



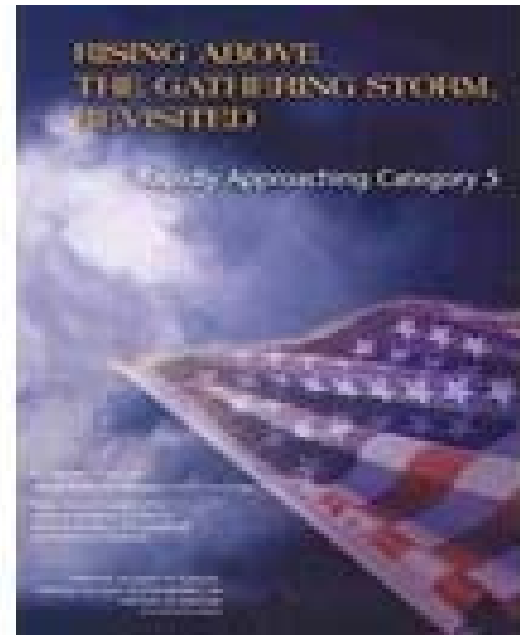
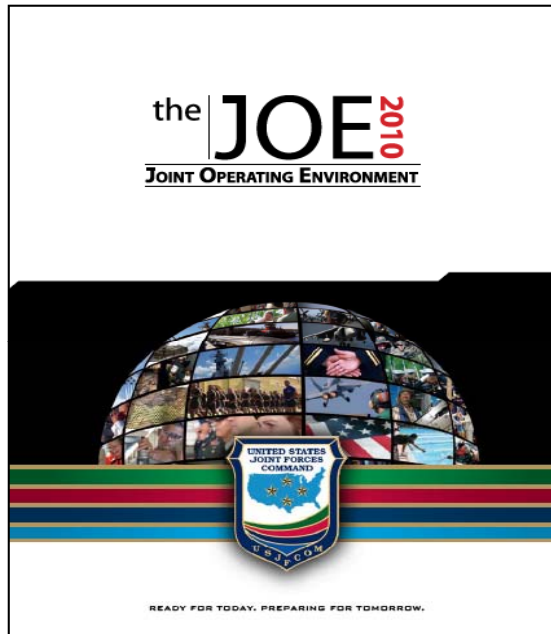
# **Building the Future Technical Workforce for the U.S. Department of Defense and the U.S. Defense Industrial Base**

**1 August 2011**

**The Honorable Zachary J. Lemnios  
Assistant Secretary of Defense for  
Research and Engineering**



# Global Challenges



**Shift in World Demographics**  
**Technology Globalization**  
**Shifting Global Economics**  
**Limited World Energy Resources**  
**Challenges to Existing State Structures**  
**WMD proliferation**

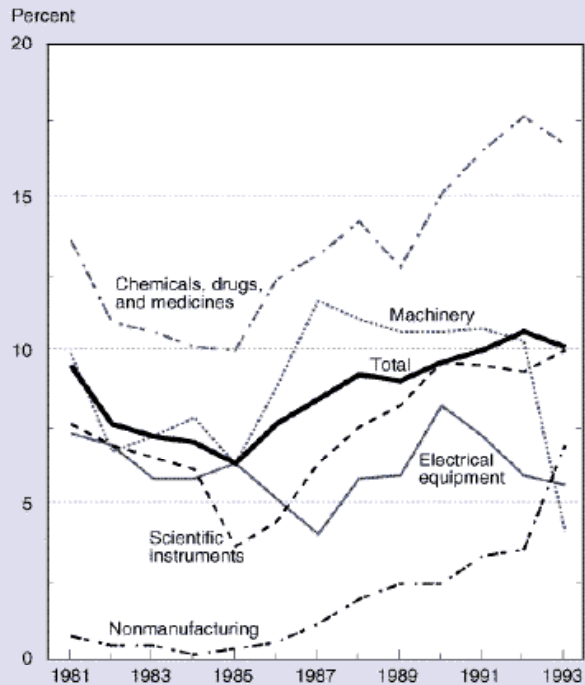
**Innovation and Competitiveness**  
**Knowledge Capital**  
**Human Capital**  
**Creative "Ecosystem"**



