



# **Department of Defense Basic Research**

**National Defense Industrial Association  
DPWG/ASD R&E Collaboration**

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**Director for Basic Research**

**Office of the Assistant Secretary of Defense for Research and Engineering**

**June 19, 2013**

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# Why Basic Research at DoD?

(from the DSB Task Force Report on Basic Research)



- Basic research probes the limits of today's technologies and discovers new phenomena and know-how that **ultimately lead to future technologies.**
- Basic research funding **attracts some of the most creative minds to fields of critical DOD interest.**
- Basic research funding **creates a knowledgeable workforce** by training students in fields of critical DOD interest.
- Basic research provides a broad perspective to prevent capability surprise by fostering a **community of U.S. experts** who are accessible to DoD, and who follow global progress in both relevant areas, **as well as those that may not seem relevant — until they are.**



# Five Examples of DoD Basic Research Leading to Game Changers



- **Global Positioning Satellite (GPS) System**
- **Gallium Arsenide (GaAs) Microwave Electronics**
- **Magnetic Random Access Memory (MRAM)**
- **Stealth Technology**
- **Kalman Filter**

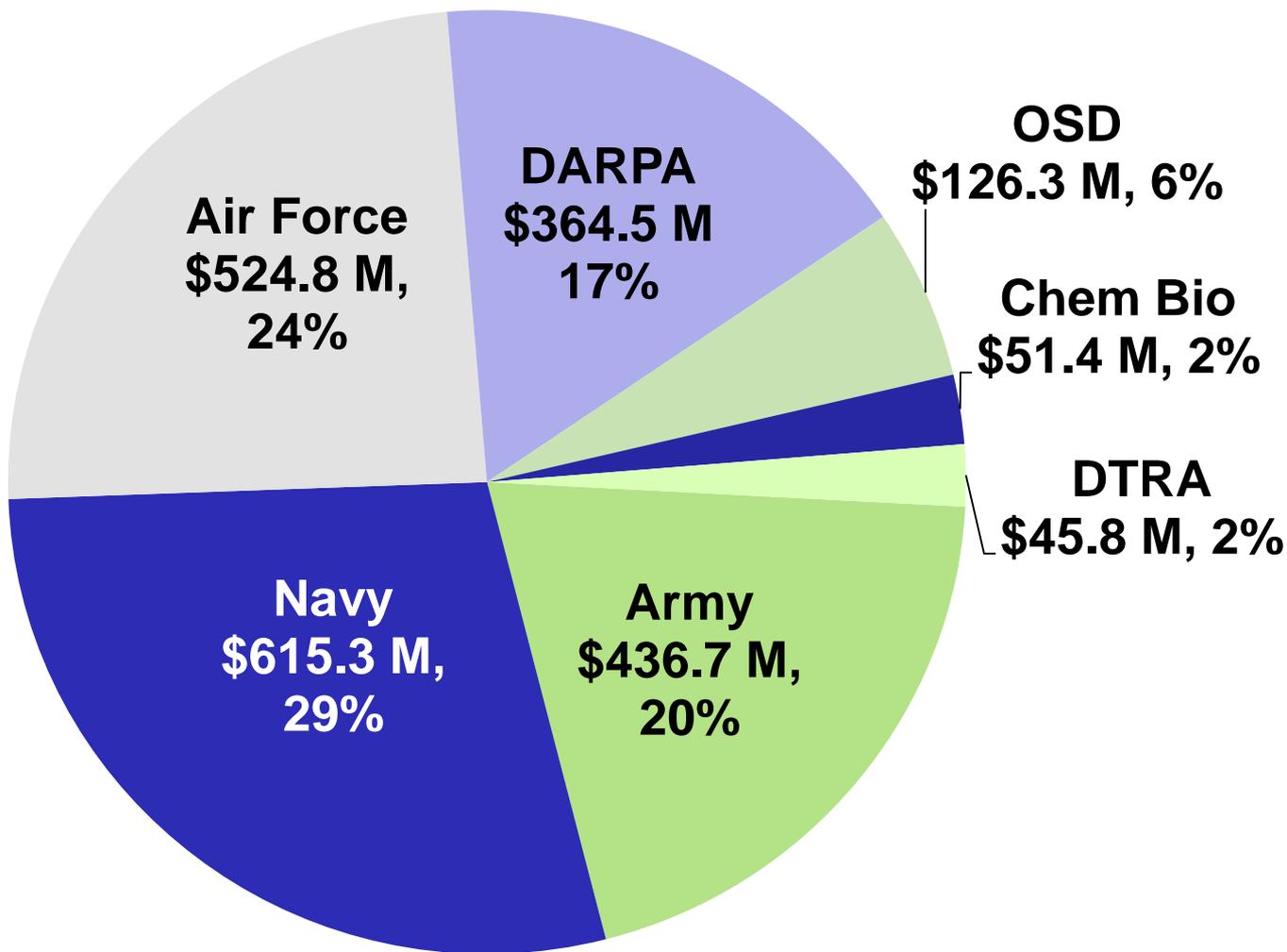
**Reference: DSB Task Force, p10**



# DoD Basic Research by Component FY14 President's Budget Request



**TOTAL**  
**\$2,165 M**

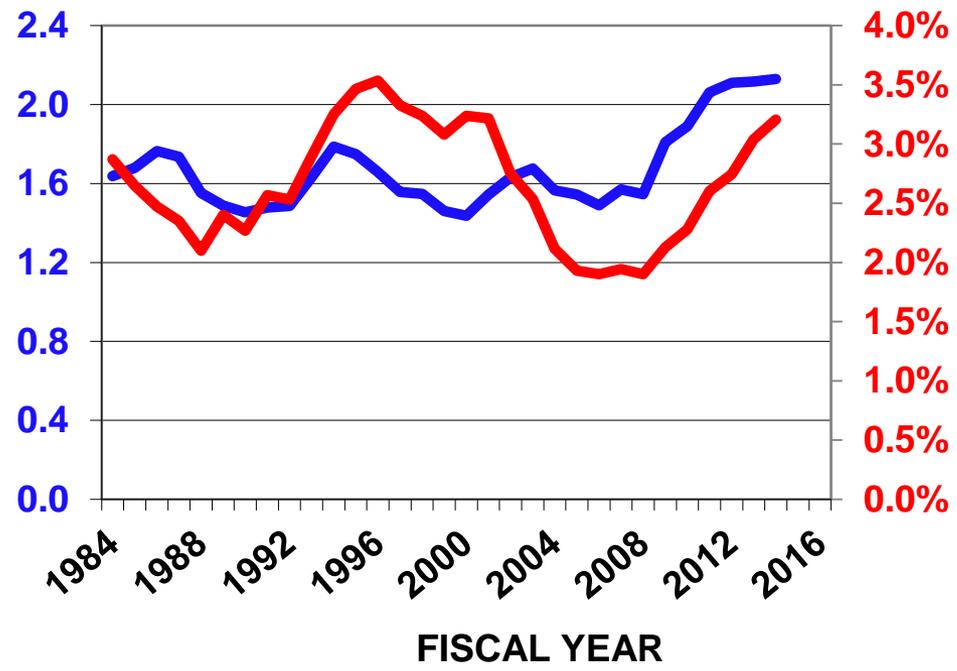




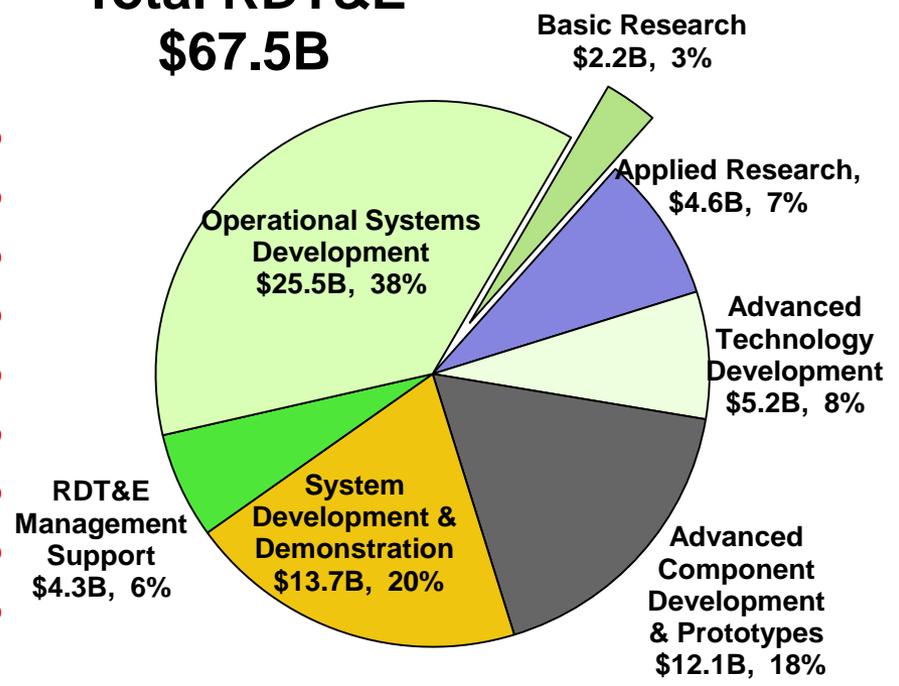
# DoD Basic Research 2014 PBR



Constant Dollars (\$B) and % of RDT&E



## Total RDT&E \$67.5B

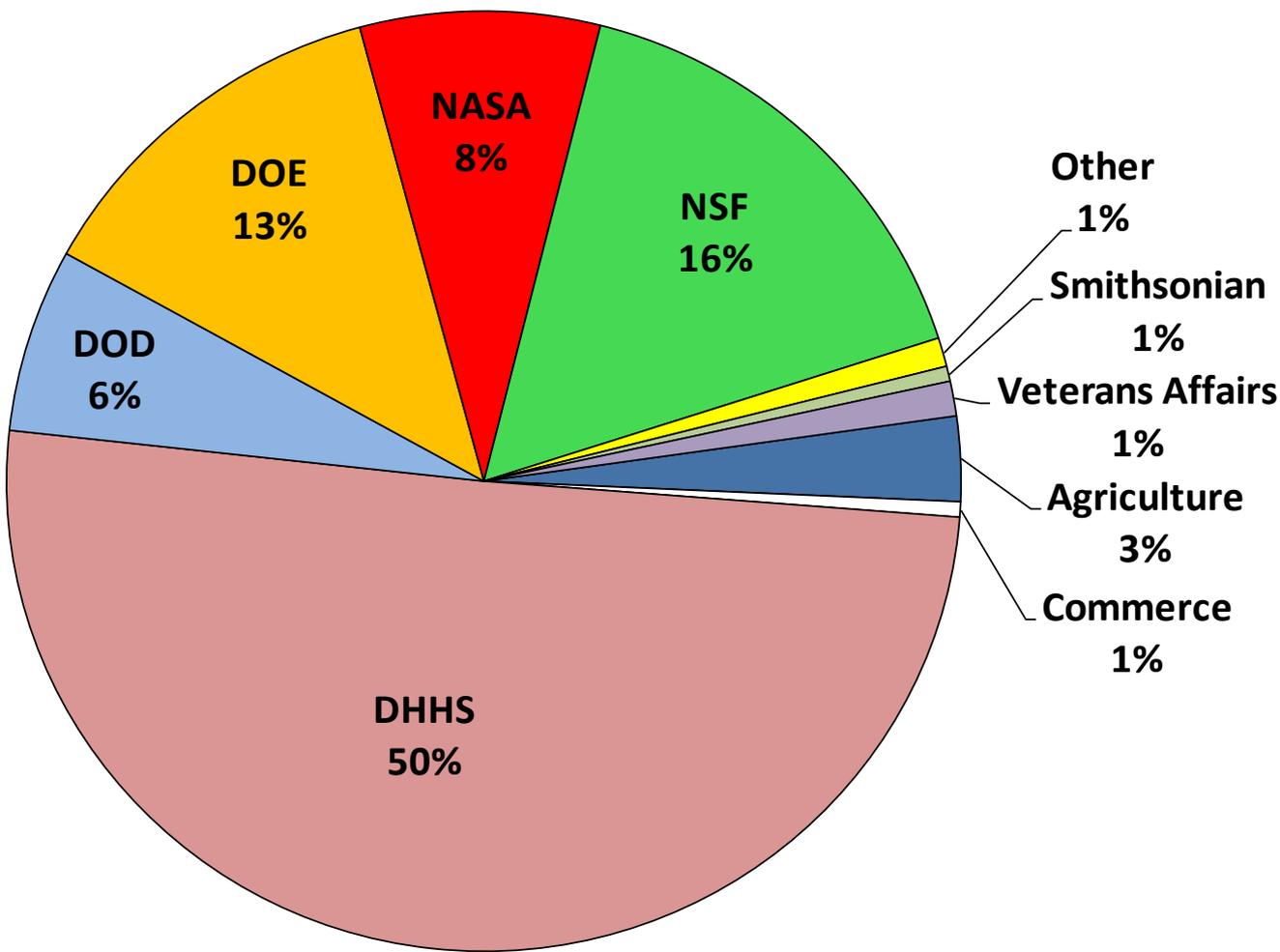




# DoD Basic Research is 6% of Overall Federal Agency Support



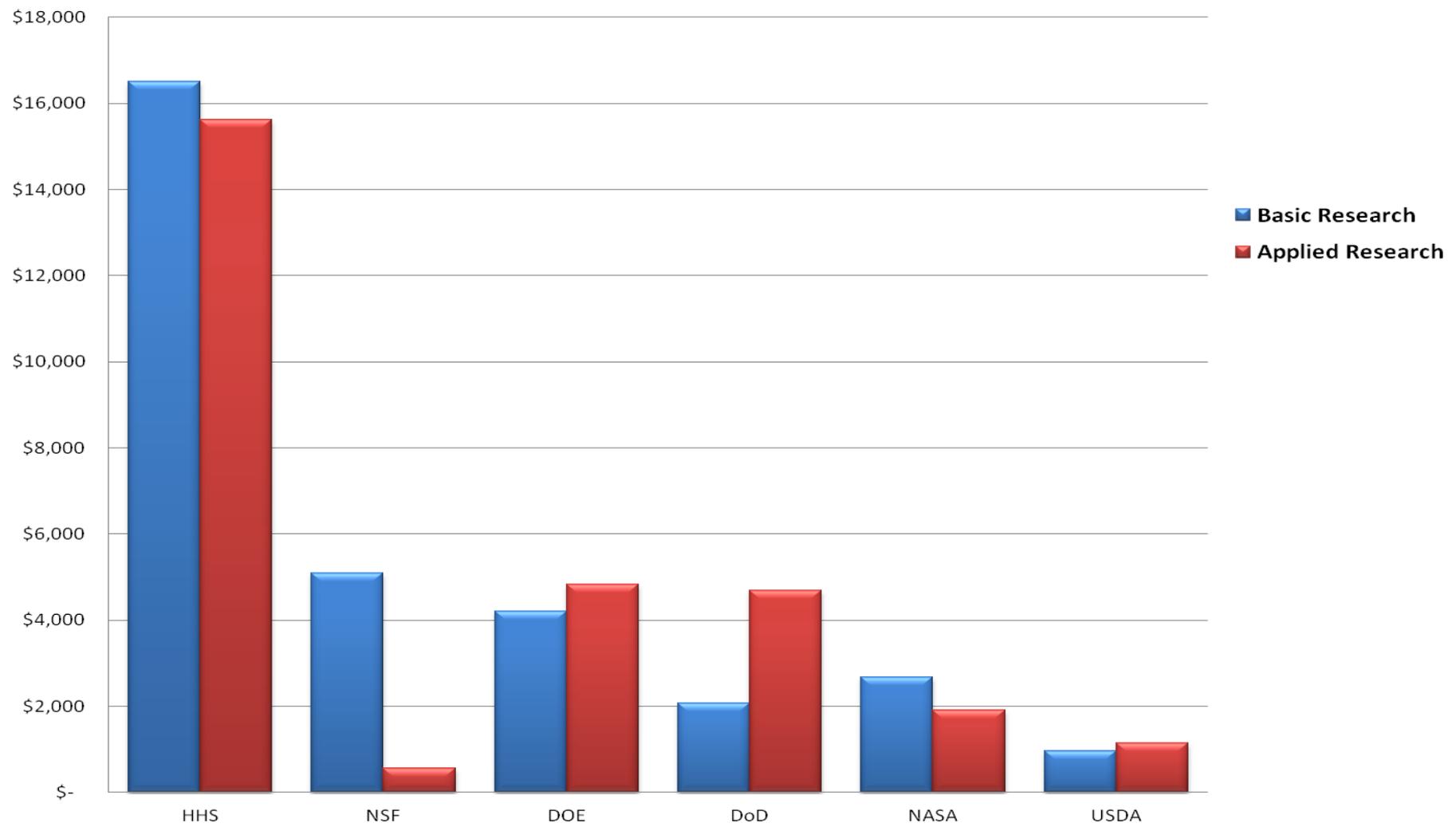
