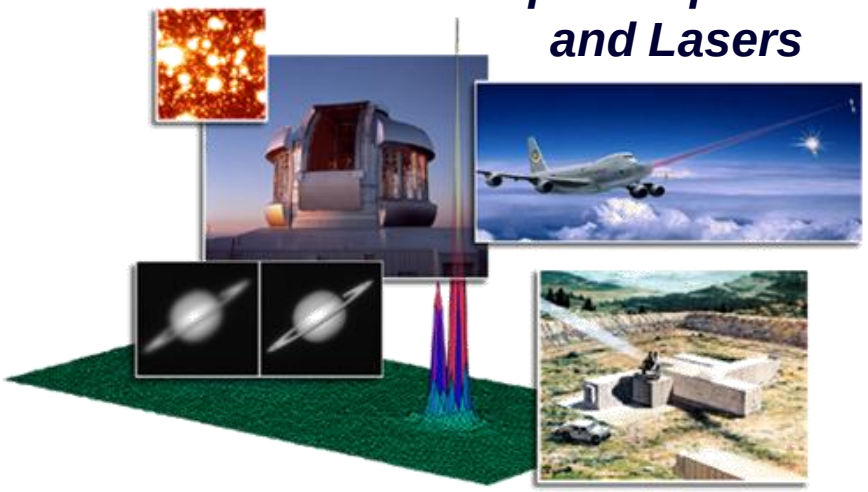
Unmanned systems


Cyber operations

Sustained S&T Investments Lead to Revolutionary Advances

Stealth

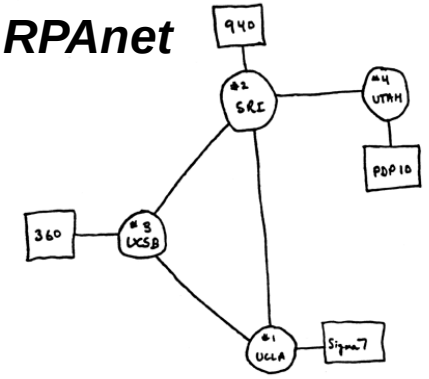
Adaptive Optics and Lasers



Night Vision

GPS

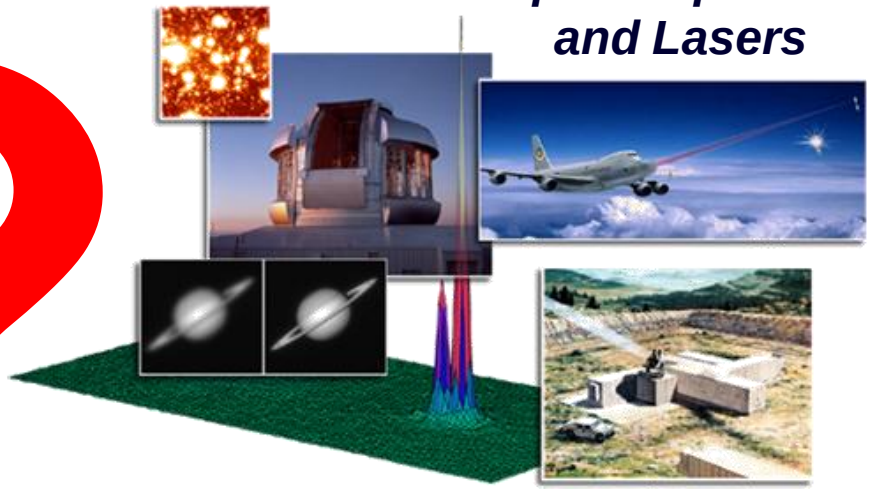
ARPAnet



What's Next ?

Stealth

Adaptive Optics and Lasers



Night Vision

GPS

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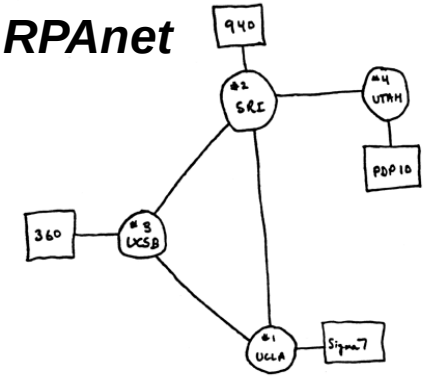
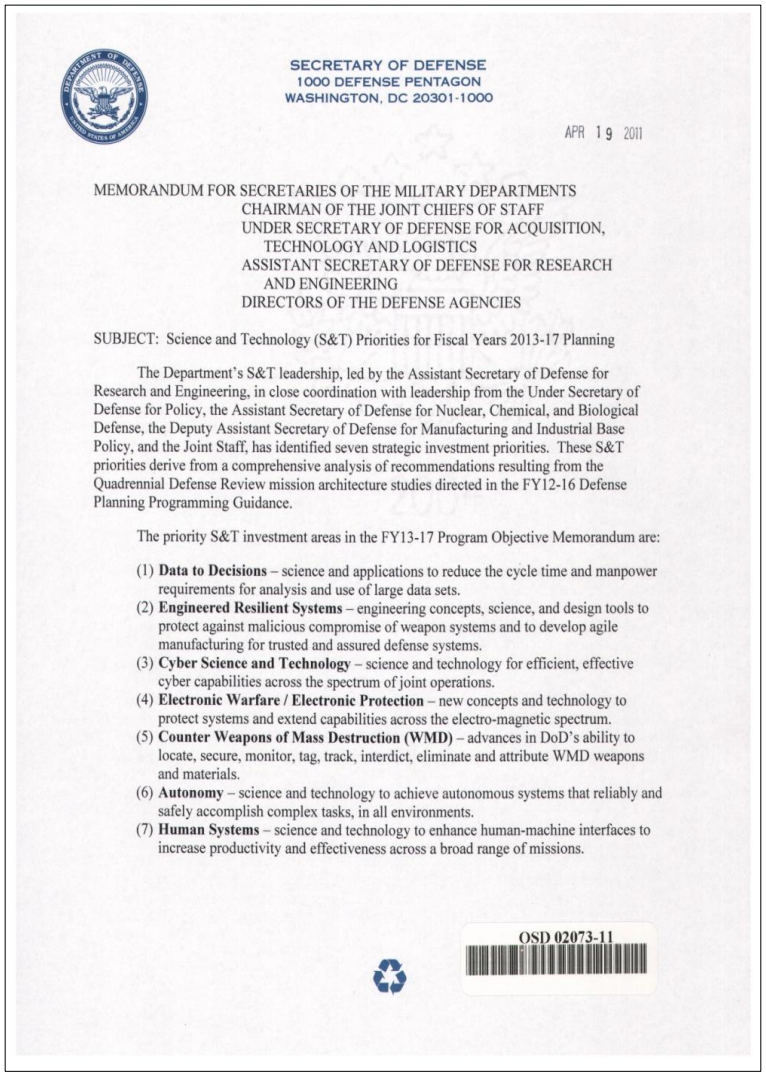


"Technology Enabled Strategy"



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:

