

THE NAVAL
STEM SCIENCE
TECHNOLOGY
ENGINEERING
MATHEMATICS
FORUM



Naval STEM Forum

RADM Nevin P. Carr
Chief of Naval Research
15 June 2011

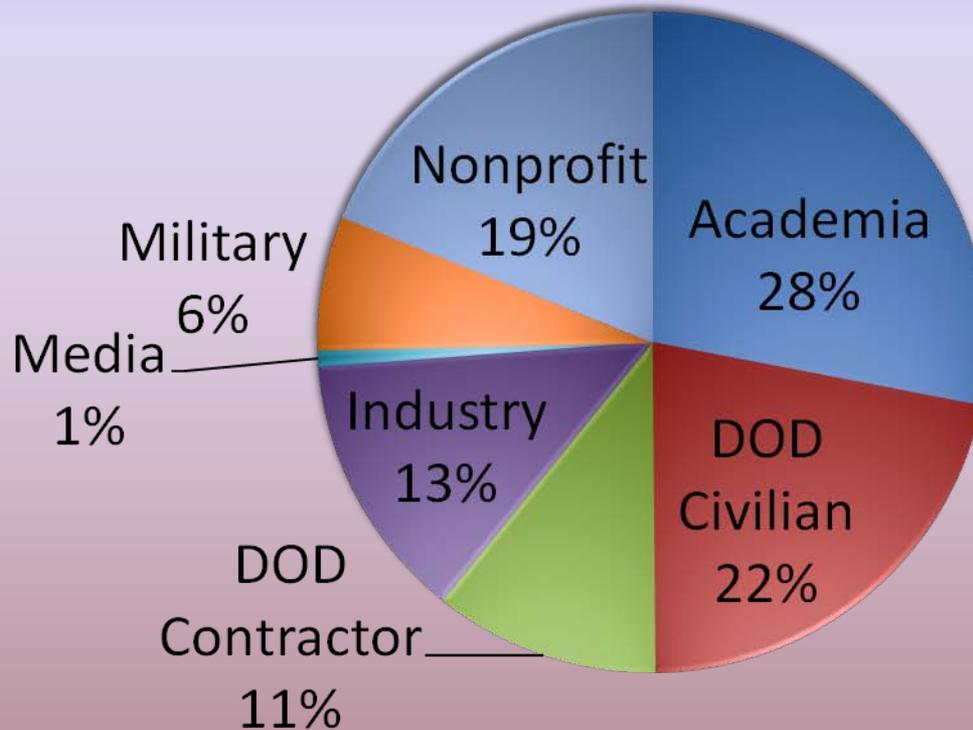




Welcome!



Participant Demographics



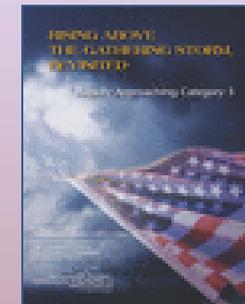
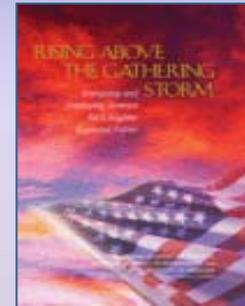


The Gathering Storm



Recommendations from “Rising Above the Gathering Storm” (2005 & 2010):

- 1) Increase America's talent pool by vastly improving K-12 mathematics and science education
- 2) Sustain and strengthen the nation's commitment to long-term basic research
- 3) Develop, recruit, and retain top students, scientists, and engineers from both the U.S. and abroad
- 4) Ensure that the United States is the premier place in the world for innovation.