Total  
\$32.9B





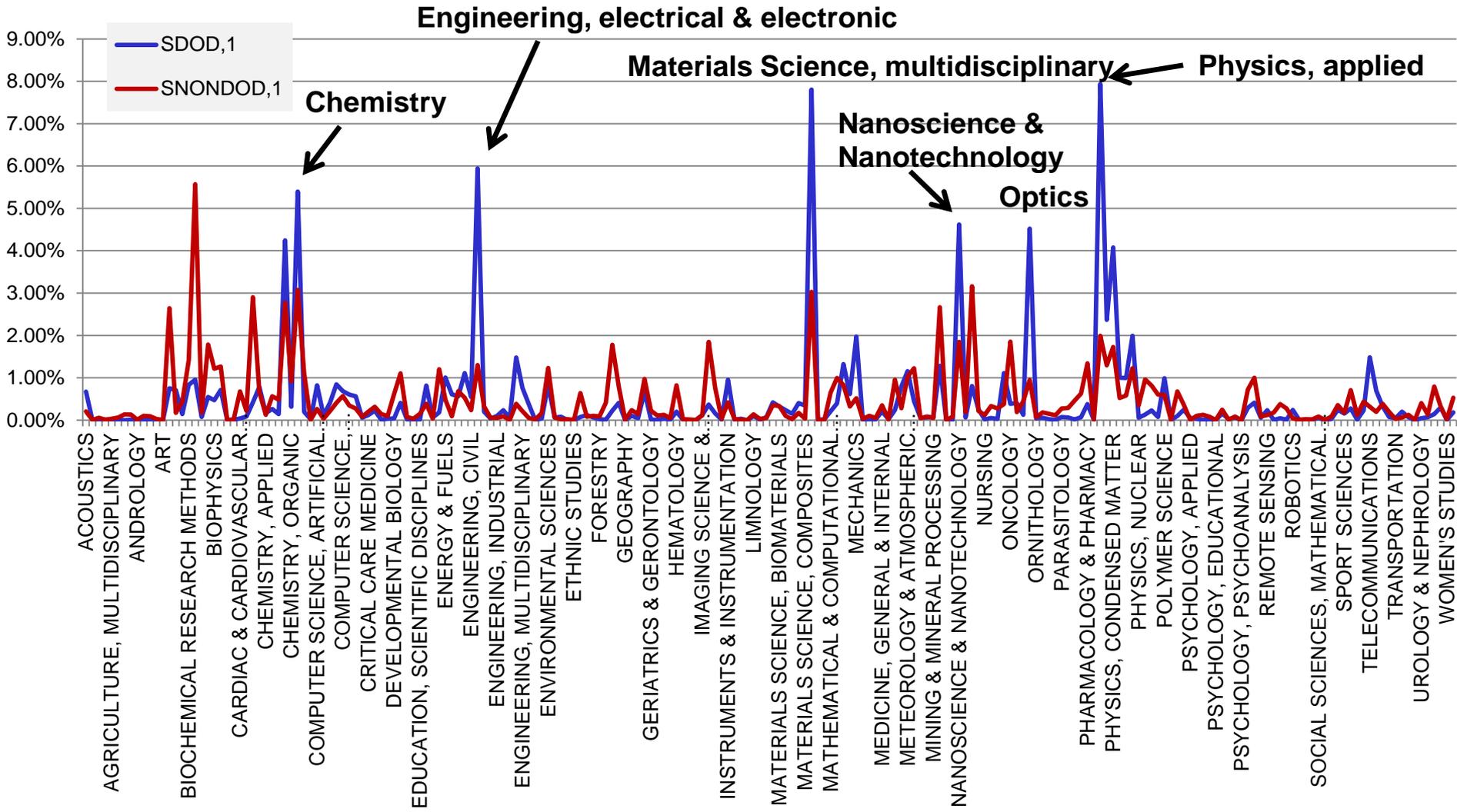
# Basic and Applied Research by Agency

### FY 2012 Basic and Applied Research





# Selective Basic Research Portfolio

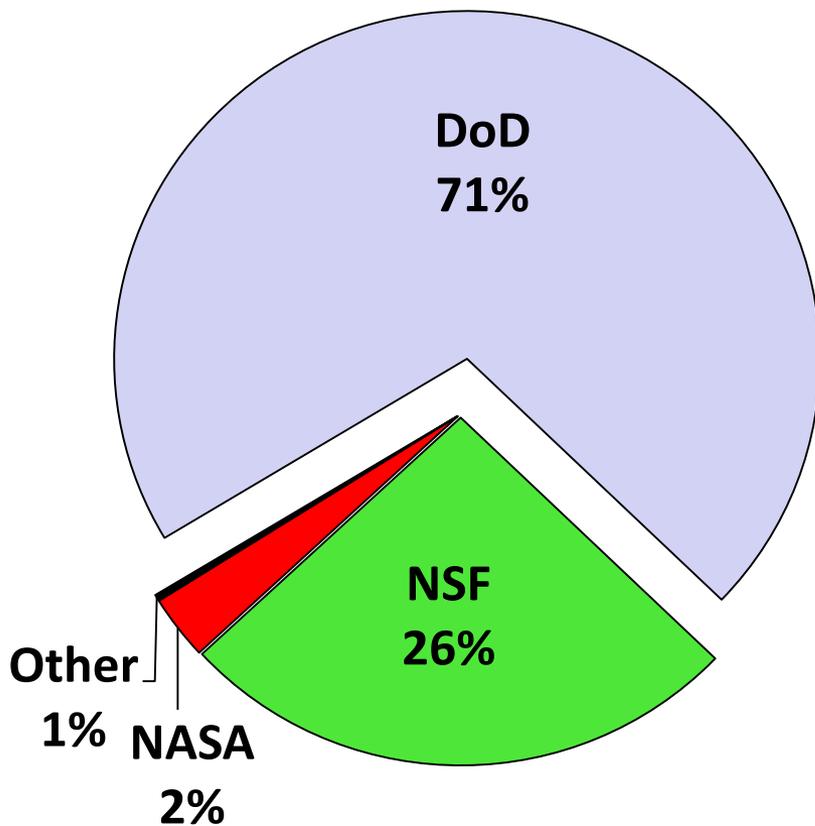




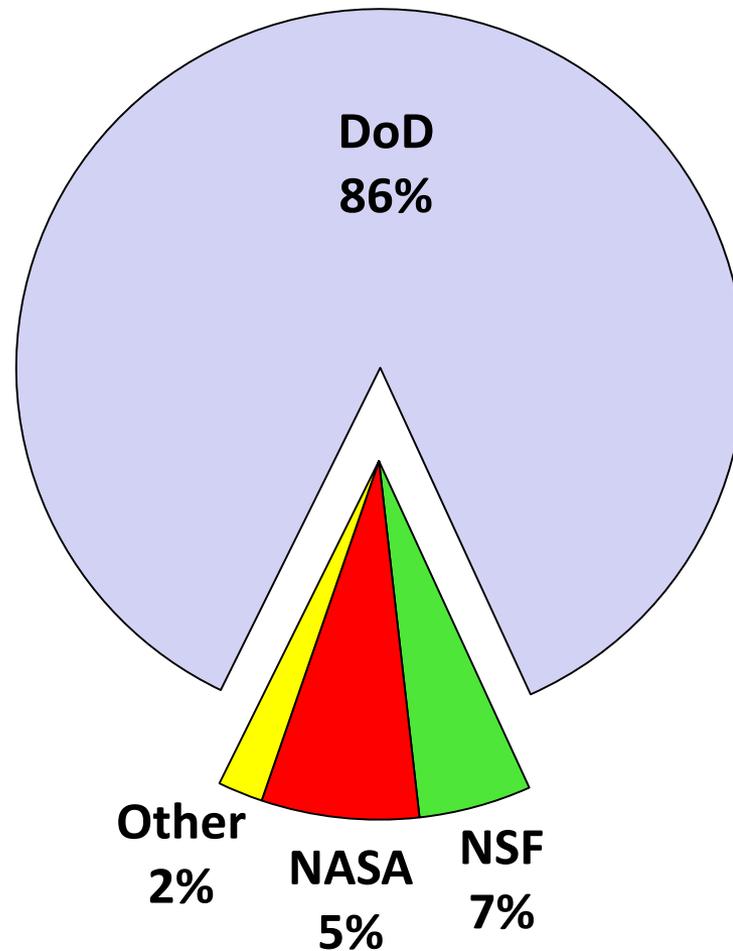
# DoD Dominates Share of Federal Basic Research in Certain Fields



## ELECTRICAL ENGINEERING



## MECHANICAL ENGINEERING



SOURCE: FY 08 obligations from "Federal Funds for Research and Development" survey data on NSF WebCASPAR system

# The First MURIs: 1986



## NEWS RELEASE

OFFICE OF ASSISTANT SECRETARY OF DEFENSE  