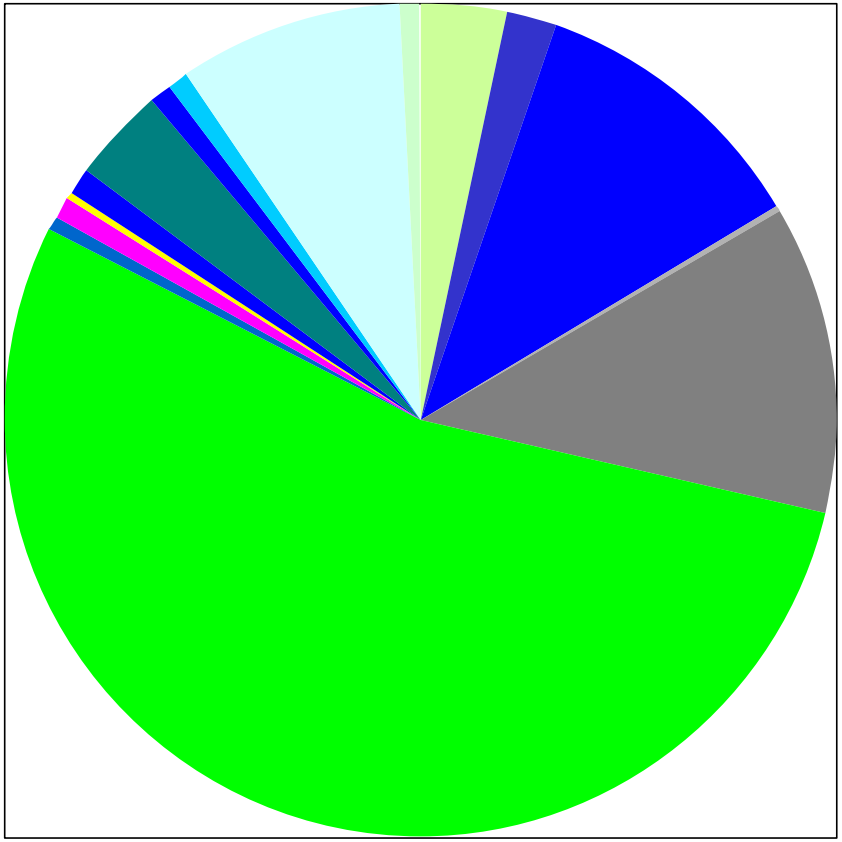
(1) **Data to Decisions** – science and applications to reduce the cycle time and manpower requirements for analysis and use of large data sets.
(2) **Engineered Resilient Systems** – engineering concepts, science, and design tools to protect against malicious compromise of weapon systems and to develop 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

- **Counter AA/AD capabilities**
- **Low-cost, agile, flexible small-footprint operations**
- **Integrated partnership capabilities**
- **Humanitarian, Disaster, Relief and Other Operations**
- **Safe, Secure and Effective Nuclear Deterrent**

Federal Obligations for Research (FY09)

Total = $54,801,007K



National Science Foundation,
Federal Funds for Research and Development: Fiscal Years 2007-09
Detailed Statistical Tables | NSF 10-305 | May 2010

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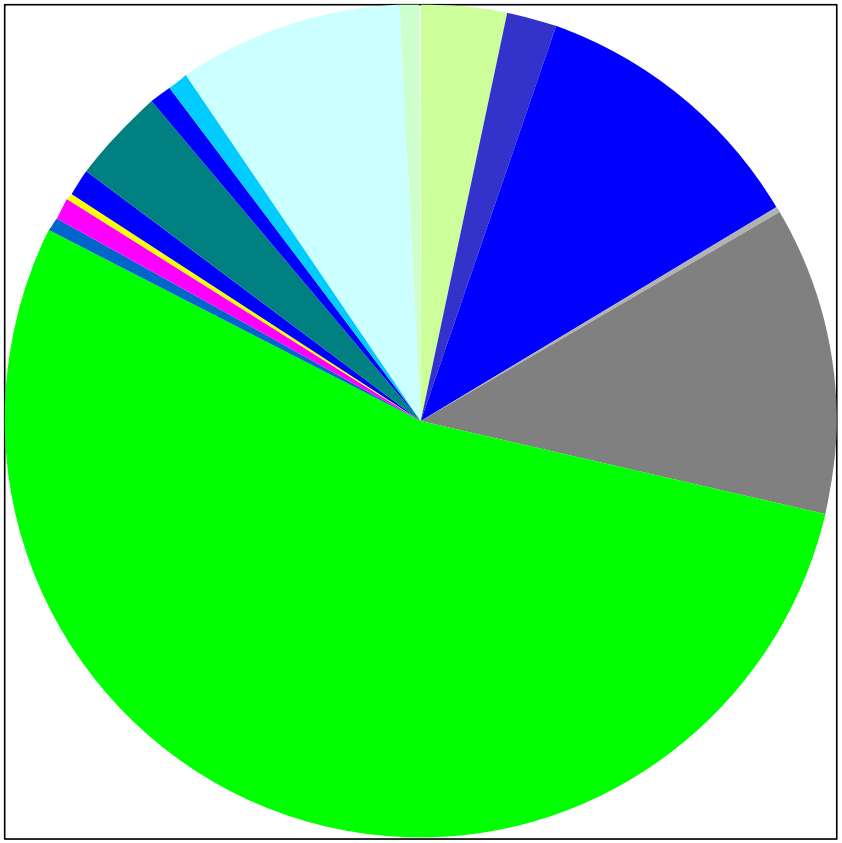
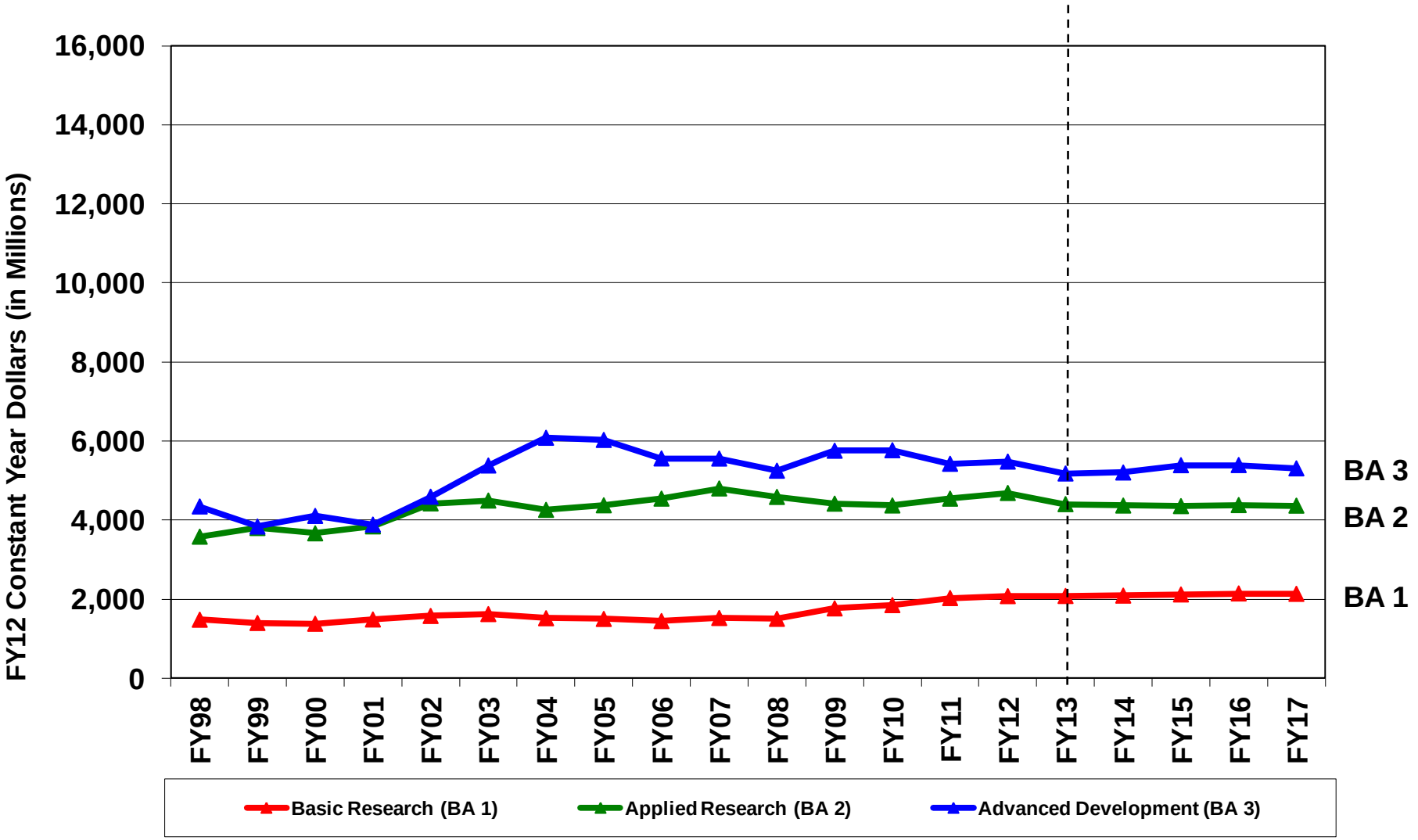