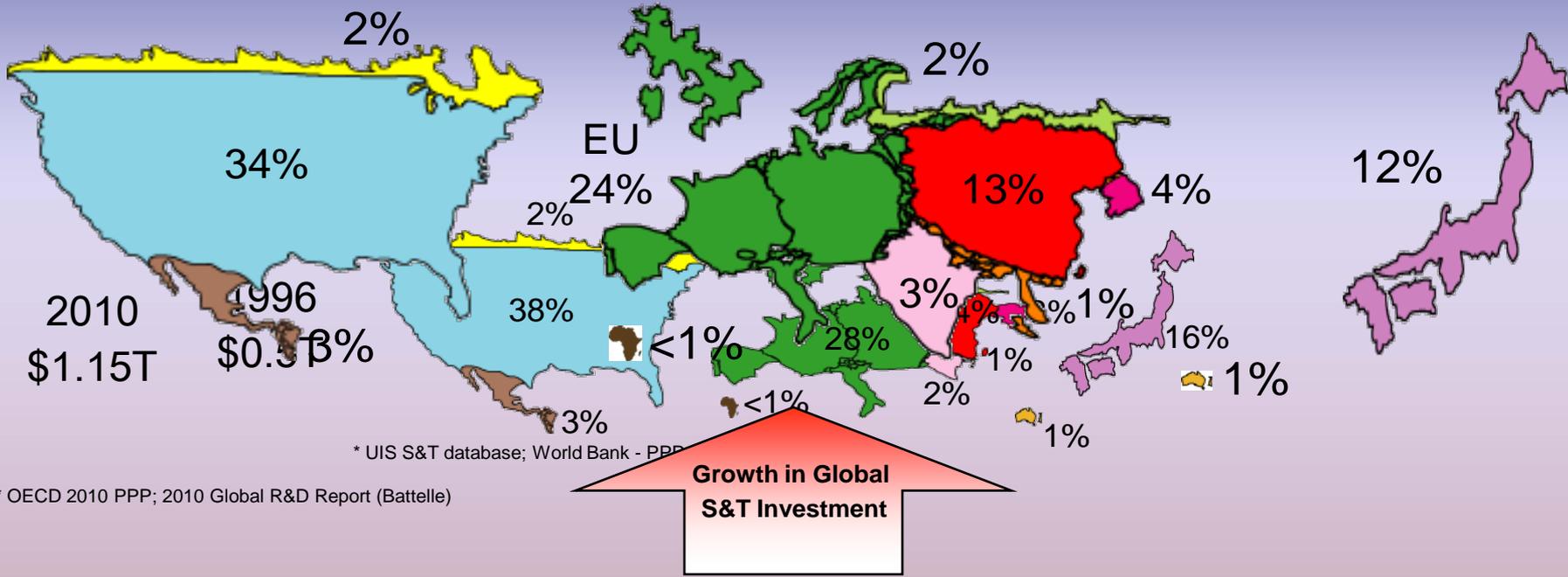


The U.S. has fallen to 27th (out of 29) for the rate of STEM bachelors degrees awarded in developed countries

(Organization for Economic Cooperation and Development, 2009)



