

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

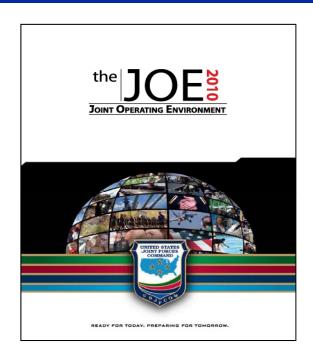
1 August 2011

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

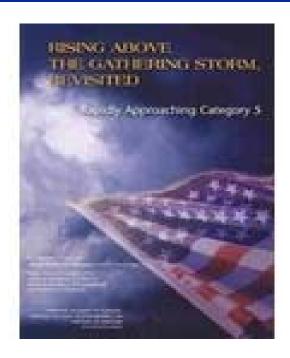


Global Challenges





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



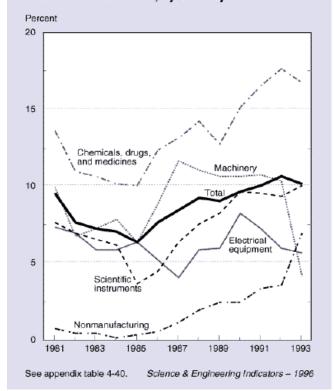
Innovation and Competitiveness
Knowledge Capital
Human Capital
Creative "Ecosystem"



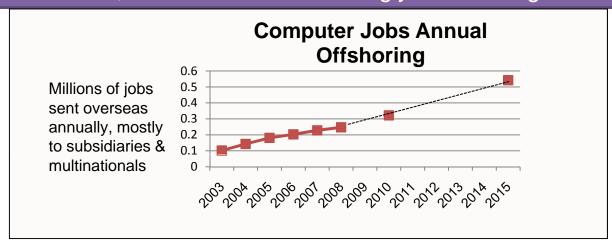
Technical R&D Outsourcing



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



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



Wage incentives for offshoring R&D:

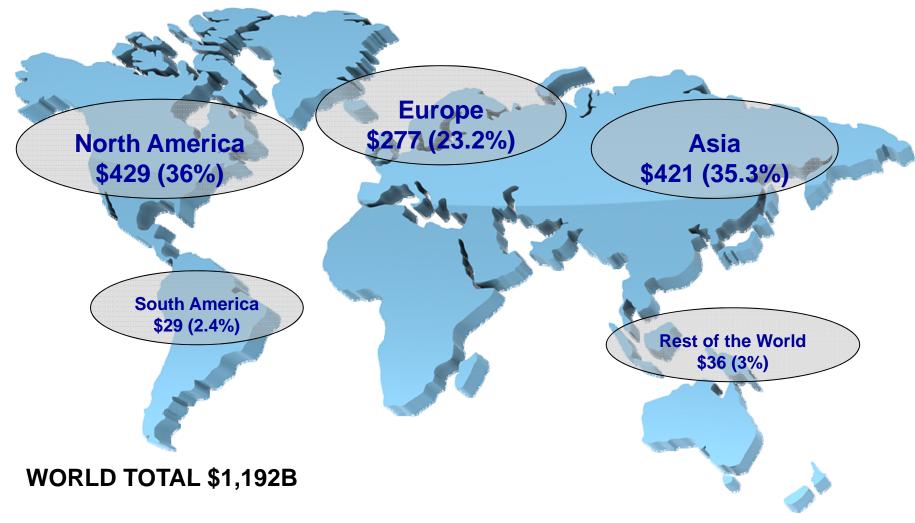


Source: William Dube, "Outsourcing and the Future of American Innovation," Research at RIT (Rochester Institute of Technology), http://www.rit.edu/research/other_story.php?id=37



Globalization of R&D



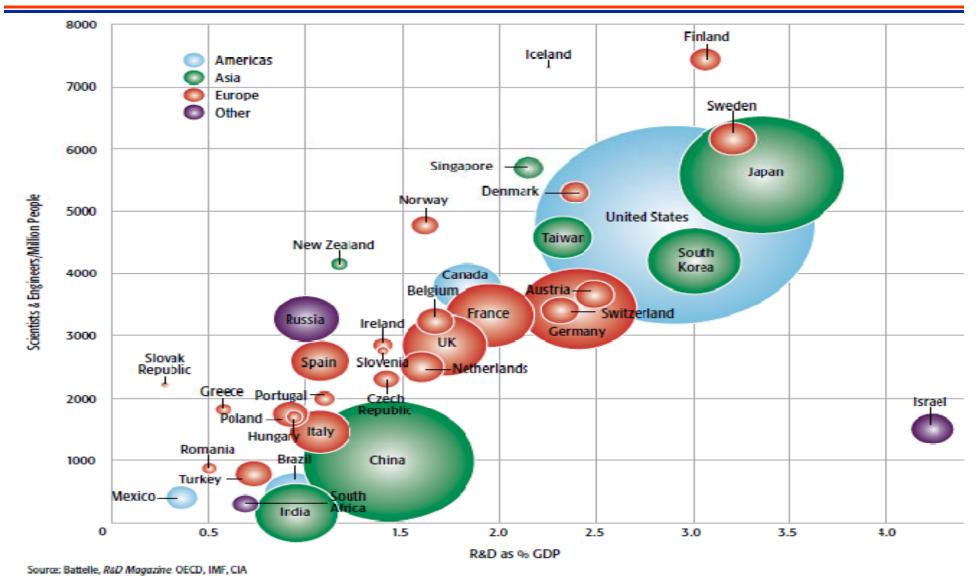


Source: www.rdmag.com "2011 Global R&D Funding Forecast" - Battelle



World R&D Trends: A Global Shift







The Challenges for Global R&E



Foreign investments, particularly in China

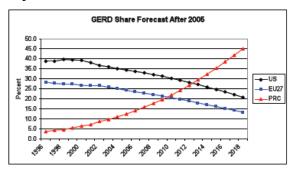


Figure 3. Forecasts of national R&D investment shares. GERD share of OECD Groupercent. (Historical data through 2005.)