- Agriculture
- Commerce
- Defense
- Education
- Energy
- HHS
- Homeland Security
- HUD
- Interior
- Justice
- Labor
- State
- Transportation
- Treasury
- NASA
- Veterans Affairs
- EPA
- NSF
- Other

National Science Foundation,
Federal Funds for Research and Development: Fiscal Years 2007-09
Detailed Statistical Tables | NSF 10-305 | May 2010

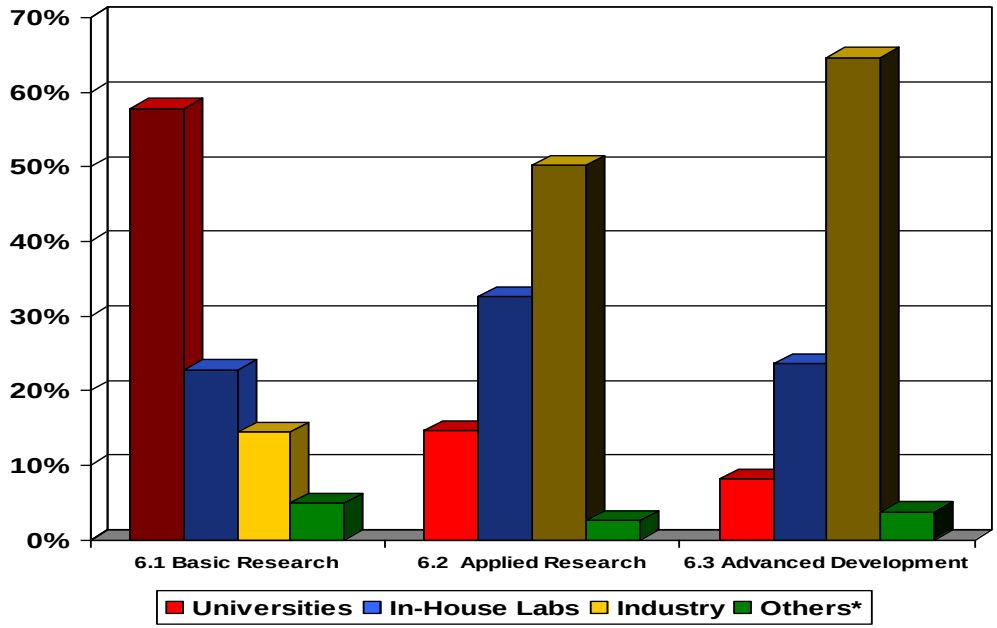
DoD S&T Funding By Budget Activity

- President's Budget Requests -



Recipients of DoD S&T Funds

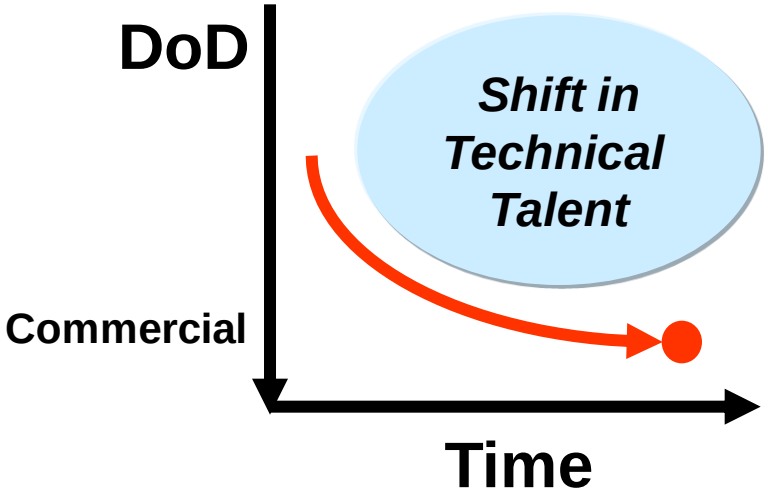
DoD S&T Funding Recipients by Percentage (PBR 2010)

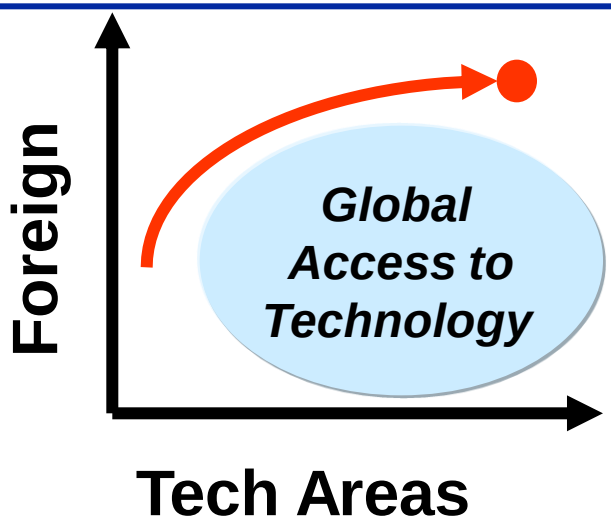


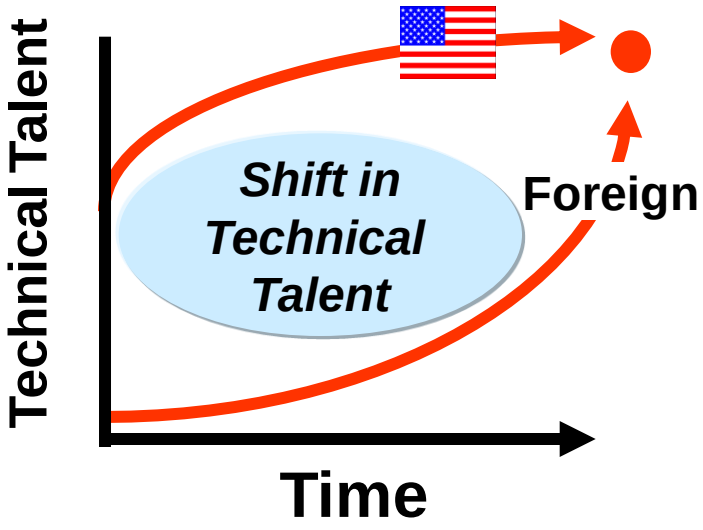
***Includes non-profit institutions, State & local govt., & foreign institutions**