Global R&D Trends



* UIS S&T database; World Bank - PPP

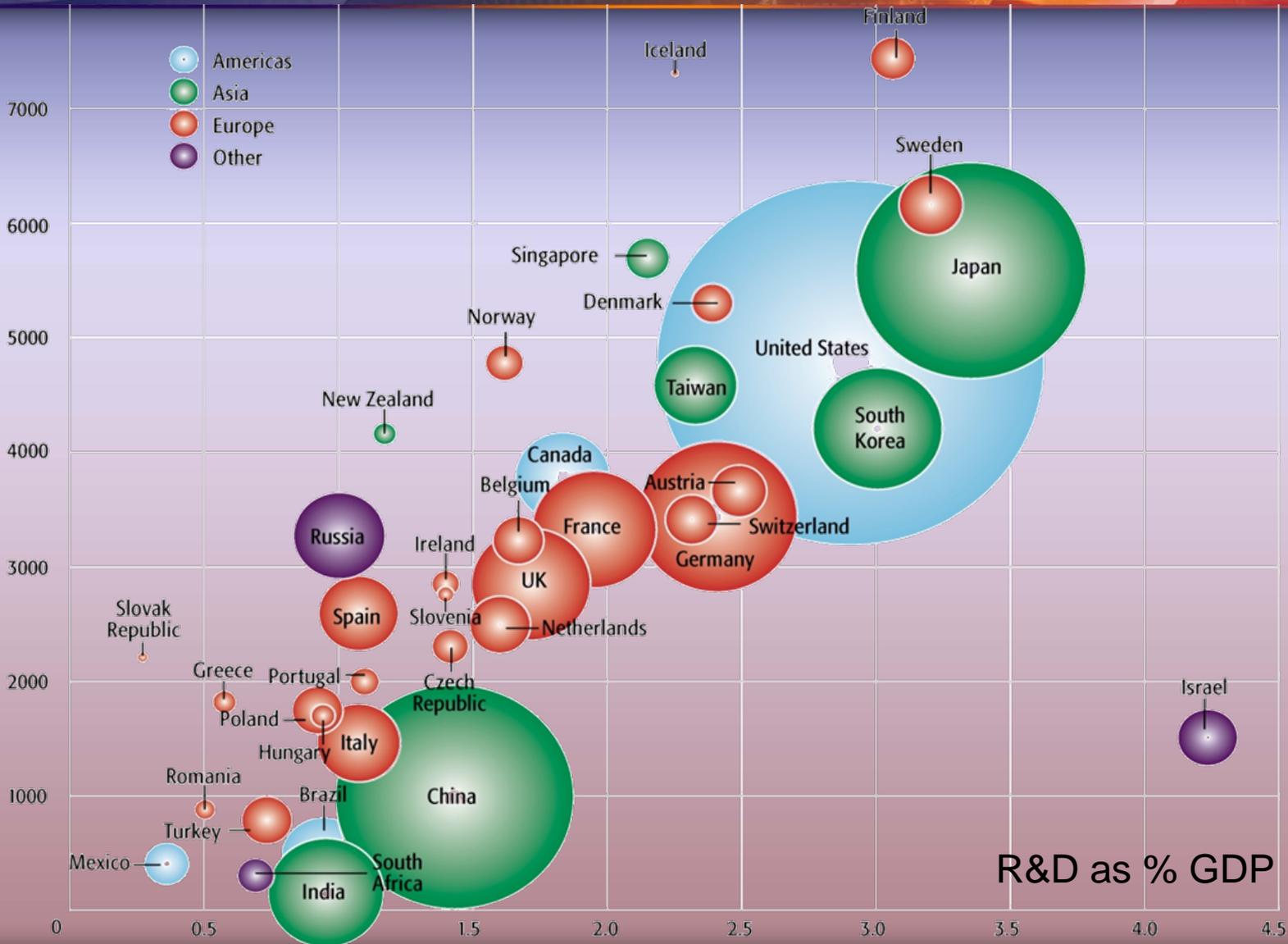
** OECD 2010 PPP; 2010 Global R&D Report (Battelle)



