Engineering Investments at the National Science Foundation

Thomas W. Peterson
Assistant Director
Directorate for Engineering
ASEE – ERC Meeting, 6 March 2012
The US employment decline in this recession was more than twice as large as in previous postwar recessions

US employment decline from peak

%  

Months since employment peak

1 Total nonfarm employment, seasonally adjusted.

US manufacturing employment has been shrinking since 1980, but the pace dramatically accelerated after 2000

Manufacturing employment, 1942–2010, 5-year moving average

Millions of jobs

Manufacturing share of US employment

%  

US Trade Balance in Advanced Technology

Includes

- Advanced materials
- Aerospace
- Biotechnology and life sciences
- Electronics, optoelectronics
- Flexible manufacturing
- IT and Communications
- Nuclear
- Weapons

NSF Science and Engineering Indicators, 2010
Charting the course in challenging times

Vision/Strategy grounded in core principles

Human capital development (GRF, post-doc, CAREER)
  Supporting the best ideas and the best people

Catalyzing Innovation

Broadening participation

OneNSF
Engineering Prioritizes Research Critical to the Nation’s Challenges

• National Priorities
  – National Nanotechnology Initiative
  – National Robotics Initiative

• OneNSF Initiatives
  – Advanced Manufacturing
  – Communications and Cyberinfrastructure
  – Education and Workforce
  – Interdisciplinary Research
  – Sustainability and Clean Energy
  – Innovation Ecosystem
National Nanotechnology Initiative

• The directorate will continue support for
  – nanomaterials and nanodevices
  – nanosystems
  – nanomanufacturing
  – environment, health, and safety

• ENG will direct additional funds towards three Signature Initiatives
  – Nanoelectronics for 2020 and Beyond
  – Sustainable Nanomanufacturing
  – Nanotechnology for Solar Energy Collection and Conversion

$174 M
National Robotics Initiative

- ENG will support
  - Assistive mechanisms for those with physical disabilities and/or cognitive impairments
  - Systems integration that enables ubiquitous, advanced robotics to be realized
  - Next-generation robotics for manufacturing, healthcare and rehabilitation, surveillance and security, education and training, and transportation

$10 M
ENG collaborates through OneNSF
**ENG will be a major contributor to Advanced Manufacturing**

- **Advanced Manufacturing**
  ENG will support multi-scale modeling, nanomanufacturing, and complex engineering systems design

- **Cyber-Enabled Materials, Manufacturing, and Smart-Systems (CEMMSS)**
  ENG will invest in breakthrough materials and design, advanced techniques and processes, and smart systems

- **Research at the Interface of the Biological, Mathematical, and Physical Sciences, and Engineering (BioMaPS)**
  ENG will focus on nanoscale biosensing, neuro-engineering, cellular biomechanics, metabolic engineering, and engineering aspects of synthetic biology

- **$68 M for Adv. Manu.**
- **$110 M for CEMMSS**
- **$5 M for BioMaPS**
ENG will strategically support better Communications and Cyberinfrastructure

- **Enhancing Access to the Radio Spectrum (EARS)**
  ENG will prioritize research on more efficient radio spectrum use and energy-conserving device technologies

- **Cyberinfrastructure for the 21st Century (CIF21)**
  The ENG investment will focus on cyber–physical systems, engineering modeling and simulation, smart networks, and sensors

- **Secure and Trustworthy Cyberspace (SaTC)**
  ENG support will focus on the engineering aspects of the Networking and Information Technology Research and Development (NITRD) strategic plan

$14 M for EARS

$11 M for CIF21

$4 M for SaTC
Education and Workforce

• The directorate emphasizes support for
  – Expeditions in Education (E\textsuperscript{2})
  – CAREER awards
  – Activities that promote the entry and retention of veterans and other non-traditional students in engineering programs

$1 \text{ M for E}^2$

$53 \text{ M for CAREER}$
NSF Investments in Workforce

Primary focus: Enhancements to Flow (all levels)
- K12 Pre-college programs – EHR, EEC, RET
- Recruitment of undergraduate Engineers
  - GI Bill, PEEC
- Encouragement to pursue Graduate degrees
  - REU
- Support during graduate studies
  - GRF, IGERT
- Support for transition to Academia and Industry
  - Innovation Fellows, BRIGE, CAREER
ENG will continue its long-standing support for Interdisciplinary Research

- **INSPIRE (Integrated NSF Support Promoting Interdisciplinary Research and Education)**
  ENG will support creative, important research collaborations between disciplines that may lead to new opportunities

- **Emerging Frontiers of Research and Innovation (EFRI)**
  ENG will provide strategic support for fundamental research that may overcome scientific and/or national challenges and lead to breakthrough technologies

$6 M for INSPIRE

$32 M for EFRI
ENG will invest heavily in Sustainability and Clean Energy

- **Science, Engineering, and Education for Sustainability (SEES)**
  ENG’s investment will focus on sustainable research networks, sustainable chemistry, and human dimensions

- **Clean Energy Technologies**
  ENG will support novel research for smart grid technologies, solar energy technologies, biofuels and bioenergy, wind energy generation, and renewable energy storage