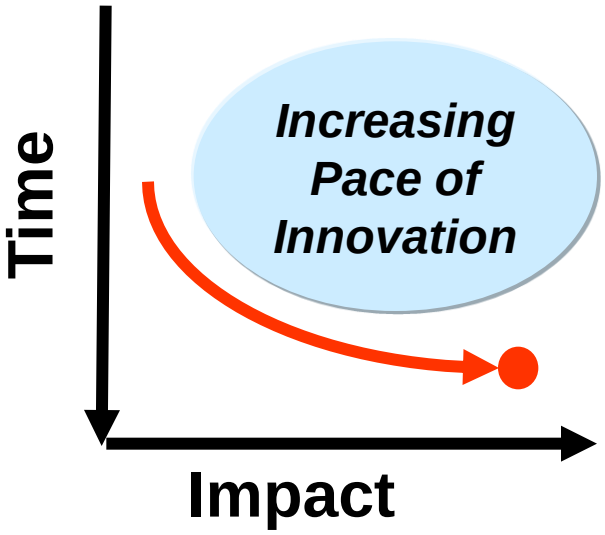
Source: National Science Foundation Report (PBR 2010)

Four Key Challenges to our Technical Base



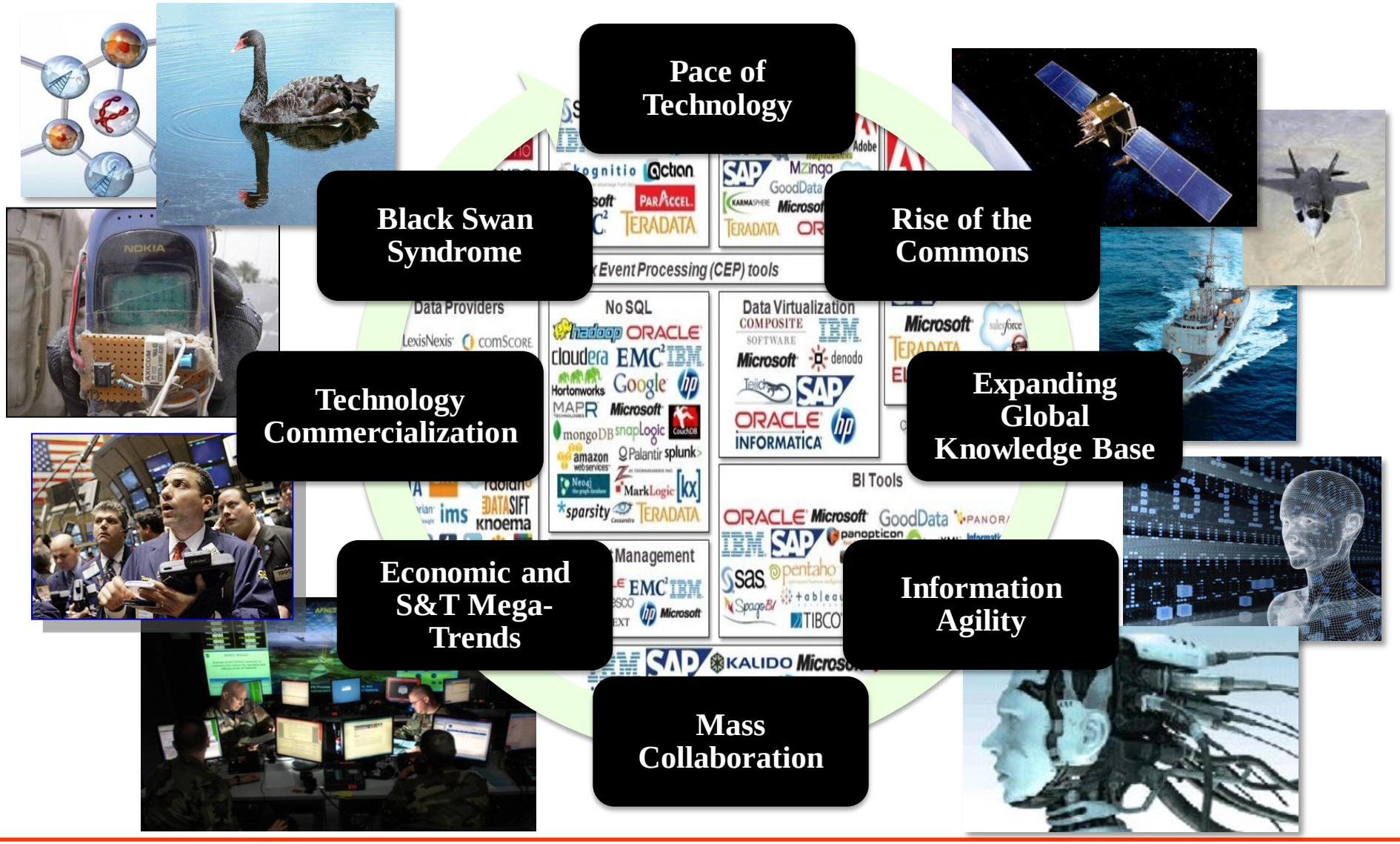




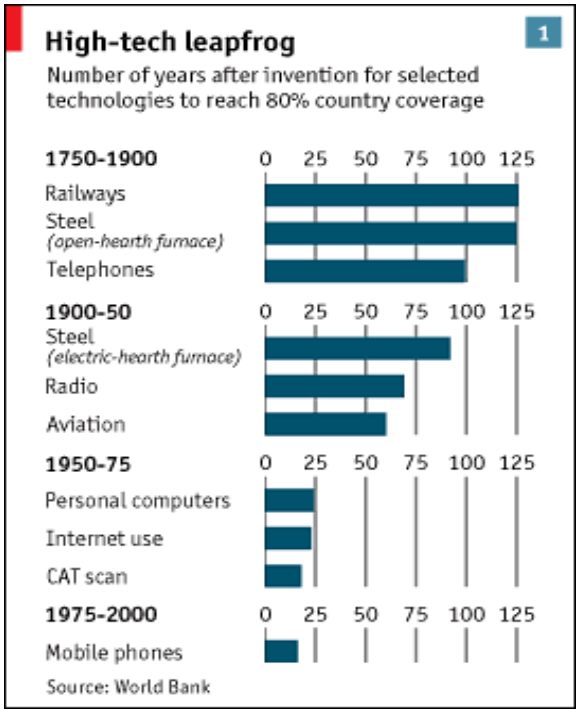


A New Reality

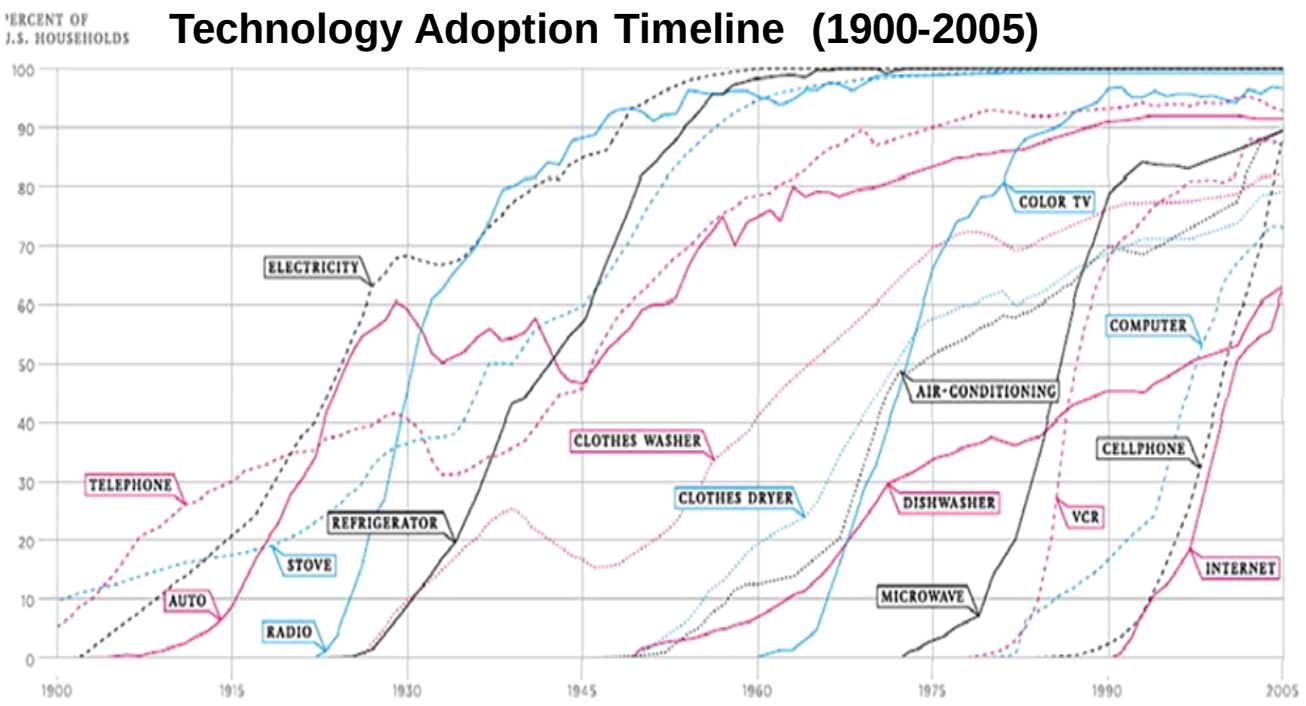
Global Dimensions Affect DoD S&T



Pace of Technology



The Economist, Feb. 9, 2008



