I/UCRC Planning Meeting for
Center for Embedded Systems

January 22, 2013

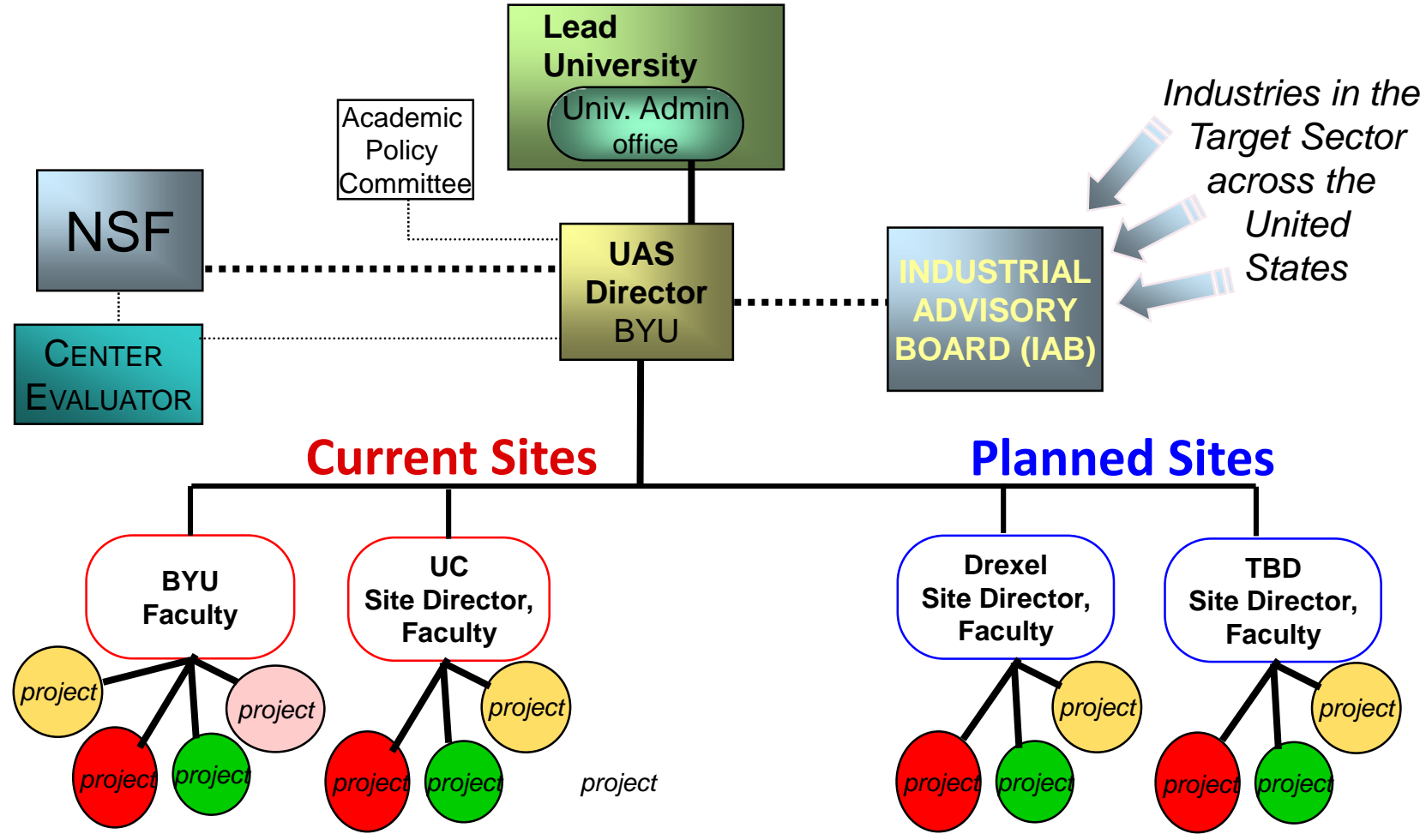Larry Hornak & Rathindra (Babu) DasGupta
Engineering – IIP
Rita Rodriguez – CNS/CISE
Alex Schwarzkopf – NSF Expert
Eric Sundstrom, NSF Evaluator