...Relative to Population & GDP



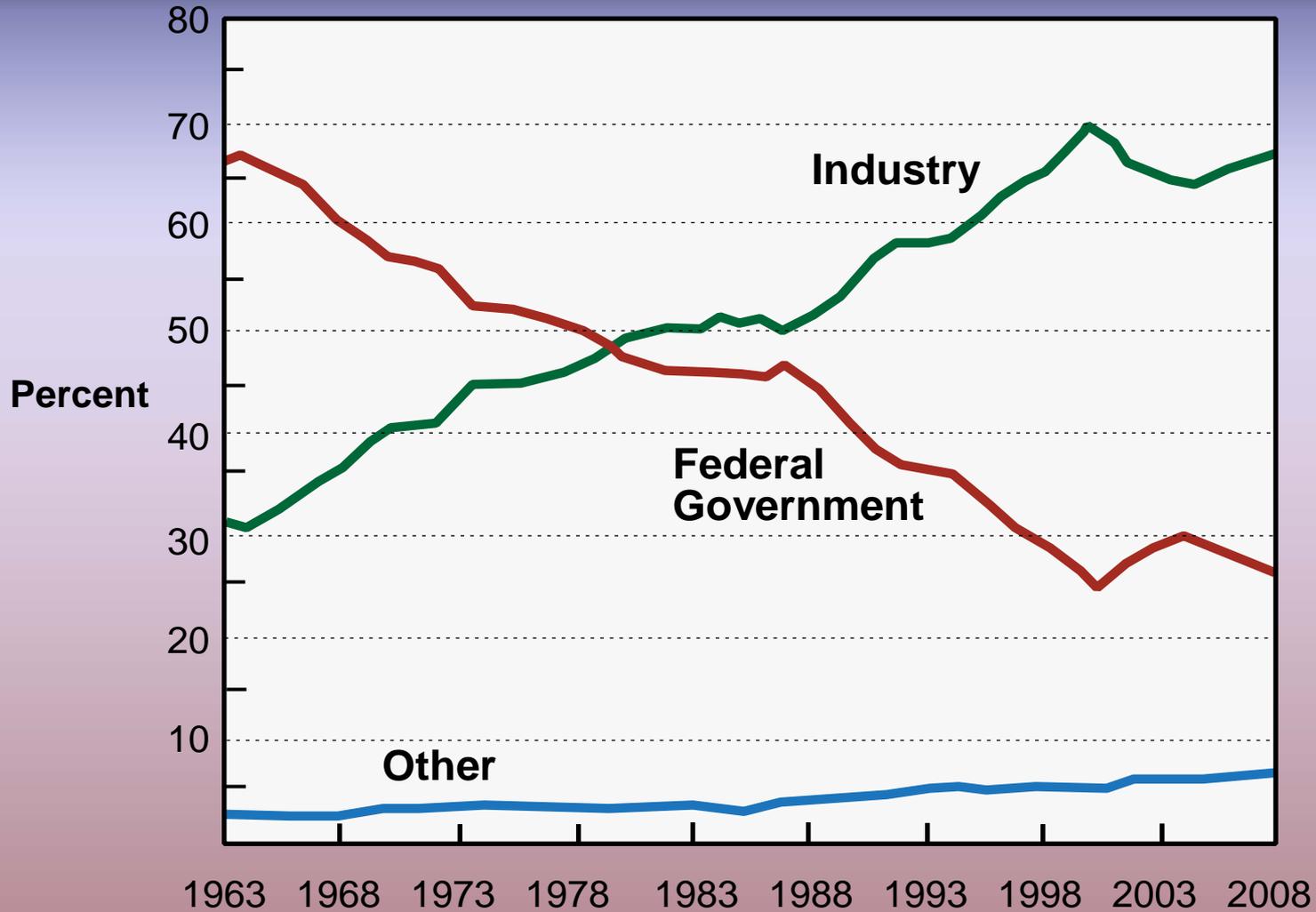
Scientists & Engineers/Million People



R&D as % GDP



U.S. R&D Trends



Source: National Science Foundation, Division of Science Resource Statistics, *Science and Engineering Indicators 2010* ("Other" is academia, non-profits)