It took 23 years to go from modeling germanium semiconductor properties to a commercial product

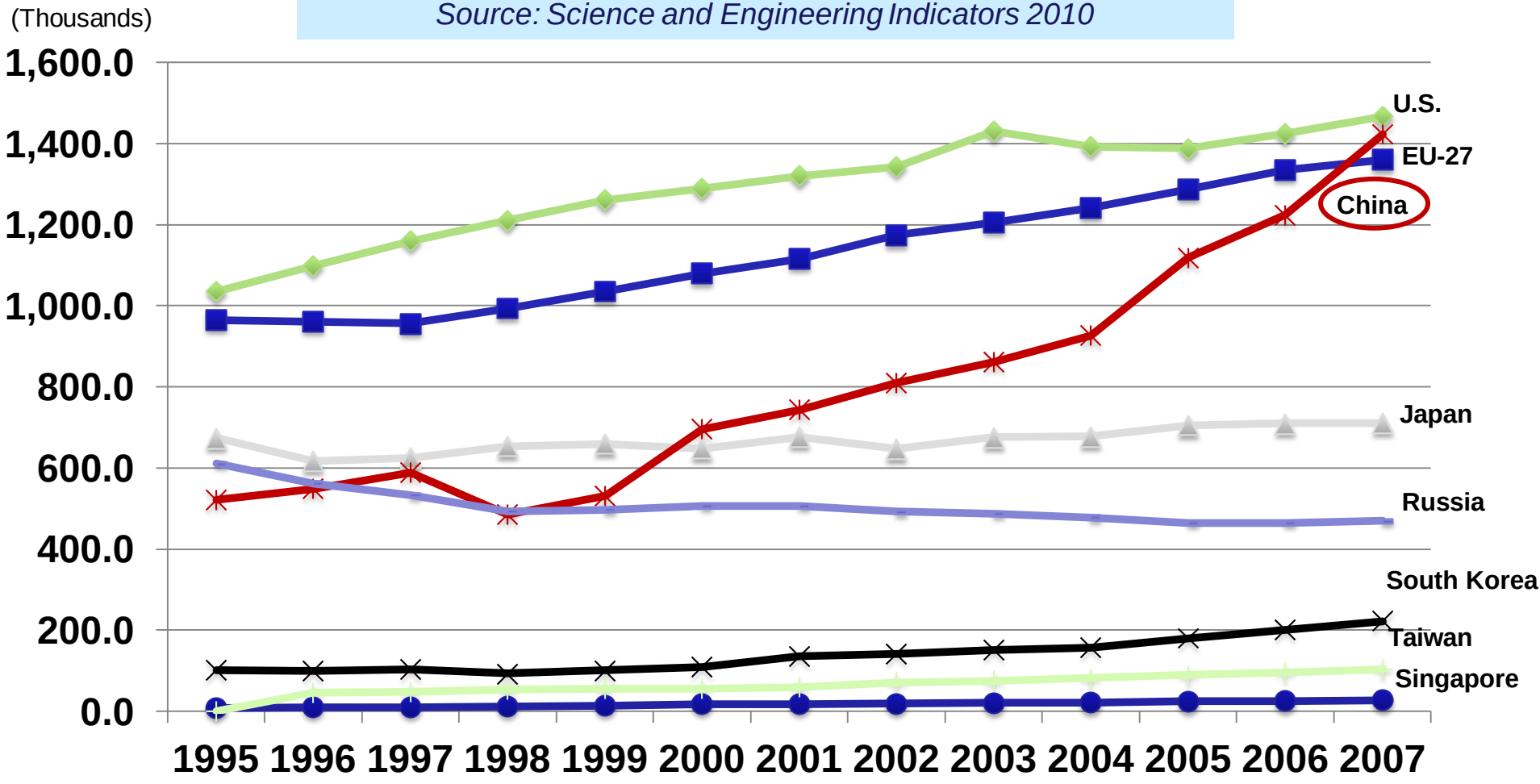
The carbon nanotube was discovered in 1991; recognized as an excellent source of field-emitting electrons in 1995, and commercialized in 2000

The pace of technology development and market availability is exceeding the pace of acquisition