# Technical R&D Outsourcing



Figure 4-24.  
U.S. overseas R&D as a share of company-financed domestic R&D, by industry

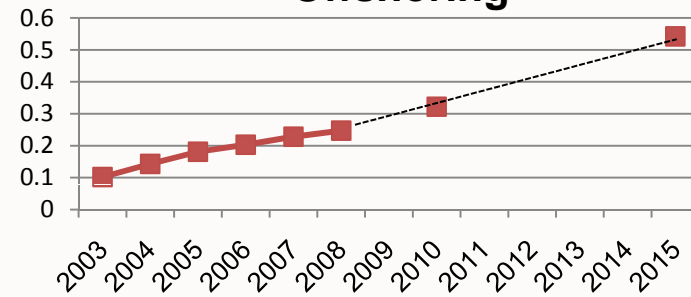


See appendix table 4-40. Science & Engineering Indicators – 1996

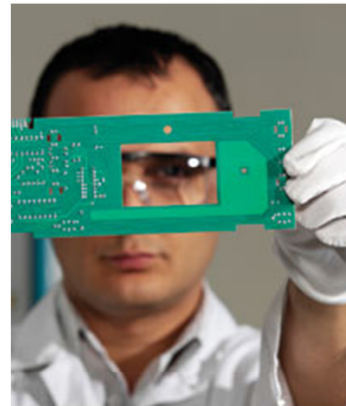
In certain fields, U.S. firms are increasingly outsourcing R&D