Naval Technology Past



Naval S&T Milestones ACCOMPLISHMENTS ACROSS ALL DOMAINS



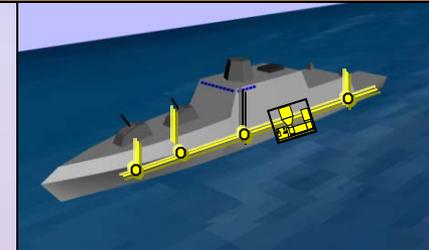
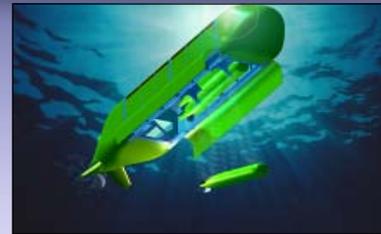
| | | | | | | | | | |
|---|---|---|--|---|--|---|---|---|--|
| MULTISTATIC RADAR TESTED AT NRL | PLAN-POSITION INDICATOR | FIRST DETECTION OF X RAYS FROM THE SUN | FIRST UNMANNED HELICOPTER | OWENS VALLEY 40M RADIO TELESCOPE | NTS-2 SATELLITE IN NAVSTAR GPS | NOBEL PRIZE TO DR. JEROME KARLE, NRL | NAVY AEROSOL ANALYSIS AND PREDICTION SYSTEM | VIRTUAL AT-SEA TRAINING (LIVE-FIRE COMBAT SKILLS) | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE |
| FIRST UNMANNED AERIAL VEHICLE | URANIUM 235 PRODUCTION | FIRST FAR-ULTRAVIOLET SPECTRUM OF THE SUN | VANGUARD I LAUNCHED | AQUEOUS FILM FORMING FOAMS (AFF) | CORONAL MASS EJECTION | NOBEL PRIZE TO DR. JEROME KARLE, NRL | HIGH TEMPERATURE SUPERCONDUCTIVE DEGAUSSING | FREE ELECTRON LASER | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE |
| PRINCIPLES OF MODERN FRACTURE MECHANICS | FIRST CONCEPT FOR A NUCLEAR SUBMARINE | SYNTHETIC LUBRICANTS | PROJECT WHIRLWIND DIGITAL COMPUTER | FIRST U.S. INTELLIGENCE SATELLITE | MOBILE ROBOTS | NOBEL PRIZE TO DR. JEROME KARLE, NRL | HIGH ENERGY MAGNETS | CLEMENTINE SPACECRAFT | HYPERSPPECTRAL IMAGER FOR COASTAL OCEANS |
| PARTICLE ACCELERATORS | SEALAB I AND II | LITHIUM BATTERIES | EXCIMER LASER TECHNOLOGY | GNR-FUNDED TECH FINDS RMS TITANIC | INTERACTIVE MULTISENSOR ANALYSIS TRAINING (IMAT) | NOBEL PRIZE TO DR. JEROME KARLE, NRL | HIGH-STRENGTH LOW-ALLOY STEELS | SHARP RECONNAISSANCE | LARGE DISPLACEMENT UNMANNED UNDERWATER VEHICLE |
| NRL COMMISSIONED | FIRST U.S. RADAR PATENTS | ONR FOUNDED 1946 | VERTICAL TAKE-OFF AND LANDING | BATHYSCAPHE TRIESTE REACHES 35,800 FT. | SOUND SURVEILLANCE SYSTEM (SOSUS) | NOBEL PRIZE TO DR. JEROME KARLE, NRL | ACOUSTIC MICROSCOPY | HULL ANTI-FOULING COATINGS | REMOTE ENVIRONMENT MONITORING UNITS |
| FAR ULTRAVIOLET LUNAR CAMERA | SIDEWINDER AIR-TO-AIR MISSILE | CONTRIBUTED TO AEGIS COMBAT SYSTEM | ULTRA-HIGH STRENGTH STEEL | QUICKCLOT® COMBAT GAUZE | WORLD-RECORD SETTING 33 MJ EMRG SHOT | NOBEL PRIZE TO DR. JEROME KARLE, NRL | GLOBAL ATMOSPHERIC PREDICTION SYSTEM | DRAGON EYE UAV | INTEGRATED TOPSIDE (INTOP) |
| GLOBAL ATMOSPHERIC PREDICTION SYSTEM | NEURAL NETWORKING COMPUTER CHIPS | FIRST OPERATIONAL GLOBAL OCEAN MODEL | CBR SENSORS FOR FLEET SECURITY | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE | NOBEL PRIZE TO ONR RESEARCHERS FOR GRAPHENE |
| 1920s | 1930s | 1940s | 1950s | 1960s | 1970s | 1980s | 1990s | 2000s | 2010 & BEYOND |



...And Future

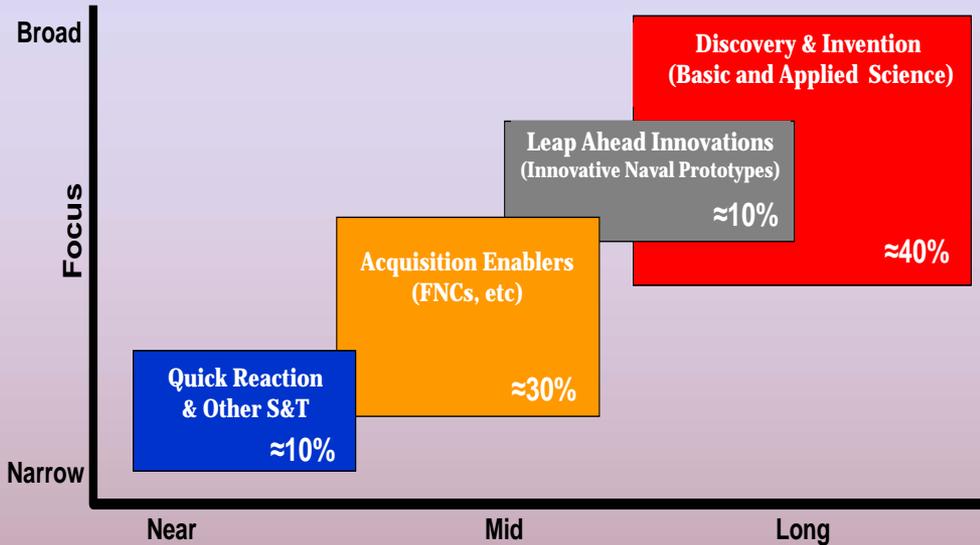


- Sustainable energy
- Autonomous vehicles
- Directed Energy & Hypersonics
- People: Health/Protection/Learning
- Information Dominance & Cyber