(PUBLIC AFFAIRS)

WASHINGTON, D.C. - 20301

PLEASE NOTE DATE

FOR RELEASE AT  
4:00 p.m. EDT

June 26, 1986

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(202) 695-0192 (Info.)  
(202) 697-3189 (Copies)  
(202) 697-5737 (Public/Industry)

### LOD SELECTS ACADEMIC INSTITUTIONS FOR UNIVERSITY RESEARCH INITIATIVE

Secretary of Defense Caspar W. Weinberger announced today the 70 academic institutions selected in the Department of Defense's (DoD) technical competition for the new University Research Initiative (URI). Subject to the successful completion of negotiations between DoD and these institutions and subject to the availability of FY87 funds for URI, approximately \$110 million in FY86/87 funds are expected to be awarded to the 70 institutions for 86 research programs. Programs are expected to range between \$170,000 and \$3 million.

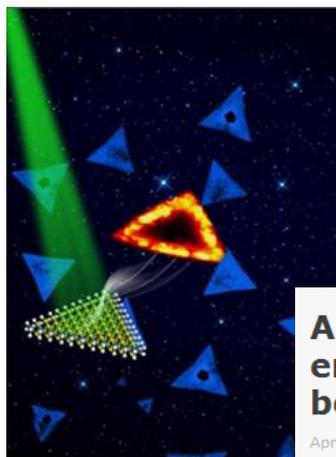


# Basic Research/MURI Impacts



Preliminary results from a commissioned study on the impact of the MURI awards show that the 500+ MURIs have directly lead to:

- 24,500+ publications
- 563,000+ citations
- 570+ patents
- 7,270+ derived patents
- Numerous start-up companies, students trained, and popular press articles



