Overview of the Industry-University Cooperative Research Centers (IUCRC) Program

NSF EPSCoR Regional Outreach

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NSF Mission

“To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”
A quick snapshot...

NSF’s Vision - A Nation that is the global leader in research and innovation

• ~$7.8B Budget

• 230+ Nobel Laureates supported

• Overall: 386,000 researchers, postdoctoral fellows, trainees, teachers, and students supported

• ~400 startups/small businesses funded each year
NSF Funds All Fields of Science & Engineering

- Engineering
- Computer & Information Science & Engineering
- Education & Human Resources
- Geosciences (including Polar Programs)
- Biological Sciences
- Mathematical & Physical Sciences
- Social, Behavioral & Economic Sciences
Translational Research towards Commercialization

$7.8B
Basic Research

$265M
Translational Research

Division of Industrial Innovation and Partnerships (IIP)

Programs for Tech Translation Partnerships & Commercialization Driven Activities
Division of Industrial Innovation and Partnerships
Driving basic research towards societal impact

- GOALI – Grant Opportunities for Academic Liaison with Industry
- INTERN – Graduate student non-academic internships
- IUCRC – Industry University Cooperative Research Center
- PFI – Partnerships for Innovation
- I-Corps – Innovation Corps
- SBIR/STTR – Small Business Innovation Research/Small Business Technology Transfer

Resources Invested
- NSF core programs
- GOALI
- INTERN
- IUCRC
- PFI
- I-Corps
- SBIR/STTR

Public funds

Private funds

Translational Research
Programs that Support Science and Engineering Across all of NSF

Basic Research
Use-inspired Research
Proof-of-Concept
Early Stage Prototype
Product Development
Commercialization
Translational Research Programs

Industry University Cooperative Research Centers
http://www.iucrc.org

Grad Student INTERN Program : <55k, 6 months
https://www.nsf.gov/INTERN

Partnerships for Innovation : Technology development
https://www.nsf.gov/PFI

I-Corps™ - Entrepreneurial Education
www.nsf.gov/icorps

Small Business Innovation Research
https://seedfund.nsf.gov
NSF Funded Research Centers – a key investment

- **STC**: Science and Technology Centers
- **MRSEC**: Materials Research Science and Engineering Centers
- **CCI**: Centers for Chemical Innovation
- **ERC**: Engineering Research Centers
- **IUCRC**: Industry/University Cooperative Research Centers

Basic Research       Applied Use-inspired

- **STC**: 1987
- **CCI**: 1985
- **IUCRC**: 1973
Industry-University Cooperative Research Centers (IUCRC)

http://www.iucrc.org/

NSF Directorates supporting IUCRC Centers

- Engineering (ENG)
- Computer and Information Science and Engineering (CISE)
- Social Behavioral and Economic Sciences (SBE)
- Geosciences (GEO)
**The Industry University Cooperative Research Program : I/UCRC**

**45 Years of Building Research and Innovation Capacity**

- First Center Proposals Received in 1972
- First “Experimental” Awards Made in 1973

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*Cooperatively Defined and Shared, Sector Precompetitive Research*

“Determine effective ways of stimulating non-Federal Investment in R&D and of Improving the application of R&D results.”*

*President’s message to the Congress on S&T, March 16, 1972*
IUCRC Goals

- Develop long-term partnerships among industry, academe and government

- Promote research programs of mutual interest, contribute to the nation's research infrastructure base, enhance the intellectual capacity of the engineering or science workforce through the integration of research and education, and facilitate technology transfer.

- Leveraging NSF funds with industry to support graduate students performing industrially relevant pre-competitive research

- Expanding the innovation capacity of our nation's competitive workforce through partnerships between industries and universities; and

- Encouraging the nation's research enterprise to remain competitive through active worldwide engagement with academic and industrial leaders
What is an IUCRC?

• A Partnership: A mechanism to enable industrially-relevant, pre-competitive research via a sustained partnership among industry, universities, and government.

• Centers bring together
  
  (1) IUCRC Sites (Academic Institutions)
    • Faculty and students from different academic institutions
  
  (2) IUCRC Industry Members
    • Companies, State/Federal/Local government, and non-profits

• Focus
  – Perform cutting-edge pre-competitive fundamental research in science, engineering, technology area(s) of interest to industry and that can drive innovation and the U.S. economy.
  – Members guide the direction of Center research through active involvement and mentoring.
IUCRC Centers: An Innovation Network

- Industry
- States
- National labs
- Interagency
- International
- Academia
- Foundations
- Scientific societies
Industry-University Cooperative Research Centers (IUCRC)

Collaborate strongly with industry
Leverage Industry funding
Industrial exposure to students/faculty

Bay areas of coverage
Advanced Electronics & Photonics
Advanced Manufacturing
Advanced Materials
Biotechnology
Civil Infrastructure Systems
Energy and Environment
Health and Safety
Information Communication & Computing
System Design and Simulation
NSF’s Role

Facilitate a Center environment in which long-term relationships between industry and academia can thrive.