Projected science publications, falling behind China

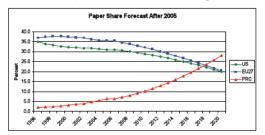


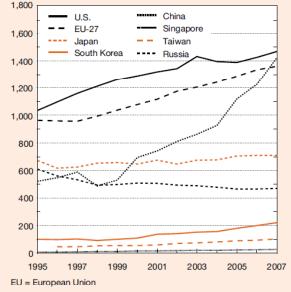
Figure 5. Forecasts of scientific publication share (after 2005) using forecasts of GERD share input to the model.

Questioning continued leadership:

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

R. D. Shelton1 and P. Foland2

'shelton@ScienceUS.org WTEC, 86½ Golde Street, Johnstown, PA 15902 (USA) Figure 3-48
Estimated number of researchers in selected regions/countries/economies: 1995–2007
Thousands



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

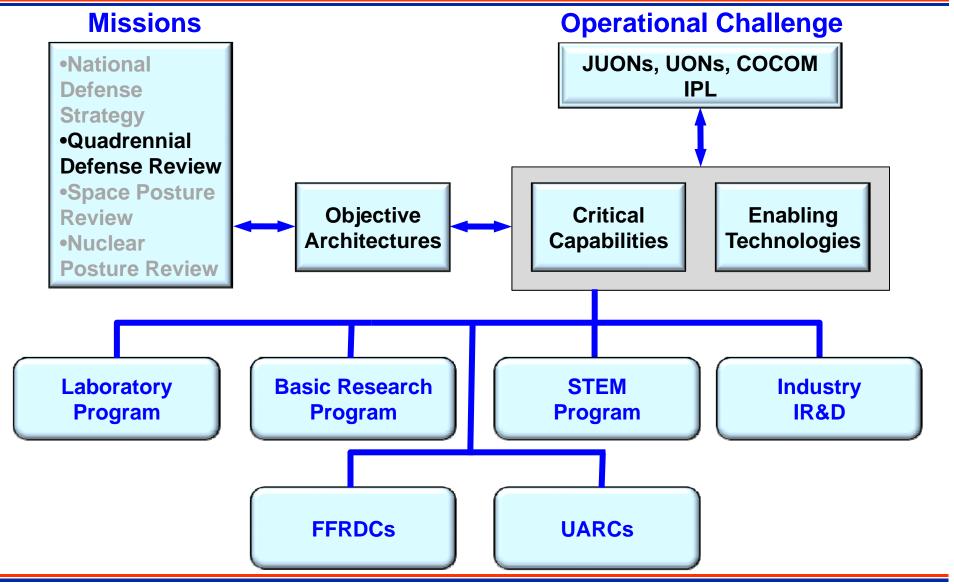
"Whenever manufacturing is located in a country, innovation always follows"--Vince Feng, Hong Kongbased managing director for *General Atlantic Partners*, *quoted in Business Week*, *Nov* 6, 2006

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



Integrated S&T Enterprise







Department S&T 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:

- 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.





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



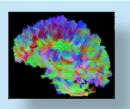
Modeling of Human Behavior



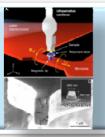
Engineered Materials



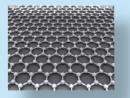
Cognitive Neuroscience



Quantum Systems



Nano Science and Engineering





ASD(R&E) STEM Landscape



PRE-K & ELEMENTARY	JUNIOR HIGH	HIGH SCHOOL	BACHELORS	MASTERS	DOCTORAL	FACULTY
K-12 INFORMAL EDUCATION						
TO STATE OF THE ST			ASSURE			
			SE CAPS	STONE		
			SMART			
			Н			
				BASIC RESEARCH		
					NDSEG	
•180,000 K-12 students • 8,000 K-12 teachers			NSSEFF			
•	rgraduate / gra	aduate				PECASE

• 250 Pls/faculty/researchers

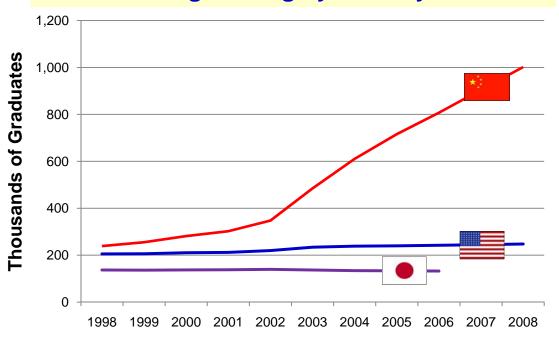
• 100+ universities and colleges

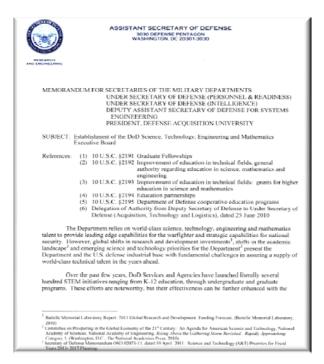


Shaping the Department's Future Workforce



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



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.