Welcome to the Industry / University Cooperative Research Center (I/UCRC) Program
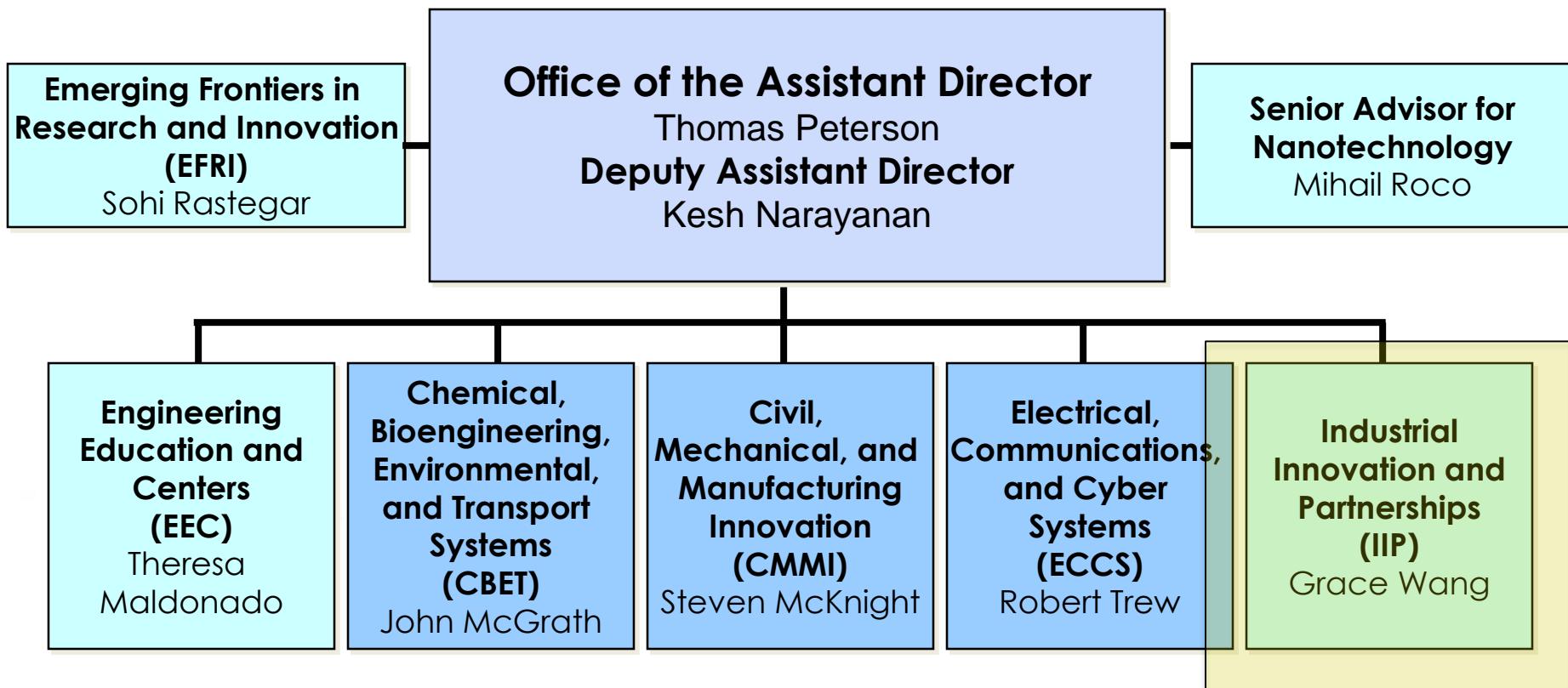
UAS/ Typical Organization Chart

Industrial Innovation and Partnerships

Division Director
Grace Wang

Assessment and Diversity
Cheryl Albus

Academic Partnerships
Donald Senich

Small Business Partnerships
Joe Hennessey

Grant Opportunities for Academic Liaison with Industry
Donald Senich

AAAS Fellow

Einstein Fellows

Nanotechnology, Advanced Material & Manufacturing (NM)
Ben Schrag

Industry/University Cooperative Research Centers
Rathindra DasGupta
Larry Hornak

Program Support Manager
Amanda May

Operations Specialist
Greg Misiorek

Biological and Chemical Technology (BC)
Prakash Balan, Greg Baxter, Ruth Shuman, Tony Walters

Analysts
Alex Schwarzkopf, Kevin Simmons

Experts/Special Topics
James Rudd, George Vermont

Electronics, Information & Communication Technology (EI)
Errol Arkilic, Juan Figueroa, Murali Nair

Innovation Cluster
Cheryl Albus

Education Applications (EA)
Glenn Larsen

Partnerships for Innovation: Building Innovation Capacity (PFI-BIC) Sara Nerlove

Partnerships for Innovation: Accelerating Innovation Research (PFI-AIR)
Karlene Hoo