- Governance Model & Operational Framework
- Provide 40+ year experience managing IUCRCs
- Franchise of centers for collaboration
- Provide deep networking opportunities
- NSF Award – Seed Funding Opportunities/Oversight
75 IUCRC Centers
100+ Universities, 800+ members

Broad Research Themes

- Advanced Electronics and Photonics (6 centers)
- Advanced Manufacturing 8
- Advanced Materials 8
- Biotechnology 7
- Civil Infrastructure Systems 1
- Energy and Environment 10
- Forensic science 1
- Geosciences 2
- Health and Safety 5
- IT, Communication, and Computing 24
- System Design and Simulation 2
29 IUCRC Centers involve EPSCoR States

# IUCRC Centers by Technology Area with sites in EPSCoR States

- Energy & Environment: 1
- Forensic Science: 1
- Civil Infrastructure Systems: 1
- Systems Design & Simulation: 2
- Advanced Manufacturing: 2
- Health & Safety: 3
- Advanced Materials: 3
- Advanced Electronics: 4
- Biotechnology: 5
- Information, Communication and Computing: 7
IUCRC Value for Universities

Student Support
Enhance resources available for student training, skills development, and job placement

Broader Impact
Work with industry to address societal challenges

Funding
Increase and diversify research funding through industry-driven research

Feedback
Receive industry guidance on research projects

Collaboration
Build relationships and develop industry partnerships for technology transfer

Access
Access to industry information to spur innovation

1,630
center-trained students
hired by members
IUCRC Value for Members

**FAST FACTS**
(Data from 2017)

1:33
$1 in member contributions leverage $33 additional dollars in research funding

**Access to Talent**
Opportunity to mentor and train students to attain desired skills for work in your industry

**De-Risk R&D**
Share risks of early stage research leading to disruptive business opportunities

**Research Cost Avoidance**
Save internal research dollars through access to facilities, infrastructure, and lower human capital costs

**Leverage Research Dollars**
Earn higher return on investment when research is jointly funded

**Access to Network**
Learn from interacting with center participants within your technology sector

**Access to Intellectual Property**
Gain royalty-free, non-exclusive licenses on intellectual property produced in the center

Facilities & Administrative overhead rate fixed at 10%
IUCRC Tenets: use-inspired, pre-competitive research portfolio that is cooperatively defined and funded on the basis of shared value.

Shared Project Portfolio
- Cooperatively defined, selected
- Governed by NSF IUCRC Agreement
  - Royalty free nonexclusive access to IP by members

Addresses precompetitive needs shared by the IAB
Leverages and builds on university strengths

Value derived from portfolio

Center Sites
Universities

90% industry funds for research

Requires trust be built in the model, and between all partners in the center.
IUCRC Membership Agreement

- **Parties to Agreement: University and Center**
- **Annual membership fee structure**
  - Industrial Advisory Board – one representative from each company per membership
  - Patent rights held by university, with royalty free, non-exclusive rights to center members
  - Companies wishing to exercise rights to a royalty-free license pay for the costs of patent application
  - If only one company seeks a license, that company may obtain an exclusive fee-bearing license
  - NSF has March-in Rights under Bayh-Dole
  - Publication delay policy – typical 90 days

All Members sign the NSF agreement upon Center Award

- **ONE center, and ONE membership agreement**
IUCRC Funding: Three 5-Year Phases

One or more universities form a center

NSF supports operations, *Industry funds research*

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**NSF Funding**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Members</th>
<th>Cash Fees Annually</th>
<th>NSF Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>3 Members</td>
<td>$150K+</td>
<td>$15K</td>
</tr>
<tr>
<td>Phase I</td>
<td>4 Members</td>
<td>$200K+</td>
<td>$150K</td>
</tr>
<tr>
<td>Phase II</td>
<td>5 Members</td>
<td>$250K+</td>
<td>$100K</td>
</tr>
<tr>
<td>Phase III</td>
<td>5 Members</td>
<td>$300K+</td>
<td>$50K</td>
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</tbody>
</table>