Naval S&T Strategic Plan



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

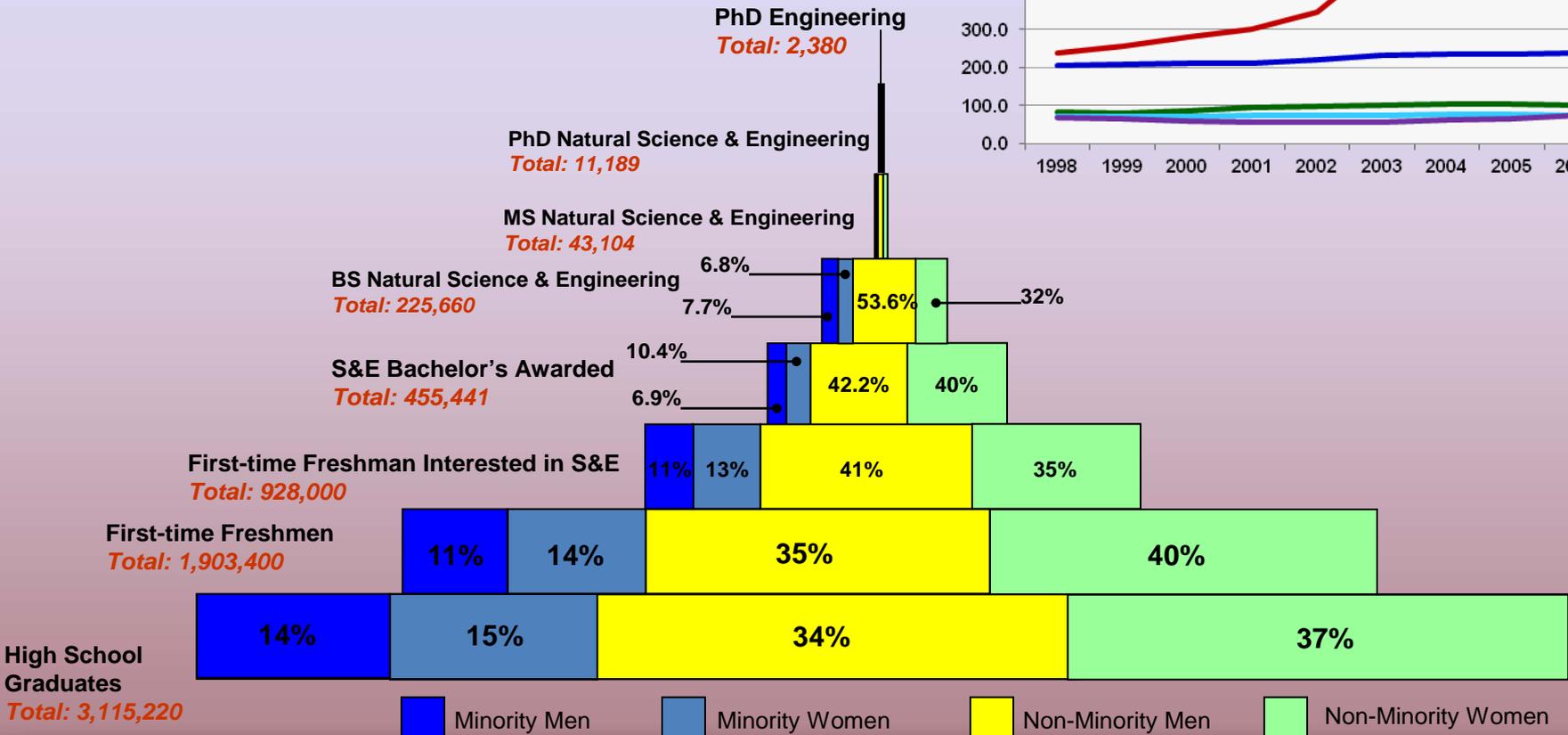
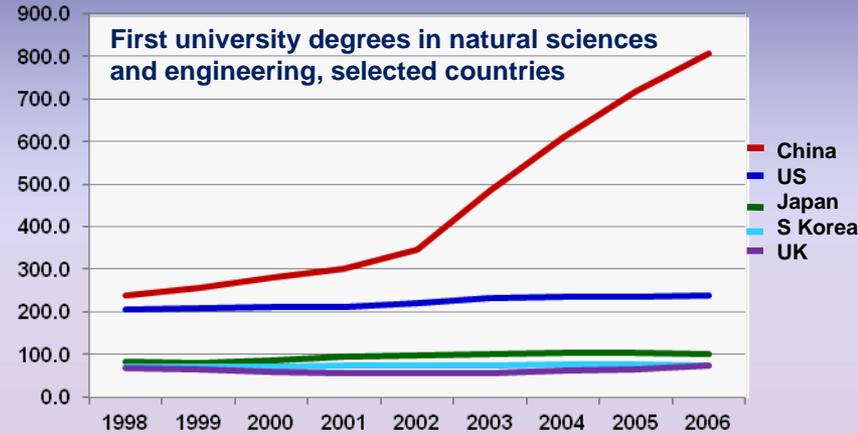