**Army sees potential in light-emitting monolayers to benefit Soldiers**

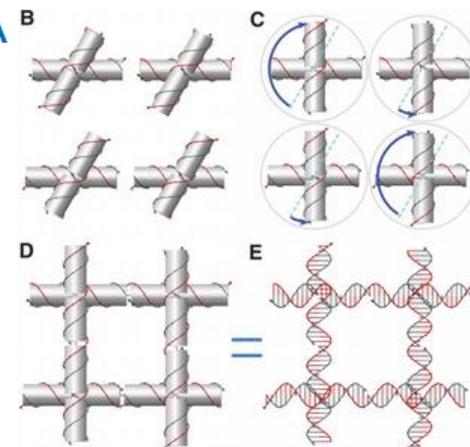
April 9, 2013

**ASU scientists develop innovative twists to DNA nanotechnology**

03/25/2013

3 April 2013

Lowering tunneling resistance in GaN/InGaN/GaN structures



17 April 2013 Last updated at 20:41 ET

**Recruiting engineered cells to work for warfighters**

Wed, 04/10/2013 - 12:22pm

**Footage reveals how insects use their bodies to hover**



# Multidisciplinary University Research Initiatives (MURI): Investing for the Future



- Currently **157 Active MURI Projects** spanning multiple technical fields (details at website below)
- Industry **welcome at annual MURI Reviews**
  - Chance to meet with PIs and other performers
  - Initiate collaborations
  - Keep track of latest basic research innovations
- Next MURI Review – **All NDIA Invited**
  - **Date: July 24-25, 2013**
- **Location : System Planning Corporation Capital Conference Center – One Virginia Square, 3601 Wilson Blvd (6<sup>th</sup> Floor), Arlington, VA**
- **Limited number of seats – check website for registration information (expected to be open after 24 Jun 2013)**

For more information contact: Director, Basic Research  
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Website: [http://www.acq.osd.mil/rd/basic\\_research/](http://www.acq.osd.mil/rd/basic_research/)



# Industrial Outreach

## Industrial Outreach: Instituted

- Invited Industry to attend **MURI Annual Review** through NDIA
  - Attended by 16 major DoD contractors  
Lockheed Martin Skunk Works, Lockheed Martin Advanced Technology, Lockheed Martin Physics, Northrup Grumman, BBN, Applied Research Associates, Robotic Technology Inc, MITRE, iRobot Aerospace, Draper laboratory, Honeywell, Alion, Crane, Intelligent Automation, DGNSS Solutions, Planned Systems International
- Held **MURI 25<sup>th</sup> Anniversary Session** at NDIA Meeting
  - Attended by 50 industry managers
- Posted list of active MURI's on ASD(R&E)/Basic Research website ([http://www.acq.osd.mil/rd/basic\\_research/muri\\_partners/list.html](http://www.acq.osd.mil/rd/basic_research/muri_partners/list.html))
- Invited industry scientists to emerging areas workshops

## Industrial Outreach: Proposed

- Encourage PI presentations at industry-oriented meetings and conferences
- Invite relevant industry reps to MURI and program reviews
- Proposals solicited for new “at the crest-of-the-wave” MURI topics
  - Service-proposed OSD approved topics



## Department of Defense's Basic Research Office

The Basic Research Office focuses on providing scientific leadership and coordination for the Department's basic research programs and stimulates the initiation and support of promising areas of research including those with the potential for transformational significance to future defense capabilities.

### OSD Thrust Areas

- Emerging Scientific Research Areas (Overview)
  - Synthetic Biology
  - Quantum Information Science
  - Cognitive Neuroscience
  - Understanding Human and Social Behavior
  - Novel Engineered Materials
  - Nanoscience

### Basic Research Opportunities

- DoD Strategic Coordination supports \$2.1B in Research
- Grants.gov for programs under which grants or cooperative agreements may be awarded
- Fedbizopps.gov for programs under which procurement contracts may be awarded

### Other Programs/ Links of Interest

#### Offices that Execute Programs

##### Army

- Army Research Office
- Army Medical Research and Materiel Command
- The Army Corps of Engineers
- The Army Research Institute for the Behavioral and Social Sciences

##### Navy

- Office of Naval Research

##### Air Force

- Air Force Office of Scientific Research

#### Other Agencies

- Defense Advanced Research Projects Agency
- Defense Threat Reduction Agency

#### OSD Programs

- Minerva Initiative: University-based social science research Initiative
- Historically Black Colleges and Universities and Minority Institutions (HBCU/MI)

#### Joint Programs

- DoD's FY13 Multidisciplinary University Research Initiative Awards Announced **\*\*NEW\*\***
- Multi-Disciplinary University Research Initiatives (MURI) Program (July/August)
  - MURI Partners List
- Defense University Research Instrumentation Program

