Leveraging Funding from Industry

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Industrial Innovation and Partnerships
Directorate for Engineering

ENG AdCom
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Leveraging Funding

- NSF ENG leverages funding from
  - industry, private investors
  - other NSF directorates
  - universities
  - other federal agencies
  - state/local governments

- This panel focuses on leveraging funding from industry and private investors only
Leveraging Funding from Industry

Funding
- Provide incentives
  - Joint solicitation
  - Third party matching fund

Network
- Assist in fundraising
  - Commercialization assistance
  - Networking opportunities

Knowledge Research Capacity
- Through centers and consortia
  - Pre-competitive research centers/consortia
  - Research facility
## Through Incentives

<table>
<thead>
<tr>
<th>ENG Program</th>
<th>Mechanism</th>
<th>NSF Funding</th>
<th>Private–Sector Funding (FY2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Resistant Systems</td>
<td>Joint solicitation with SRC</td>
<td>$3.6 M</td>
<td>$2.4 M</td>
</tr>
<tr>
<td>AIR</td>
<td>Requests third party matching fund</td>
<td>$6.0 M</td>
<td>$6.2 M</td>
</tr>
<tr>
<td>SBIR Phase IIB</td>
<td>Requests third party matching fund</td>
<td>$18.3 M</td>
<td>$76.3 M</td>
</tr>
</tbody>
</table>
## Through Centers and Consortia

<table>
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<tr>
<td>ERC</td>
<td>~Sponsored projects ~Membership fee</td>
<td>~$61 M</td>
<td>~$20 M (FY2012)</td>
</tr>
<tr>
<td>I/UCRC</td>
<td>~Membership fee ~Sponsored projects</td>
<td>~$16 M</td>
<td>~40 M (FY2012)</td>
</tr>
<tr>
<td>NSECs</td>
<td>~Joint research projects</td>
<td>--</td>
<td>$76 M*</td>
</tr>
<tr>
<td>NNIN and NCN</td>
<td>~Facility user fee ~In–kind contribution</td>
<td>--</td>
<td>$89 M*</td>
</tr>
<tr>
<td>National Additive Manufacturing Innovation Institute</td>
<td>Research consortium</td>
<td>$1 M ($30 M total Federal funding)</td>
<td>$40 M (FY2012)</td>
</tr>
</tbody>
</table>

* Cumulative through the life of all centers till Dec. 2011
ENG leveraged funding from industry

A conservative estimate of $145 to 160 million in FY2012
Global Perspective

Increasing global competition
- In 2009, U.S. R&D was 31% of global R&D
- Down from 38% a decade ago
Historical Perspective

1950s–1970s

- Federal government as the primary R&D funding source
- Industry
  - Closed innovation model
  - Corporate research labs
Starting 1980s

- Industry as the primary R&D funding source
- Industry: Open innovation
- Universities play a key role in R&D
- More connected world

Henry Etzkowitz, Loet Leydesdorff, etc.
Timing...

#1 Concern of Industry R&D Managers in 2012

- Balancing short-term and long-term R&D goals (47%)
- Attracting, developing and retaining talents (16%)
- Building, maintaining an innovative culture (7%)

2012 R&D Trend Forecast, IRI
Pasteur Quadrant

- Pure basic research (Bohr)
- Use-inspired basic research (Pasteur)
- Pure applied research (Edison)

What NSF sponsors
Limited Budget

Funding Sources for U.S. Basic Research

Primary source of basic research funding

Science and Engineering Indicators Digest 2012
What role can NSF/ENG play to further stimulate academic–industrial partnerships and leverage funding from industry?
Panelists

- **Olivier Cadet**
  - Director, Logistics Excellence, Air Liquide Industrial US
  - Industrial Advisory Board Chair, Center for Excellence in Logistics Distribution (CELDi), an NSF I/UCRC

- **Claire Gmachl**
  - Director of the NSF ERC on Mid-InfraRed Technologies for Health and the Environment (MIRTHE), Princeton University

- **Terri Lomax**
  - Vice Chancellor for Research, Innovation and Economic Development, North Carolina State University

- **J. Christopher Ramming**
  - Director, University Collaboration Office, Intel Labs
Backup
ERC and Industry Funding

Notes:
* Does not include centers from the Earthquake Technology Sector
* FY-2012, support data is the sum of (received support + promised support) since some ERCs have not yet entered actual amounts for 2012.
* The Industry sector includes Industry (Domestic and Foreign) and Industrial Associations industry types.
* Under the Industry sector, the organization types included are Industrial/Practitioner Members, Funders of Associated Projects, Funders of Sponsored Projects, and Contributing Organizations.
Academic–Industry Partnership Models

- Joint Research Projects
- Research Center/Consortium
- Research Facility
- Internship/Fellowship
Major Challenges and Opportunities in Academic–Industry Partnerships

- Unclear understanding of problems
- Different timelines
  - Sense of urgency vs. urge to perfection
- Focusing on projects instead of people
- Assuming IP is overwhelmingly important
- Different measures of successes
  - publication vs. feasibility demonstration
- Basic research taking lower priority in most CEOs’ minds
“the lack of relationships represents institutional and cultural barriers to effectiveness” – Hanson