*indirect costs capped @ 10% of members fee*
Path to center creation

1. Ideation
2. Planning proposal
3. NSF Grant Planning
4. Merit review
5. Planning Grant
6. Bootcamp training
7. Member recruitment
8. New fast track Option DCL 18-064
9. Site award
10. New IUCRC Site/Center
11. Planning meeting
Key outcomes from a planning workshop

• Strong Convergence between academia and industry on broad cutting edge, high impact Center research thrusts

• Industry engagement via financial commitments to support a new center

• Competitive Proposal to NSF for creation of a Phase I IUCRC Center
Assessing a Planning Grant Proposal

- Mission and Vision
- Why Create the center? Responsive to societal needs? Industry collaboration potential? Strong Industrial interest?
- Are the proposed projects state of the art?
- Economic impact potential?
- Strength of the Team, Facilities and institutional collaboration potential?
- Does the Site and the envisioned Center have an effective strategy and plan to build strong industry membership?

Each University Site submits a separate proposal
Assessing a Phase I Proposal

• Did prior planning activities effectively engage industry?

• Is there evidence of good convergence between academia and industry
  ➢ broad cutting edge emerging research thrusts identified?
  ➢ potential for transformative knowledge creation driven by industrial need?
  ➢ High economic impact potential in the research arena pursued by the center?

• Is the center addressing an unmet or underserved research need? Is there an identified research roadmap to the center’s future?

• Is there potential for workforce development and training of students and under-represented groups in center research?

• What is the strength of the team assembled to support the center?

• What are the unique capabilities contributed to the center by the university site?

• Is there a clear plan to market the center effectively to grow membership?
A few IUCRC Center examples...
Center for Arthropod Management Technologies

Mission

Effective management of arthropod and nematode pests through pre-competitive research prioritized by center members, and training of personnel for future employment within industry

Research Thrusts

• Addressing pesticide resistance issues
• Pest-tolerant plants/crops
• Identification of novel and new pest control measures
• Pest control optimization

Center members include
Unlocking the Power of RNA-interference (RNAi) technology for agricultural insect pest control

RNAi, a powerful new tool for pest control

RNAi does not work well in some major insect pests e.g. Fall Armyworm

- Center research shed new light on how RNAi problems can be overcome
- Industry members are developing a new generation of RNAi pest control products for the $84 billion global pesticides market
Mission: Serving the Automotive and ground transportation industry

Technical focus areas:
- Electrified vehicle powertrains
- Conventional powertrains and alternative fuels
- Vehicle systems optimization
- Efficient and sustainable autonomous vehicles
- Ground transportation systems and infrastructure

Members
- LG Innotek
- Volvo
- TDK
- NXP
- SMI
- LG E
- KU
- Daegu Gyeongbuk Technopark
- Sambomothers
- Great Wall Motor Company
- Huawei
- ON Semiconductor
- Ford
- Structured Materials Industries, Inc.
- Coffman Engineers
- Daegu Gyeongbuk Institute of Science and Technology
- NSF Industry/University Cooperative Research Center (IUCRC) for Efficient Vehicles and Sustainable Transportation Systems (EVSTS)

University Sites
- The University of Alabama
- Arizona State University
- University of Louisville
- Texas A&M University
- Daegu Gyeongbuk Institute of Science and Technology

Projects
17 center-funded projects encompassing all five technical focus areas are currently underway, distributed as follows:

- Electrified Vehicle Powertrains, 35.3%
- Conventional Powertrains/Alternative Fuels, 23.5%
- Non-Powertrain Vehicle Systems Optimization, 11.8%
- Efficient/Sustainable Autonomous Vehicles, 17.6%
- Transportation Systems and Infrastructure, 11.8%

*International Site Under Review
SCeMFis
Science & Industry
Working Together for Sustainable Fisheries

University of Southern Mississippi

Mission:
SCeMFis uses academic, recreational, and commercial fisheries resources to address urgent scientific problems limiting sustainable fisheries.

Value proposition:
Economic health requires simultaneously:
• Sustainable fish and shellfish stocks
• Sustainable fish and shellfish fisheries.