### More Resources

- Federal Business Opportunities
- All Industry Resources
- 2012 Big Data Solicitations
- Current S&T Emphasis Area Solicitations
- Army Resources
- Navy Resources
- Air Force Resources
- USMC Resources
- Announced Army, Navy, & OSBP FY12 Rapid Innovation Fund BAAs
- 2011 Rapid Innovation Fund Awards
- Other DoD Resources

Overview of  
OSD Thrust  
Areas and  
General  
Presentations

Link to  
MURI  
Partner  
list  
2007-  
2013  
Projects



## Topics to be reviewed in July 2013 Program Review

- **Controlling the Abiotic/Biotic Interface to Enable Bio-Nanostructures with Unique Functionality**
- **Quantum Stochastics and Control**
- **Qubit-Enabled Imaging, Sensing & Metrology**
- **Flex-Activated Materials**
- **Game Theory for Adversarial Behavior**
- **Light Filamentation**
- **Value of Information for Distributed Data Fusion**
- **Novel Free-Standing 2D Crystalline Materials (Oxides/Nitrides)**
- **Nanofabrication of Tunable 3D Nanotube Architectures**
- **Quantum Memories and Light-Matter Interfaces**
- **Nanostructural Control of Thermal and Electrical Transport Properties with Organic Hybrid Materials**
- **Investigation of 3-D Hybrid Integration of CMOS/Nanoelectronic Circuits**
- **Science of Cyber Security**
- **Large Scale Integrated Hybrid Nanophotonics**
- **Knowledge Representation and Reasoning for Decentralized Autonomy**
- **III-Nitride Terahertz Electronics — Scaling strategies beyond Silicon**
- **Charge Transport in DNA Molecular Wire**
- **Integrated Oceanographic, Atmospheric, and Acoustic Physics**
- **Improved Meteorological Modeling in Mountainous Terrain**
- **Bacterial or Cellular Controllers for Device Autonomy**
- **NanoScience-based High-Speed Fabrication of Full Function Hybrid Flexible Electronic Systems**
- **Atomic-Scale Interphases: Exploring New Material States**



# New MURI Cutting Edge Topics



**Quantum Dynamics / Quantum Chemistry**

**Information Science / Mathematics**

**Nano – devices and circuits**

**Advanced Metamaterial Structures**

**New Approaches to Biology / Synthetic Biology**

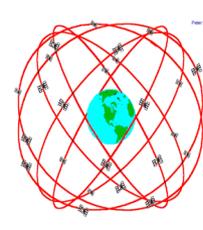
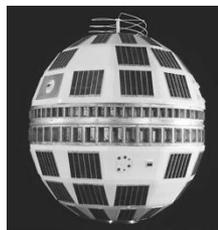
**Novel Functional Materials**

**Complex EM Propagation**

**Non-traditional Fluid Dynamics**



# DoD Basic Research: the Early Foundations of Progress



40s	50s	60s	70s	80s	90s	00s
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<ul style="list-style-type: none"> <li>• Nuclear weapons</li> <li>• Radar</li> <li>• Proximity fuse</li> <li>• Sonar</li> <li>• Jet engine</li> <li>• LORAN</li> </ul>	<ul style="list-style-type: none"> <li>• Digital computer</li> <li>• ICBM</li> <li>• Transistor</li> <li>• Laser technology</li> <li>• Nuclear propulsion</li> <li>• Digital comm.</li> </ul>	<ul style="list-style-type: none"> <li>• Satellite comm.</li> <li>• Integrated circuits</li> <li>• Phased-array radar</li> <li>• Defense networks</li> <li>• Airborne surv.</li> <li>• MIRV</li> </ul>	<ul style="list-style-type: none"> <li>• Airborne GMTI/SAR</li> <li>• Stealth</li> <li>• Strategic CMs</li> <li>• IR search and track</li> <li>• Space track network</li> <li>• C2 networks</li> </ul>	<ul style="list-style-type: none"> <li>• GPS</li> <li>• UAVs</li> <li>• Night vision</li> <li>• Personal computing</li> <li>• Counter-stealth</li> <li>• BMD hit-to-kill</li> </ul>	<ul style="list-style-type: none"> <li>• Wideband networks</li> <li>• Web protocols</li> <li>• Precision munitions</li> <li>• Solid state radar</li> <li>• Advanced robotics</li> <li>• Speech recognition</li> </ul>	<ul style="list-style-type: none"> <li>• GIG</li> <li>• Armed UAVs</li> <li>• Optical SATCOM</li> <li>• Data mining</li> <li>• Advanced seekers</li> <li>• Decision support</li> </ul>
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