D&I





STEM





Naval STEM Landscape



Programs

Girls Day Out
SeaPerch
Mathcounts
Iridescent
USMC outreach

SEAP
YES
FIRST Robotics
Science Fairs
Starbase Atlantis

NREIP
SMART (DoD)
Space Grant
Employment
Co-ops

NREIP
SMART (DoD)
ULI

SMART
NDSEG (DoD)
ULI
IAR, ILIR

PECASE
YIP
IAR, ILIR



Lever

- Fun
- Interesting
- Hands-on
- Real-world
- Family Involvement
- Use of Near-Peers

- Exciting / Relevant
- Competition
- Mentoring
- Social Networking
- Funding / Support
- Hands-on Experience

- Employment/Stability
- Prestige
- Relevance
- Compelling Research
- Opportunity to Publish

Inspire → Engage → Educate → Employ



1 in 16 U.S. 9th Graders



For security reasons, DoN relies on U.S. citizens for classified technology work, yet 57% of students receiving doctoral degrees in Physical Science, Engineering, Computer Science, or Mathematics are foreign born.



1999: 4,000,000 9th graders

2007: 137,000 U.S. citizens earned a four-year degree in these disciplines



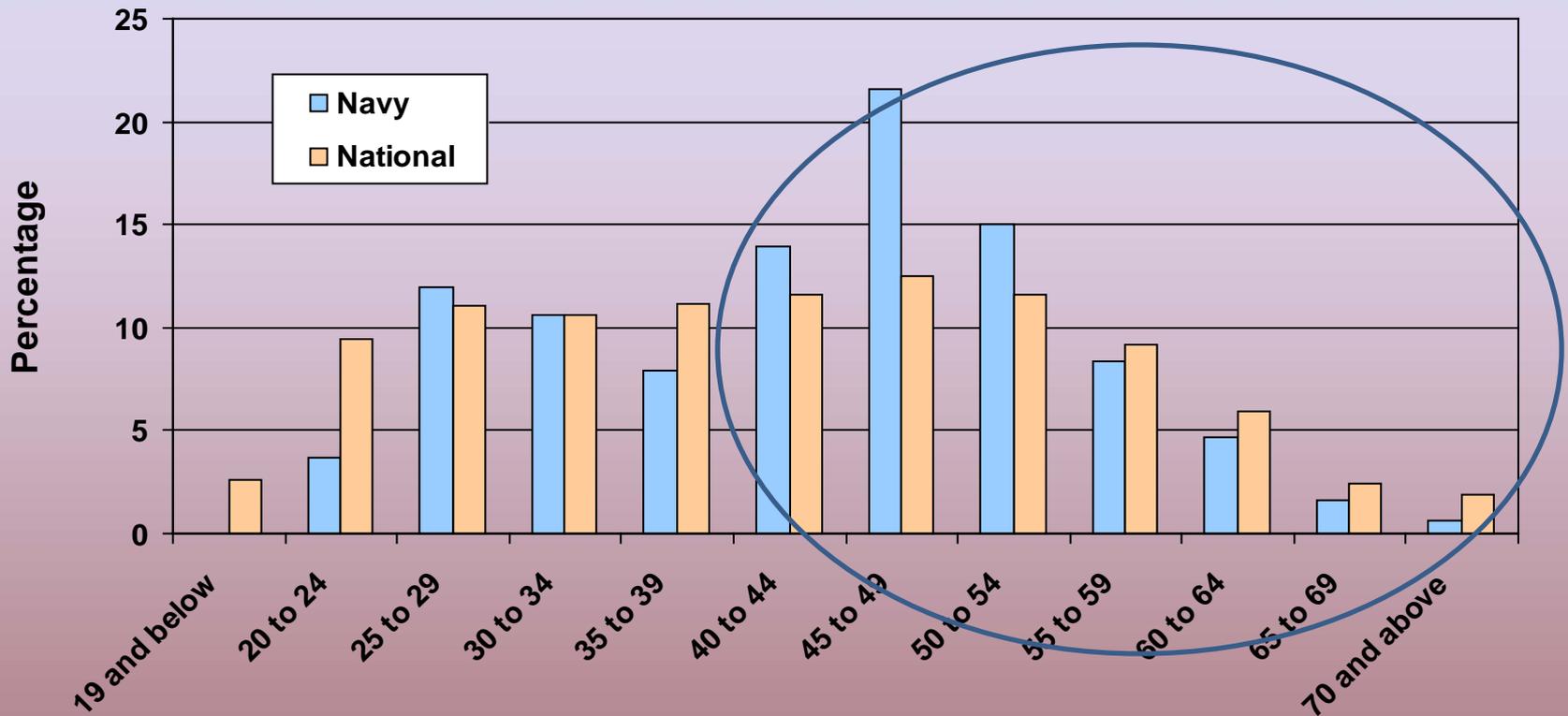
Source: 2010 S & E Indicators