Target fisheries:
Atlantic surfclams
Summer flounder
Atlantic menhaden
Ocean quahog
Black sea bass
Gulf menhaden
Scup
Short-finned squid
Longfin squid
Chub mackerel

Value Added and Economic Impacts By Market Segment
Massachusetts Surf Clams - 2014

<table>
<thead>
<tr>
<th>Segment</th>
<th>Direct Impact ($000)</th>
<th>Indirect Impact ($000)</th>
<th>Total Impact ($000)</th>
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<tbody>
<tr>
<td>Harvest</td>
<td>$16,794</td>
<td>$8,038</td>
<td>$24,832</td>
</tr>
<tr>
<td>Primary Wholesale/Processing</td>
<td>$32,244</td>
<td>$20,938</td>
<td>$53,182</td>
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<tr>
<td>Secondary Wholesale/Distribution</td>
<td>$5,885</td>
<td>$3,267</td>
<td>$9,151</td>
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<tr>
<td>Final Retail</td>
<td>$5,215</td>
<td>$2,714</td>
<td>$7,929</td>
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<tr>
<td>Final Food Service</td>
<td>$121,693</td>
<td>$93,533</td>
<td>$215,226</td>
</tr>
<tr>
<td>Total</td>
<td>$181,831</td>
<td>$128,489</td>
<td>$310,320</td>
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</table>
CB² Center for Bioplastics and Biocomposites

Mission:
CB² will develop knowledge about an array of high-value products from agricultural, forest feedstocks:
- Plastics
- Coatings
- Adhesives
- Composites

Value proposition:
- Increase of value of renewable materials
- Economic growth of US economy

Members:

- Newell Rubbermaid
- Diageo
- McDonald’s
- Sherwin-Williams
- 3M
- Dow
- Ecolab
- Boehringer Ingelheim
- AGRI Fiberboard, Inc.
- ADM
- John Deere
- Berry Plastics Corporation
- Inland
- Hyundai Motor Group
- Creative Composites, Ltd.
- Dukane
- Ford
- PCR
- US Department of Agriculture
- Minnesota Corn Research & Promotion Council
- Roche Diagnostics
- Shell
- Alcoa
- INEOS
- Shire
- FujiFilm
- ABF Performance Products
- TRW
- Teijin
- TAYLOR TECHNOLOGIES
- Florida Power & Light
- GE Healthcare
- SIEGWERK
- Baring
- ADAYO
- Honeywell
- KAO
- The Coca-Cola Company
- Heineken
- FUTAMURA
- POTLATCH DULKEIN
- Calumet Specialty Products
- DCN
- Newco Plastics
- Southern Woods
- St. Regis Paper Company
- Scott Paper Company
- FPL Enterprises
- UScellular
- Carlson
- NuCana
- Forest Products Research
- University of Florida
- USDA Forest Service
- Virginia Tech
- Michigan State University
- University of Arkansas
- University of Wisconsin
- University of Missouri
- University of Southern Mississippi
- Washington State University
- University of Missouri-Columbia
- University of North Carolina at Chapel Hill
- University of Maryland
- University of Tennessee
- University of Kentucky
- University of Michigan
- North Carolina State University
- University of South Carolina
- University of Illinois
- University of Nebraska-Lincoln
- University of Wisconsin-Madison
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- University of Wisconsin-Madison
2016 Compendium of Industry-Nominated IUCRC Technology Breakthroughs (iucrc.org)

Over 1400 Publications in ’13, 248 co-authored w/Members

http://www.iucrc.org/breakthroughs
2019 IUCRC Deadlines

• Preliminary Proposal – Apr & Oct – 3rd Wed
  – Cover Page, 2 page project description, 2 pages bio sketches
  – Rapid Program Director review
  – You receive an Encourage/Discourage recommendation for Full proposal Submission
  – Discouraged proposals may still submit a Full Proposal

• Full Proposal Jun and Dec – 3rd Wed

Centers meet industry twice a year

http://iucrc.org/meetings-and-events

- There are ~150 two-day Center meetings occurring each year

- Connect with a center director at an IUCRC to learn more

- Ask to attend an IUCRC Center meeting

- Contact info available at www.iucrc.org
IUCRC global expansion
International Sites

• Explore the potential to develop a true, mutually beneficial collaboration with an established IUCRC

• An established IUCRC may submit a supplement request for collaborative work with the international research entity
  – NSF Funding supports research visits and expenses related to international collaboration (including students and junior investigators)
  – $25K, 12 months with possible renewal

Supplements are subject to the NSF merit review process
IUCRC international expansion

- Academic institution with complimentary expertise to an established IUCRC
- Infrastructure to enable research collaboration
- Commitment letters from companies that demonstrate the Academic Institution will have industry dollars to support research
  - Companies become members of an IUCRC by signing membership agreement
  - Must be able to agree to the terms in membership agreement
Building and Launching a Successful IUCRC....

- Takes an entrepreneurial mindset. Challenges are similar to launching a startup.
- Build a strong leadership team. Pull together a dedicated group of core faculty researchers
- Develop strong cross-institutional support.
- Engage in extensive customer discovery
- Bring on a key team member with strong and deep industrial experience to guide the academic team
- Network, Network and then some more.....
Thank you!

Questions?

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