## Computer Jobs Annual Offshoring

Millions of jobs sent overseas annually, mostly to subsidiaries & multinationals



## Wage incentives for offshoring R&D:

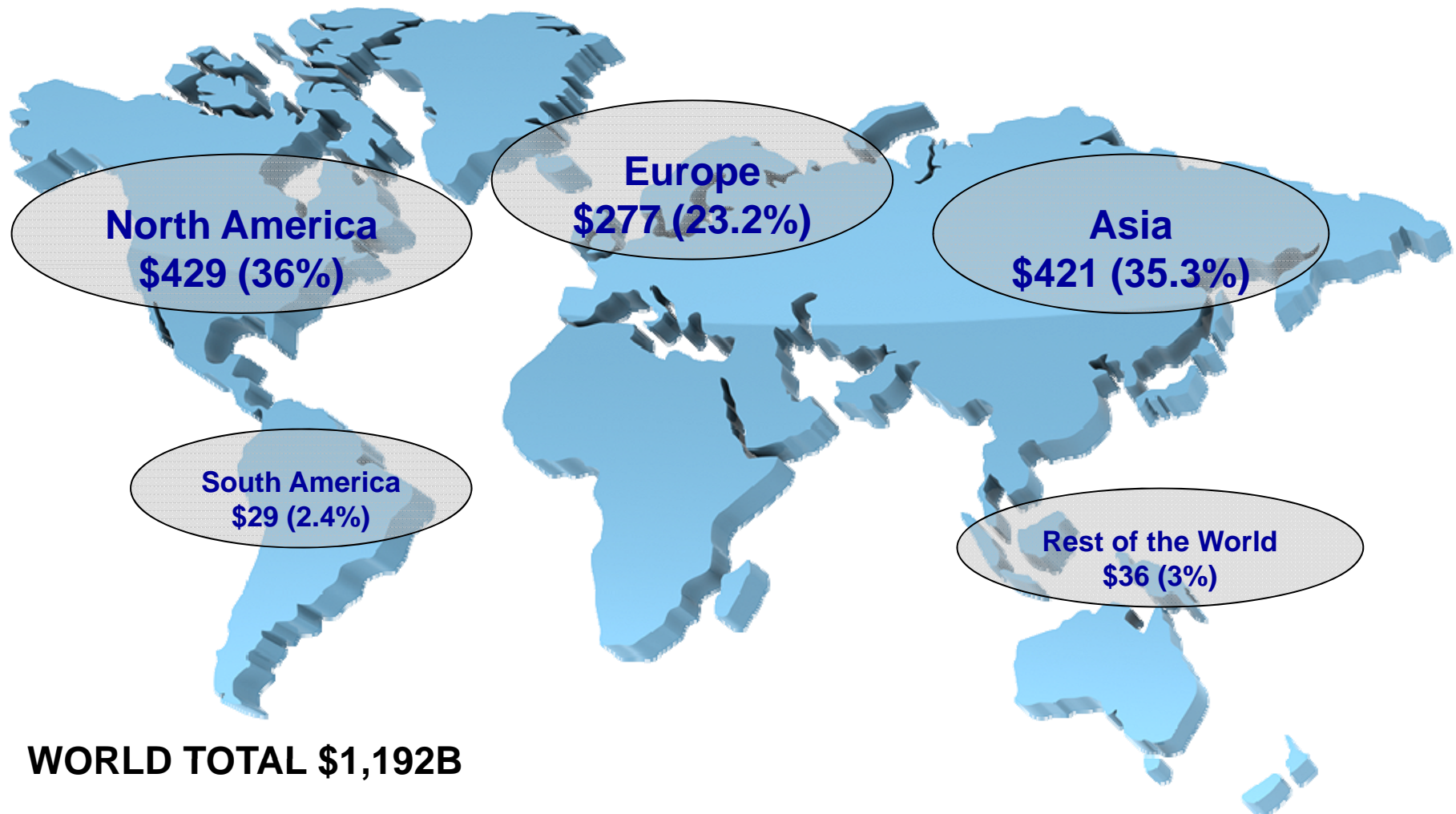


Electronic Engineer	
Offshorability Index	70
# of Jobs in U.S.	135,990
Average Annual Wage in U.S.*	\$91,500
Average Annual Wage in India <sup>#</sup>	\$13,200
Average Annual Wage in China <sup>§</sup>	\$26,000
Average Annual Wage in Phillipines <sup>†</sup>	\$7,000

Source: William Dube, "Outsourcing and the Future of American Innovation," Research at RIT (Rochester Institute of Technology), [http://www.rit.edu/research/other\\_story.php?id=37](http://www.rit.edu/research/other_story.php?id=37)