Global R&D: Increasing Competition

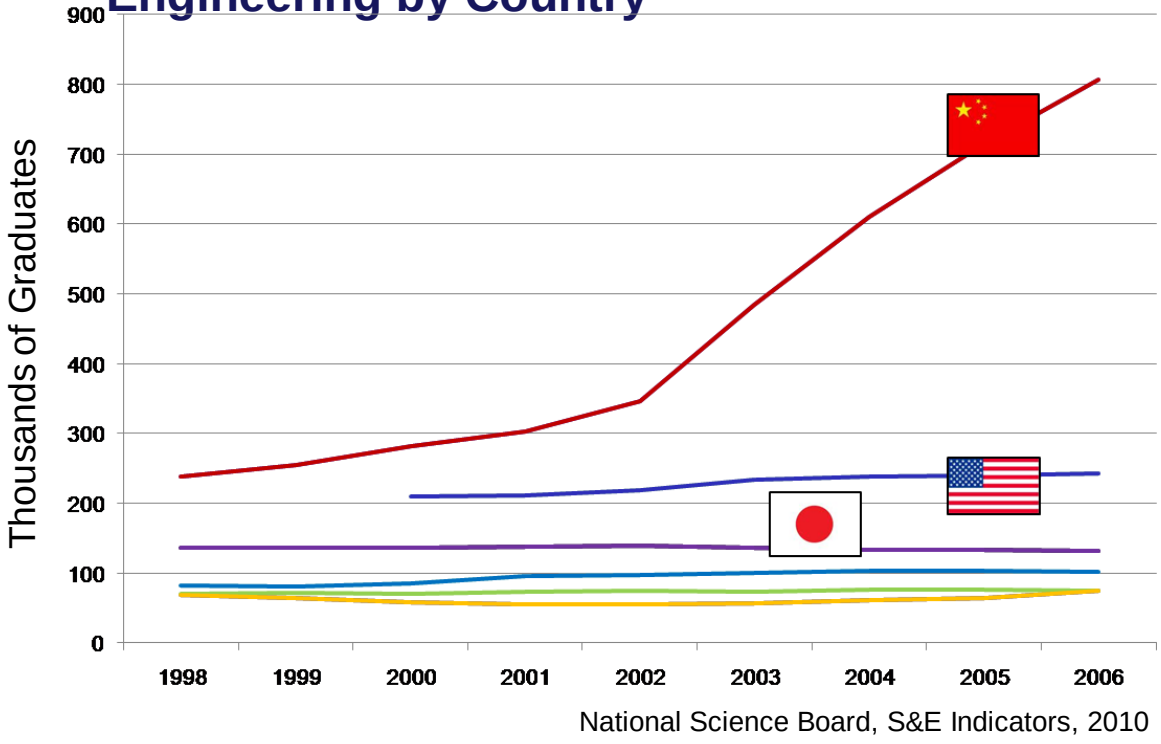
Estimated number of researchers in selected regions/countries/economies: 1995-2007

Source: Science and Engineering Indicators 2010

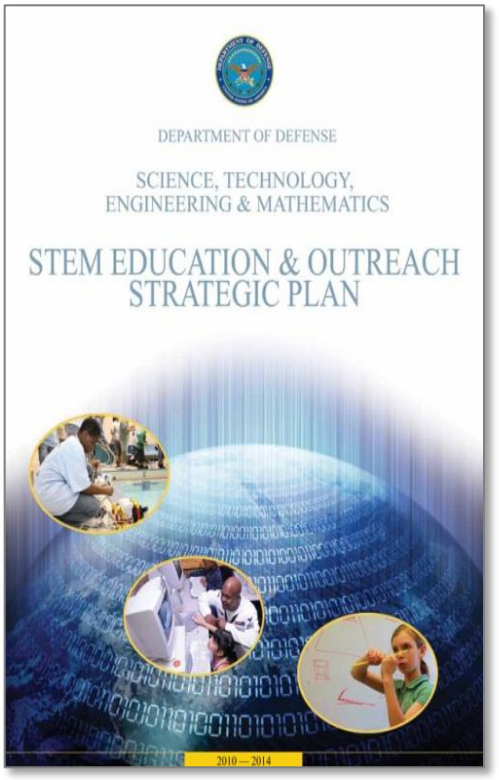


World-class STEM Education & Outreach

First Degrees in Natural Sciences and Engineering by Country

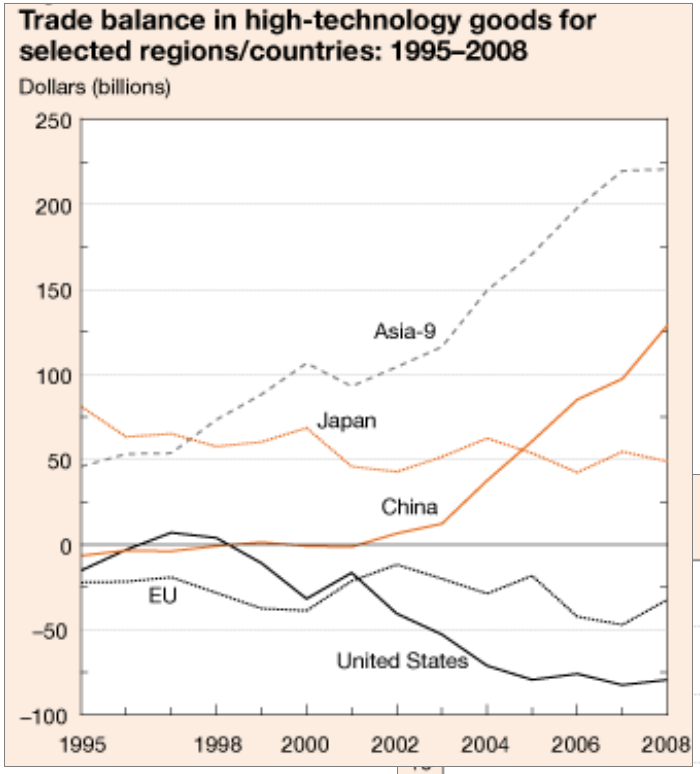


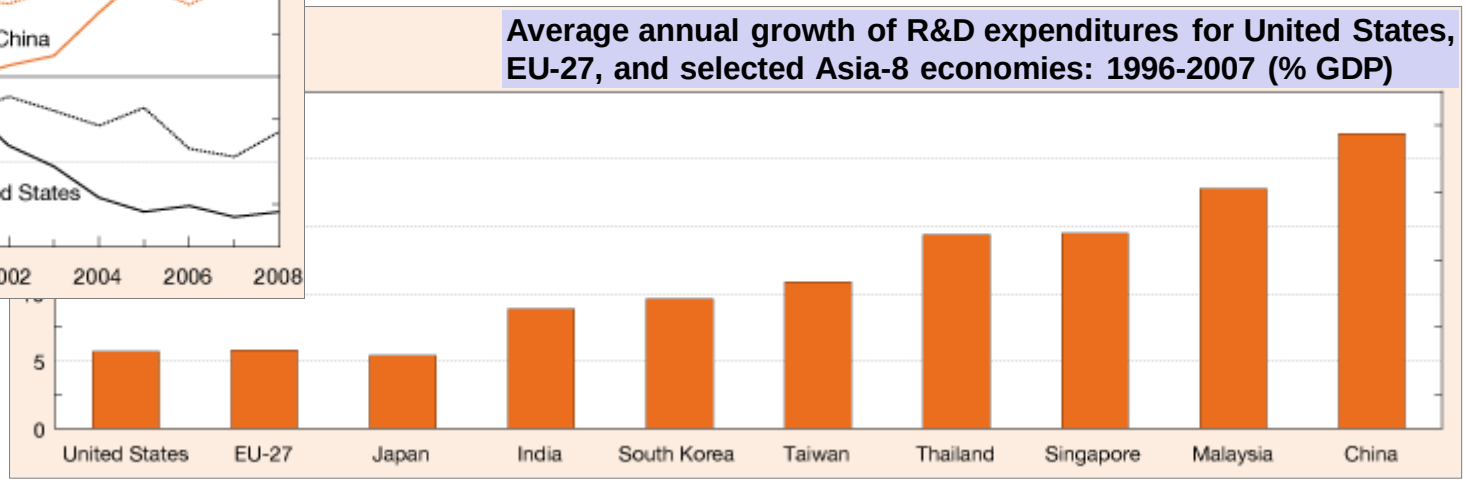
National Science Board, S&E Indicators, 2010