$20 M for SEES

$128 M for Clean Energy
ENG will invest strategically in the Innovation Ecosystem

- **Innovation Corps (I-Corps)**
  The ENG investment will provide mentoring and resources to help determine the commercial readiness of technology built on NSF-funded basic research

- **Partnerships for Innovation**
  - ENG support for Accelerating Innovation Research (AIR) will foster connections with an existing NSF innovation research alliance
  - ENG support for Building Innovation Capacity (BIC) will enable collaboration between academia and business to advance basic research for market-accepted innovations

$6 M for I-Corps

$23 M for PFI
Research Centers

- Engineering Research Centers (ERCs)
  - EEC will continue support for the first class of Nanosystems ERCs from FY 2012 and 17 others

- Science and Technology Centers (STCs)
  - CBET will continue supporting the Center on Emergent Behaviors of Integrated Cellular Systems
  - ECCS will continue supporting the Center for Energy Efficient Electronics Science

$69 M for ERCs

$10 M for STCs
NSF Innovation Investments

Resources Invested

Discovery    Development    Commercialization

University  Small Business  Investors  Foundations  Industry

The Innovation Corps Space

Engagement overall

GOALI
ERC
I/UCRC
PFI
AIR
STTR
SBIR

Foundations

NSF overall

ENG overall

STC

Resources Invested

Discovery Development Commercialization

Translational Research

Industry

Investors

Foundations

Small Business

University
I-Corps in A Nutshell

- **A Public/Private Partnership**: to support the translation of NSF research into the development of technologies, products and processes

- **Increasing Network Opportunities**: aims to help create a national network scientists, engineers, innovators, business leaders and entrepreneurs building on existing NSF grantee events

- **Supporting NSF Strategy**: I-Corps will enhance our nation’s economic competitiveness by “reaching out to a range of communities that play complementary roles in the innovation process and are essential to ensuring the impact of NSF Investments.” *

*From “Empowering the Nation through Discovery and Innovation” NSF Strategic Plan, April 2011*
I-Corps Projects are Team-Based

- Team Composition:
  - Entrepreneurial Lead: Post-doc or Student to move it forward
  - I-Corps Mentor: Domain-relevant volunteer guide
  - PI: Researcher with current or previous award

- Program Outcomes
  - Functioning network of Mentors/Advisors
  - Scientist and Engineers trained as Entrepreneurs
  - Increased impact of NSF-funded basic research

- 30 Hours of Curriculum
- $50,000 per award
- F&A $5,000 maximum
- 25 awards in FY2011
- 100 awards in FY2012
NSF Career-Life Balance Initiative

Announced at the White House on Sept. 26, 2011
Career Life Balance

• Deferral of grants for child birth/adoption
• Grant suspension for parental leave
• Technician support for parental/family leave
Science Across Virtual Institutes (SAVI)

- Create a uniform platform for International Collaborations between NSF funded US researchers and other institutions around the world.
- Facilitate collaboration among scientists, engineers and educators across the globe to help solve society's most vexing problems.
- Early pilots VIs:
  - Mathematical and Statistical Sciences (VI-MSS) with India
  - Physics of Living Systems Student Research Network (PoLS SRN) with Israel and others
  - Wireless Innovation (WiFiUS) with Finland
<table>
<thead>
<tr>
<th>Program</th>
<th>FY 2011 Actual</th>
<th>FY 2012 Estimate</th>
<th>FY 2013 Request</th>
<th>Change over FY 2012 Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Amount</td>
</tr>
<tr>
<td>CBET</td>
<td>$158.82</td>
<td>$171.45</td>
<td>$179.40</td>
<td>$7.95</td>
</tr>
<tr>
<td>CMMI</td>
<td>189.62</td>
<td>203.58</td>
<td>217.06</td>
<td>13.48</td>
</tr>
<tr>
<td>ECCS</td>
<td>97.54</td>
<td>106.73</td>
<td>114.30</td>
<td>7.57</td>
</tr>
<tr>
<td>EEC</td>
<td>125.76</td>
<td>120.00</td>
<td>123.27</td>
<td>3.27</td>
</tr>
<tr>
<td>IIP</td>
<td>162.65</td>
<td>193.41</td>
<td>210.30</td>
<td>16.89</td>
</tr>
<tr>
<td><strong>SBIR/STTR</strong></td>
<td>126.47</td>
<td>152.76</td>
<td>165.20</td>
<td>12.44</td>
</tr>
<tr>
<td>EFRI</td>
<td>28.95</td>
<td>31.00</td>
<td>32.00</td>
<td>1.00</td>
</tr>
<tr>
<td>ENG TOTAL</td>
<td><strong>$763.33</strong></td>
<td><strong>$826.17</strong></td>
<td><strong>$876.33</strong></td>
<td><strong>$50.16</strong></td>
</tr>
</tbody>
</table>
OneNSF

catalyze human capital development

improve organizational efficiency

create networks and infrastructure for the nation

spark greater innovation and opportunity for scientific discoveries

address multidisciplinary challenges of national/global significance

support fundamental research in all disciplines
Questions