Aging Naval S&E Workforce



- 65% of DoN scientists and engineers are over 40
- 50% will be retirement eligible by 2020



Source: Bureau of Labor & Statistics



www.STEM2Stern.org



Best Practices • Naval Relevance • Diversity • Metrics • Program Bridging



Engage



Educate



Inspire



STEM2Stern

Opening Minds • Capturing the Future

Collaborate



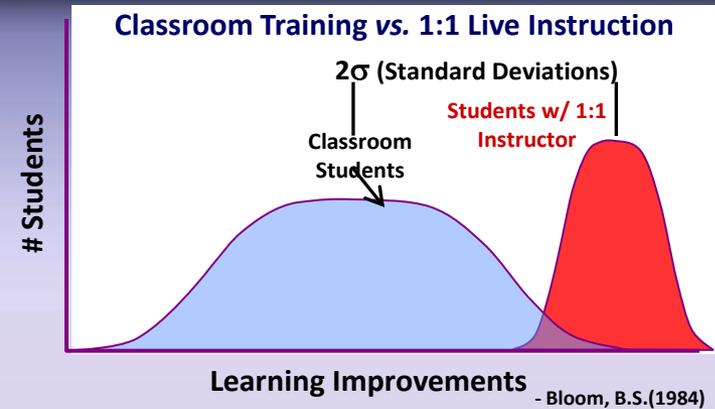
Employ



Announcing the ONR \$8m STEM Grand Challenge



- **The Problem:** 1:1 instruction significantly improves performance, but is economically infeasible



- **The Challenge:** Develop intelligent tutor technologies for middle/high school STEM instruction that improve student retention, reasoning and problem solving by at least 2 σ .
- **\$8m Opportunity:** Phase I: up to four awards of up to \$1.5 million each; Phase II: finalists, up to two awards of up to \$1 million each
- **POCs:** LCDR Joseph Cohn, PhD, joseph.cohn@navy.mil ; Dr. Ray Perez, ray.perez@navy.mil



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*