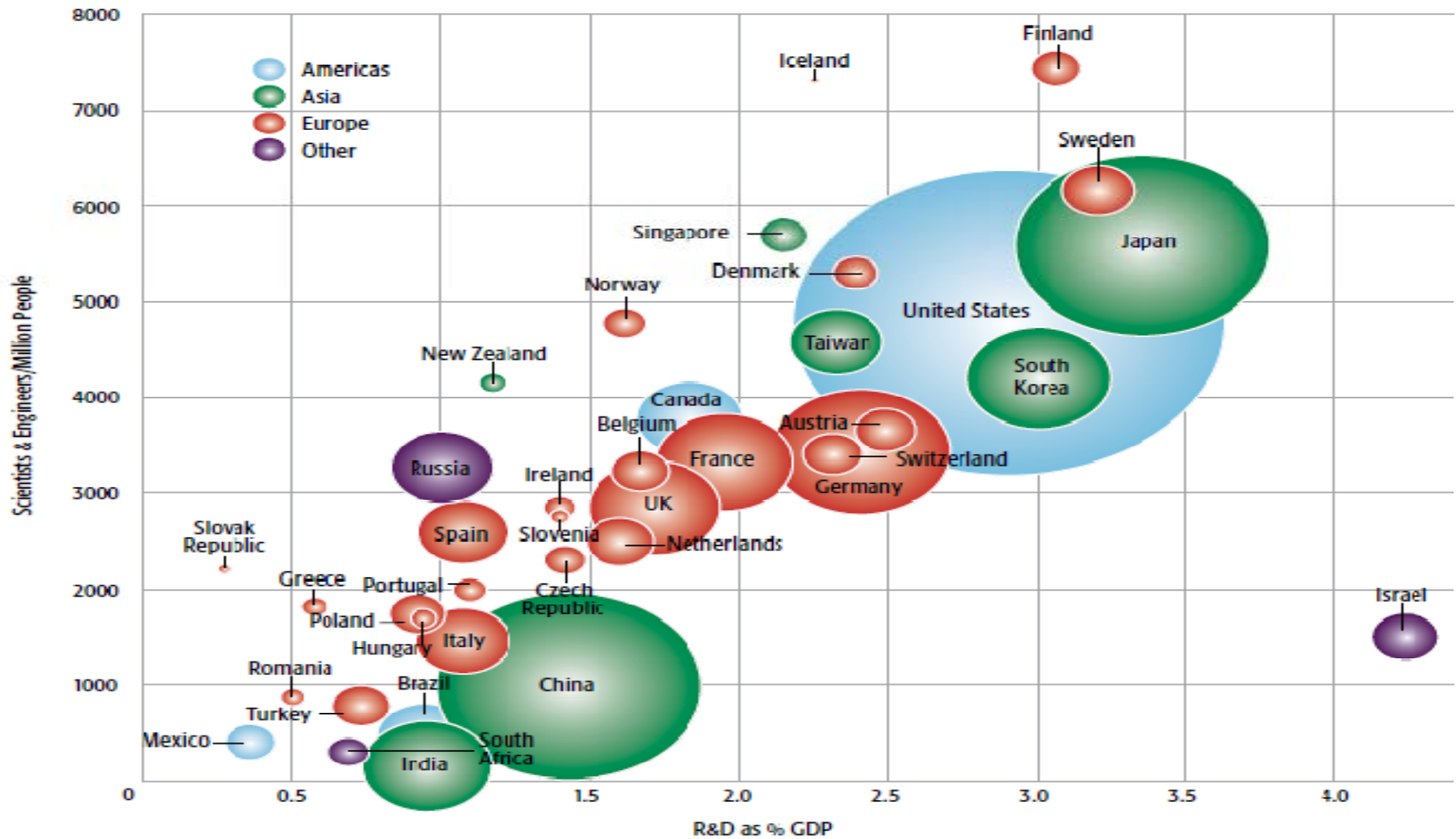
# Globalization of R&D



Source: [www.rdmag.com](http://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





# The Challenges for Global R&E



## Foreign investments, particularly in China

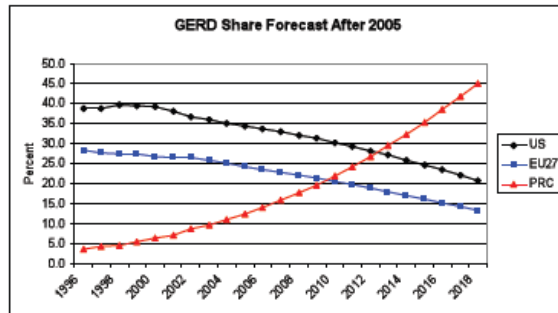


Figure 3. Forecasts of national R&D investment shares. GERD share of OECD Group percent. (Historical data through 2005.)

## Projected science publications, falling behind China

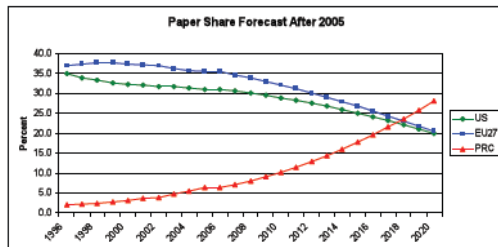


Figure 5. Forecasts of scientific publication share (after 2005) using forecasts of GERD share input to the model.

## Questioning continued leadership:

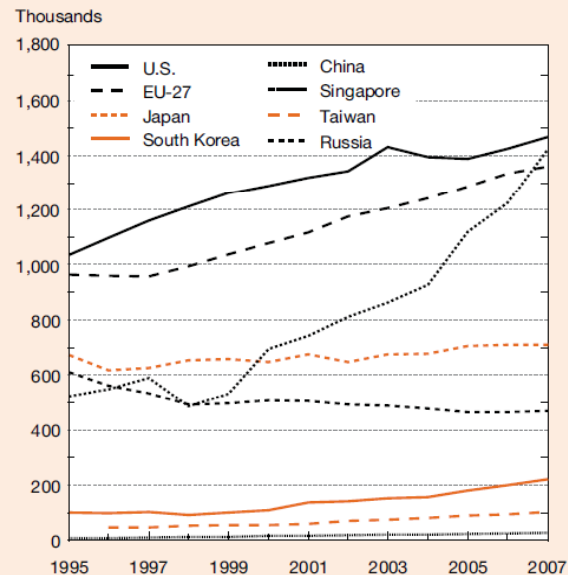
The Race for World Leadership of Science and Technology: Status and Forecasts