Academia

New technical & Behavioral Discoveries that result in New Technologies, New Principles

Industry

Leading-Edge Products & Process Platforms That Satisfy Customer Needs

Knowledge Generation

Knowledge Transfer

New Knowledge Converted into New Teachings, New Talent

Continuously Educated Employees Using Latest Knowledge for Effective Execution of Technical & Management Processes

silos = barriers

(Hanson, 1997, p.161)

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“knowledge system”

New Knowledge
New Talent

Knowledge Generation
Knowledge Transfer

Academia
Industry

Joint Research
Customer Solutions
New Knowledge
Knowledge Application
Best Practices
Customer Needs
Customer Feedback

Integrated Enterprises
Integrated Product/Process Development
Learning Organizations
Enterprise-Wide Supply Chains

Faculty
New Talent
Curriculum
Stakeholder Needs
Talent Specification
Industrial Educators

Area of focus

(Hanson, 1997, p.162)

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Leverage Network

Challenges/Opportunities

- Large and complex network

- Communities
  - Academia, industry, startups, investors, non-profits and trade associations

- More connected world
  - By 2014, Gartner forecasts that social network will become the main form of business communication for 20% of employees worldwide
Leverage Network
Current and Future Efforts

Virtual network
- Revamping IIP website
  - New SBIR website launched
- Utilizing webinars
  - 19 webinars convened
- Using social media
  - More than 200 followers

Targeted network
- Focus on non-profits and trade associations with large networks (ACA, CEA, ISTE, BIO etc.)
- Create regional networks
Overall R&D performed in U.S. in 2009: ~$400 billion

The business sector performed 71% or ~$282 billion

The academic sector performed 14% or $54 billion in 2009

In 2008, U.S. MNC parent companies and their majority-owned foreign affiliates performed $236.1 billion in R&D worldwide
  ◦ $37.0 billion by their majority-owned foreign affiliates.
## Impact vs. Investment: 3 Centers

**Industry Sector Impacts, NSF IUCRC Investments since center inception**

CPaSS: Center for Particulates & Surfactants (1998)
BSAC: Berkeley Sensors and Actuators Center (1986)

<table>
<thead>
<tr>
<th>IUCRC investments &amp; Impacts</th>
<th>TOTAL</th>
<th>IMS</th>
<th>BSAC</th>
<th>CPaSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated impacts (present value)</td>
<td>$1267.1M</td>
<td>$846,738,946</td>
<td>$410,727,849</td>
<td>$9,638,633</td>
</tr>
<tr>
<td>Total investments (present value)</td>
<td>$19.6M</td>
<td>$3,133,857</td>
<td>$13,250,712</td>
<td>$3,203,057</td>
</tr>
<tr>
<td>Benefit:Cost Ratio</td>
<td>64.7:1</td>
<td>270.2:1</td>
<td>31.2:1</td>
<td>3.0:1</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>$1247.5M</td>
<td>$843,605,090</td>
<td>$397,477,137</td>
<td>$6,435,577</td>
</tr>
</tbody>
</table>

- Realized impacts with a net present value of $1.25B.
- Each dollar invested by NSF-I/UCRC generated an estimated 64.7 dollars in impacts.

IUCRC Evaluation Team (D. Gray, et al.)
Figure 4-14
Global R&D expenditures by region: 2009
U.S. PPP dollars (billions)

North America
$433 (33.9%)

Central America & Caribbean
$0.6 (<0.1%)

South America
$31 (2.4%)

Central Asia
$33 (2.6%)

East, Southeast Asia
$369 (28.9%)

Europe
$319 (25.0%)

Middle East
$26 (2.0%)

South Asia
$34 (2.6%)

Africa
$9 (0.7%)

Australia & Oceania
$22 (1.8%)

World total = $1,276

PPP = purchasing power parity

NOTES: Foreign currencies converted to U.S. dollars through purchasing power parities. Some country figures are estimated. Countries are grouped according to the regions described by The World Factbook, www.cia.gov/library/publications/the-world-factbook/index.html


Science and Engineering Indicators 2012
### Closed vs. Open Innovation

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<th>Closed Innovation Principles</th>
<th>Open Innovation Principles</th>
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<tbody>
<tr>
<td><strong>The smart people in the field work for us.</strong></td>
<td><strong>Not all the smart people in the field work for us. We need to work with smart people inside and outside the company.</strong></td>
</tr>
<tr>
<td><strong>To profit from R&amp;D, we must discover it, develop it, and ship it ourselves.</strong></td>
<td><strong>External R&amp;D can create significant value: internal R&amp;D is needed to claim some portion of that value.</strong></td>
</tr>
<tr>
<td><strong>If we discover it ourselves, we will get it to the market first.</strong></td>
<td><strong>We don't have to originate the research to profit from it.</strong></td>
</tr>
<tr>
<td><strong>If we create the most and the best ideas in the industry, we will win.</strong></td>
<td><strong>If we make the best use of internal and external ideas, we will win.</strong></td>
</tr>
<tr>
<td><strong>We should control our IP, so that our competitors don't profit from our ideas.</strong></td>
<td><strong>We should profit from others' use of our IP, and we should buy others' IP whenever it advances our business model.</strong></td>
</tr>
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