OSD Services, Agencies, Components	K – 12	Undergrad / Grad	Teachers	Faculty	Military	Public Outreach
33	1,500,000 students	11,000	20,000	300	1,600	Est. 2,000,000

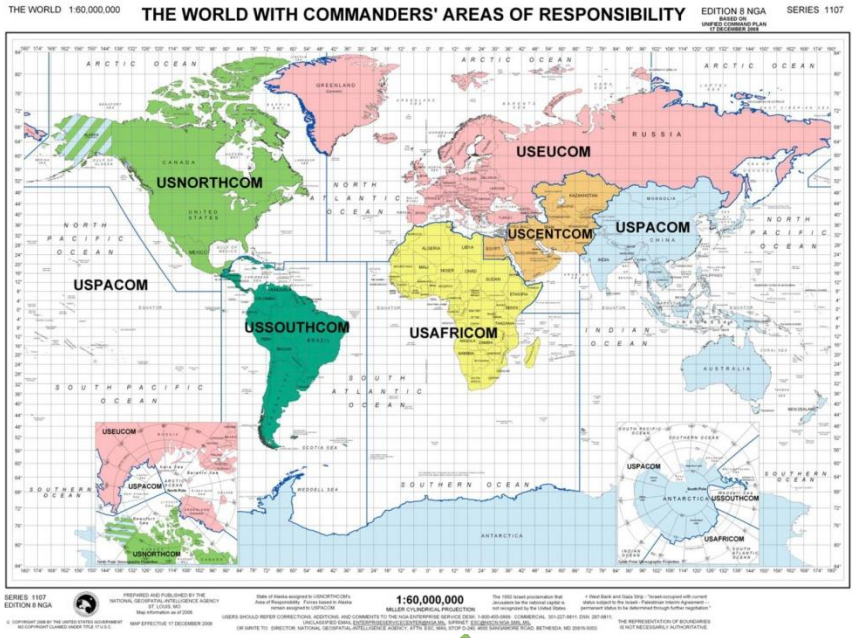
Economic and S&T Mega Trends





Where will tomorrow's advantage come from?

Operationalizing Global Technology Awareness



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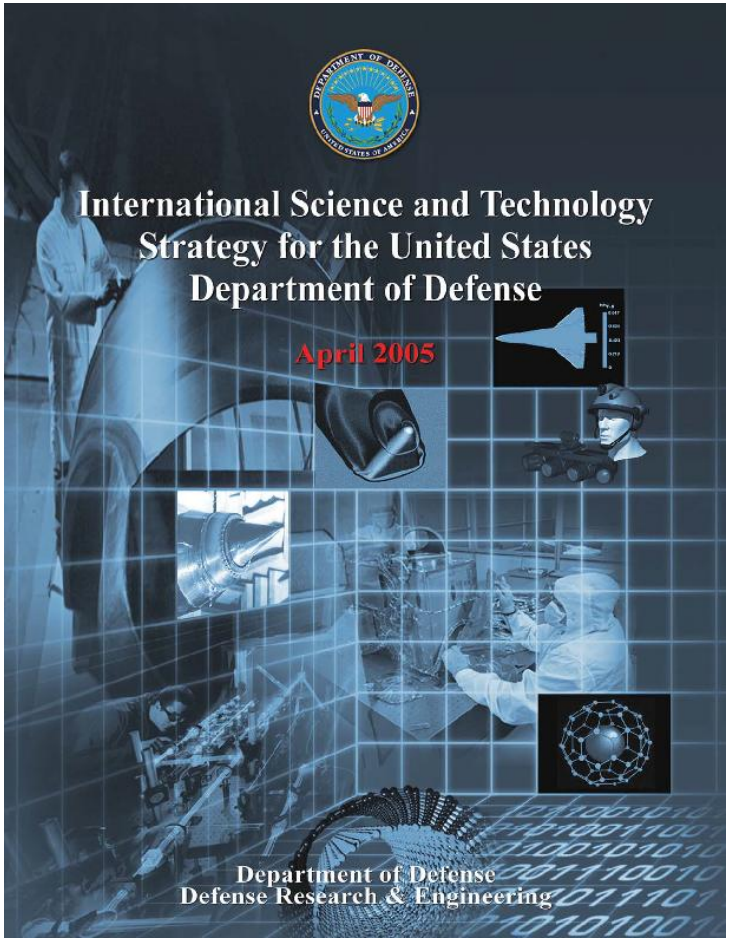
International S&T Strategy for DoD (April 2005)



- Bi-Lateral Agreements
- Multi-Lateral Agreements
- NATO Research & Technology Organization (RTO)
- The Technical Cooperation Program (TTCP)

International Strategy for Research, Development and Acquisition – 2013

Under development

Vision

Enhanced interoperability and acceleration of developmental acquisition programs - gaining economic efficiencies and mitigating risk of technology surprise

Guiding Principles:

- Support Service efforts where needed at the basic research level; develop a 'clearing house' of activity
- Use the Priority Steering Councils and Communities of Interest as lead 'integrators' of international applied research activity where large investments and multiple Services are involved
- Lead efforts to integrate information from the Services and external assessments to provide leadership an understanding of international research opportunities and threats
- Prioritize and invest in international activities only as a tool to benefit the U.S. technically or strategically
- Stratify international activities to ensure security of critical U.S. technologies

Mechanisms:

Leverage existing partnerships (NATO, TTCP, bilateral and multilateral agreements, basic research relationships) and build new relationships in priority areas

I. Globalization of Basic Research

"In the area of scientific development and innovation, international boundaries are fading, making DoD's relationship with the global network of researchers even more critical for scientific and technological advancement and success."

- **Action 1.1: Sponsor sabbatical research by DoD scientists and engineers at top research laboratories overseas**
  - Task 1.1.1 Expand sabbatical laboratory research
    (35 DoD S&E overseas sabbaticals within 3 years, assigned to DoD laboratories)
  - Task 1.1.2 Conduct a phased expansion of Service–supported overseas sabbaticals for university faculty.
    (30-50 annual faculty sabbaticals within 3 years, assigned to ARO, ONR, AFOSR)
- **Action 1.2: Identify & utilize overseas locations where US S&Es can work with leading foreign researchers in a collaborative environment**
  - Task 1.2.1 Increase US DoD S&E sabbaticals to leading foreign laboratories or satellite locations and, where desirable, under the encouragement of a government to government agreement.
    (50% more within 3 years, assigned to DoD laboratories)
  - Task 1.2.2 Increase agreements with foreign laboratories to accommodate more faculty sabbaticals in more nations over three years.
    (25% more sabbaticals, 25% more nations within 3 years, assigned to ARO, ONR, AFOSR)