R. D. Shelton<sup>1</sup> and P. Foland<sup>2</sup>

<sup>1</sup> shelton@ScienceUS.org  
WTEC, 86% Golde Street, Johnstown, PA 15902 (USA)

Of the World Technology Evaluation Center, www.wtec.org

Figure 3-48 Estimated number of researchers in selected regions/countries/economies: 1995–2007



EU = European Union

NOTES: Researchers are full-time equivalents. 2007 data for United States are estimated based on annual growth rate between 1995 and 2006.

SOURCE: Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (2009/1 and earlier years).

Science and Engineering Indicators 2010

## Industry moving R&D Centers overseas



Kevin Wale, President and Managing Director of GM China, at the groundbreaking for the GM China Advanced Technology Center

“Whenever manufacturing is located in a country, innovation always follows”--Vince Feng, Hong Kong-based managing director for General Atlantic Partners, quoted in Business Week, Nov 6, 2006



# Integrated S&T Enterprise

## Missions

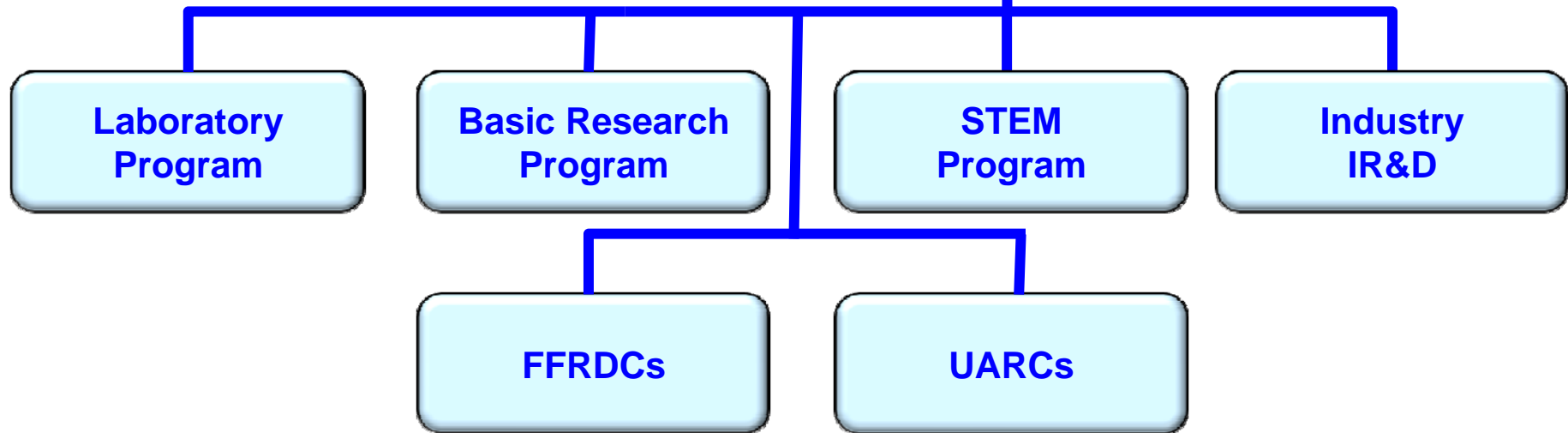
- National Defense Strategy
- Quadrennial Defense Review
- Space Posture Review
- Nuclear Posture Review