I. Globalization of Basic Research

- **Action 1.3: Establish domestic locations where visiting researchers can work with DoD laboratory researchers without clearances or other obstacles**
  - Task 1.3.1 Establish modern, collaborative research areas at or in proximity to existing laboratory facilities
    (goal as stated within 5 years, assigned to AFRL, ARL, NRL)
  - Task 1.3.2 Expand participation of leading foreign scientists in DoD laboratory efforts.
    (50% more within 3 years, assigned to AFRL, ARL, NRL)
- **Action 1.4: Promote mutually beneficial collaborations between US and leading foreign universities**
  - Task 1.4.1 Negotiate agreements with foreign science agencies to jointly fund cooperative research between US and foreign universities, including exchange visits of faculty and students.
    (3 major agreements within 3 years, assigned to ARO, ONR, AFOSR)
- **Action 1.5: Double current funding of DoD international activities, currently 2-3% of BA 1 funds, over a five year period.**
  - Task 1.5.1 Steadily expand the basic research funds devoted to international activities.
    (5% of assignees' BA 1 appropriations within 5 yrs, assigned to Army, Navy, Air Force)

NATO Science & Technology Organization (STO)

- The STO is a NATO subsidiary body having the same legal status than the NATO itself, and created within the framework of the North Atlantic Treaty signed in Washington in 1949. It has been established with a view to meeting to the best advantage the collective needs of NATO, NATO Nations and partner Nations in the fields of Science and Technology. The STO is operated under the authority of the North Atlantic Council which has delegated the operations of the STO to a Board of Directors (the Science & Technology Board – STB) comprising the NATO Nations S&T managers. The STB is chaired by the NATO Chief Scientist who is a high level recognized S&T leader of a NATO Nation, being permanently assigned to the NATO headquarters in Brussels and also serving as the senior scientific advisor to the NATO leadership

- The Office of the Chief Scientist (NATO HQ, Brussels) providing executive and administrative support to the Chief Scientist in exercising his/her three roles as STB Chairperson, Scientific Advisor and head of the Office.

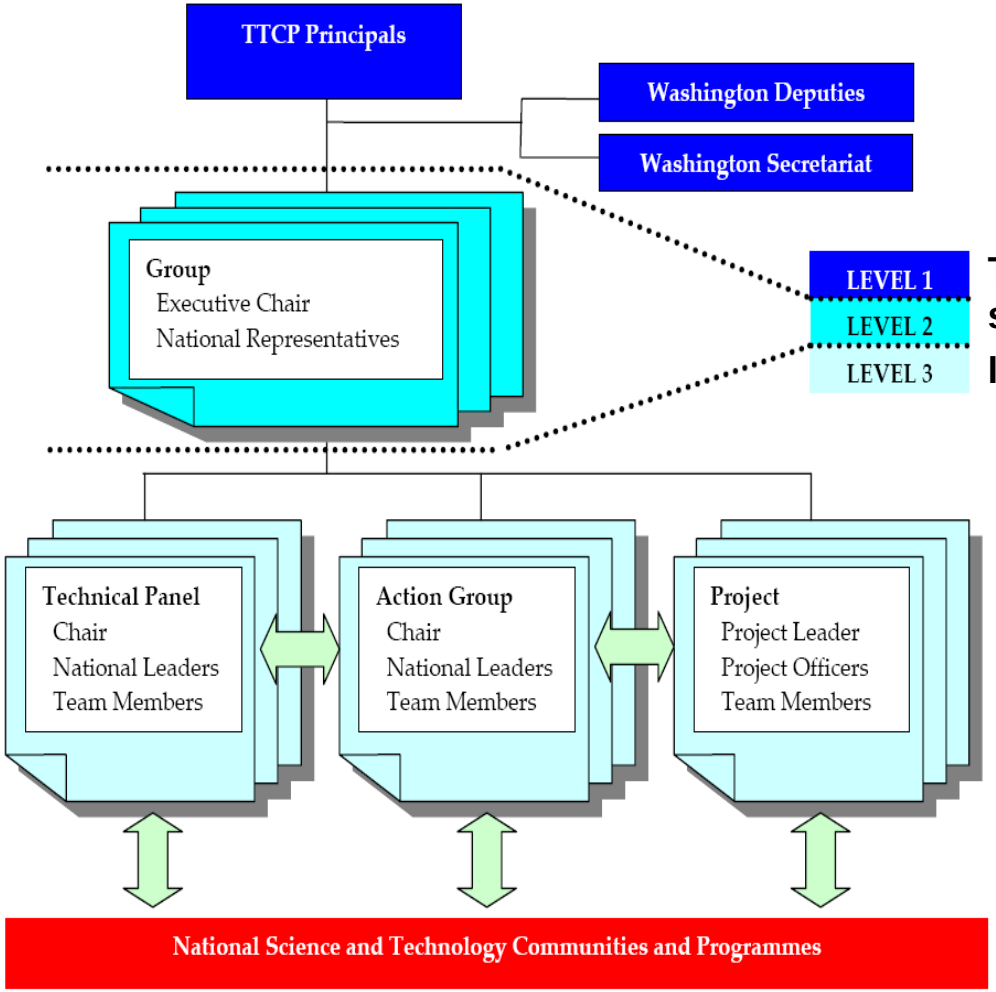
- The Collaboration Support Office (Paris, France) providing executive and administrative support to the activities conducted in the framework of the Collaborative business model and its level 2 committees and level 3 groups.

- The Centre for Maritime Research and Experimentation (La Spezia, Italy) organizing and conducting scientific research and technology development and deliver innovative and field tested S&T solutions to address the defence and security needs of the Alliance. Its mission is centered on the maritime domain but it may extrapolate to other domains to meet customers' demands.

What is TTCP?

- **Five-nation cooperative arrangement**
  - United Kingdom, Canada, Australia, New Zealand, United States
- **Eleven S&T Groups consisting of:**
  - 85 Technical Panels with 1200 scientists and engineers
  - 170 organizations at 450 sites
  - 300 active work strands
- **Defense-wide organization with emphasis on S&T**
  - Mechanism to facilitate combat interoperability through S&T cooperation
- **Global network of world class scientists and engineers**

Current TTCP Structure



TTCP is a hierarchical structure with three basic levels

Designator	Group Name
AER	Aerospace Systems
C3I	Command, Control, Communications and Information Systems
CBD	Chemical, Biological and Radiological Defence
EWS	Electronic Warfare Systems
HUM	Human Resources and Performance
JSA	Joint Systems and Analysis
LND	Land Systems
MAR	Maritime Systems
MAT	Materials and Processes Technology
SEN	Sensors
WPN	Conventional Weapons Technology

Wrap Up

- **"As global research and development (R&D) investment increases, it is proving increasingly difficult for the United States to maintain a competitive advantage across the entire spectrum of defense technologies. Even at current, relatively robust levels of investment, the DoD S&T program is struggling to keep pace with the expanding challenges of the evolving security environment and the increasing speed and cost of global technology development. The Department's options for managing risk with respect to S&T must be synchronized with efforts by other agencies as well as the private sector" (2010 Quadrennial Defense Review Report)**

- **"The clear technical advantage our forces enjoyed is not guaranteed – the rise in global research and development investments and the globalization of technology has collapsed the pace of innovation for both the U.S. and our adversaries" (ASD(R&E) HASC Testimony 2/29/12)**

- **How do we establish & implement DoD international S&T policies that maintain DoD technological advantage?**