## Operational Challenge

JUONs, UONs, COCOM  
IPL

Objective Architectures

Critical Capabilities      Enabling Technologies





# Department S&T Priorities



## Complex Threats

**Electronic Warfare / Electronic Protection**

**Cyber Science and Technology**

**Counter Weapons of Mass Destruction**

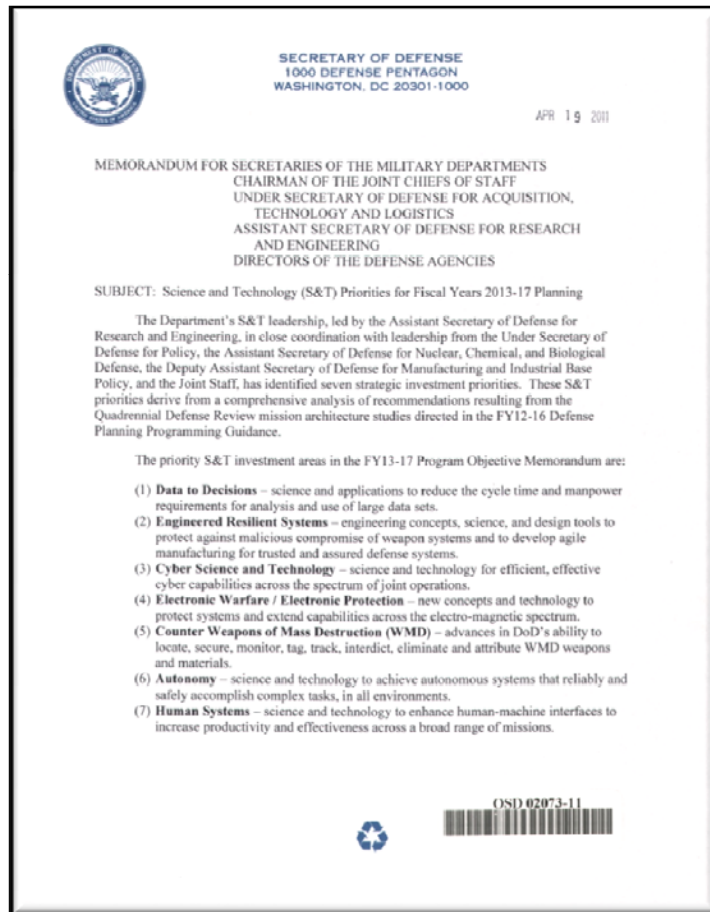
## Force Multipliers

**Data-to-Decisions**

**Autonomy**

**Engineered Resilient Systems**

**Human Systems**



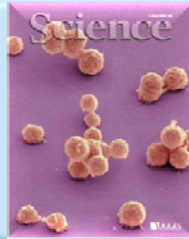




# High Interest Basic Science Areas



**Synthetic Biology**



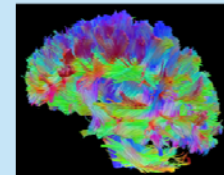
**Modeling of Human Behavior**



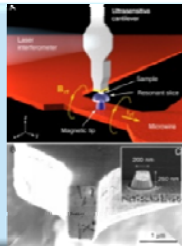
**Engineered Materials**



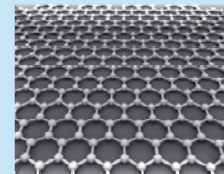
**Cognitive Neuroscience**



**Quantum Systems**




**Nano Science and Engineering**





# ASD(R&E) STEM Landscape



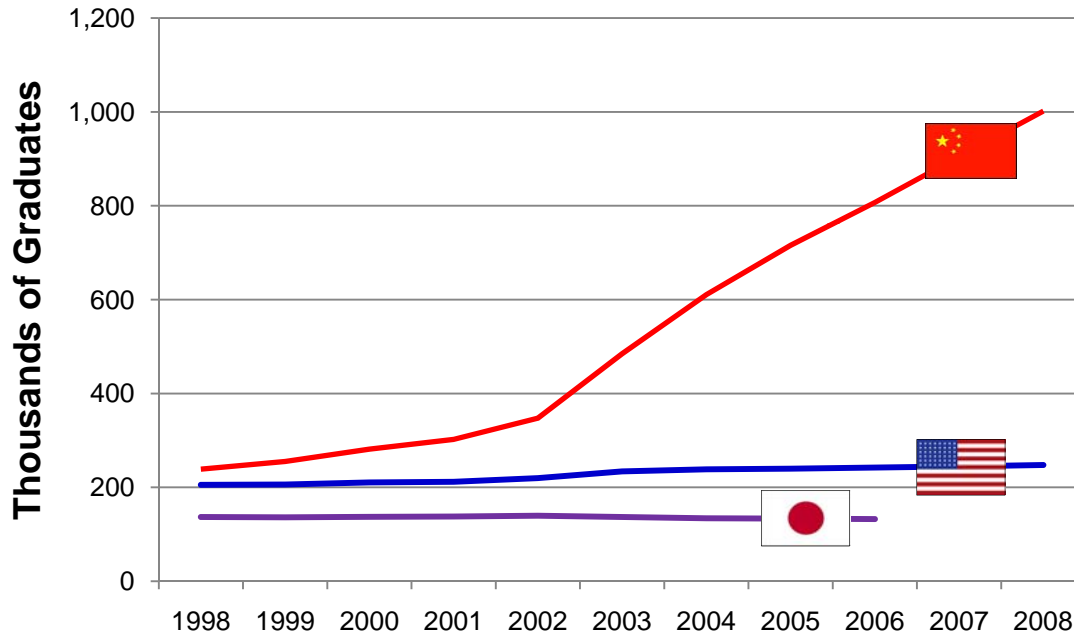
PRE-K & ELEMENTARY	JUNIOR HIGH	HIGH SCHOOL	BACHELORS	MASTERS	DOCTORAL	FACULTY		
<b>K-12 INFORMAL EDUCATION</b>								
 <ul style="list-style-type: none"> <li>• 180,000 K-12 students</li> <li>• 8,000 K-12 teachers</li> <li>• 9,750 undergraduate / graduate students</li> <li>• 250 PIs/faculty/researchers</li> <li>• 100+ universities and colleges</li> </ul>			ASSURE					
			SE CAPSTONE					
			SMART					
			HBCU / MSI PROGRAM					
						BASIC RESEARCH		
							NDSEG	
						NSSEFF		
					PECASE			



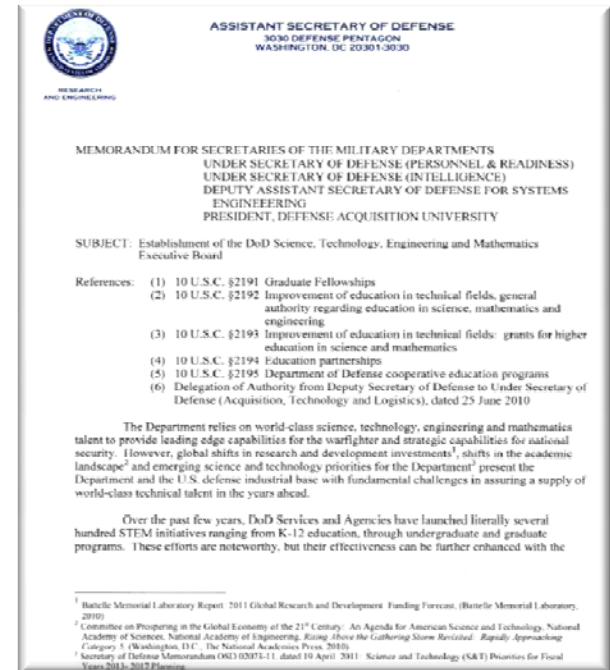
# Shaping the Department's Future Workforce



## First Degrees in Natural Sciences and Engineering by Country



Source: National Science Board, S&E Indicators, 2010; SDO Analysis



OSD Services, Agencies, Components	K – 12	Undergrad / Grad	Teachers	Faculty	Military	Public Outreach
33*	1,700,000 students	11,000	23,000	300	1,600	Est. 2,250,000

\*Estimates with revisions in June 2011



# National Academies Study



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## Science, Technology, Engineering and Mathematics Workforce Needs for the U.S. Department of Defense and the U.S. Defense Industrial Base

1. Review current projected STEM workforce needs.
2. Assess current limitations to meeting these needs
3. Identify approaches for overcoming limiting factors
4. Identify emerging S&T fields that will likely have significant impact on the DOD/national needs (5-15 years).
5. Provide analysis on the capacity of the nation's higher education enterprise in meeting the necessary scale and scope of STEM workforce needs for DOD and the defense industrial base.