I-Corps
Errol Arkilic,
Rathindra DasGupta

6

# The Industry/University Cooperative Research Centers (I/UCRC) Program

Mission:

- To contribute to the nation's research infrastructure base by **developing long-term partnerships among industry, academe and government**
- To leverage NSF funds with industry to **support graduate students performing industrially relevant research**

Vision:

- To **expand the innovation capacity of our nation's competitive workforce** through partnerships between industries and universities
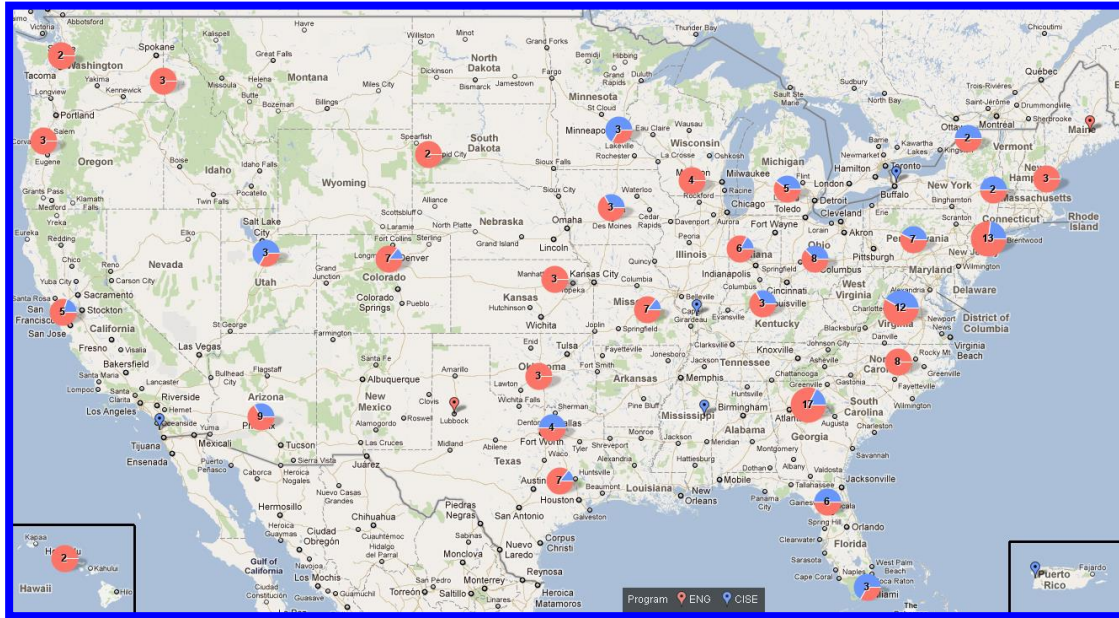
Challenge: Foster and grow long-term trusted relationships between Industry and academe based on shared value
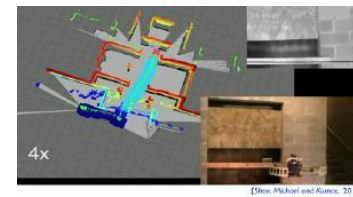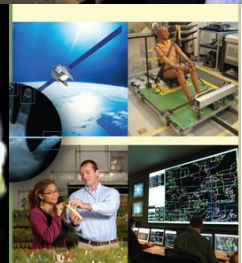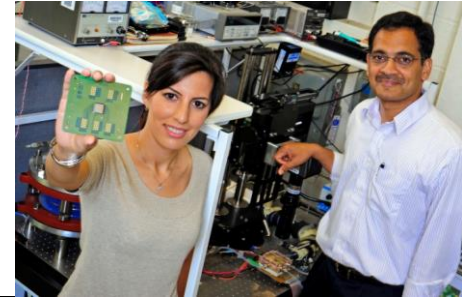
I/UCRC Fast Facts – FY11 Snapshot

ENG – Engineering

CISE – Computer and Info. Sci and Eng.

Program Funding

- $15M in Program Funding (ENG, CISE)
- $118M in Total Center Funding,
- Nearly 8:1 Leveraging of NSF funds.

Centers Nationally:

- **61 Centers with 178 Sites**
- Over 760 Members representing over 500 distinct organizations holding over 1000 Memberships

- 55% Large Business, 23% SB, 15% Federal Members

Students

- 225 PhDs, 249 MS & 128 UGs graduated in 2010, trained in Center research
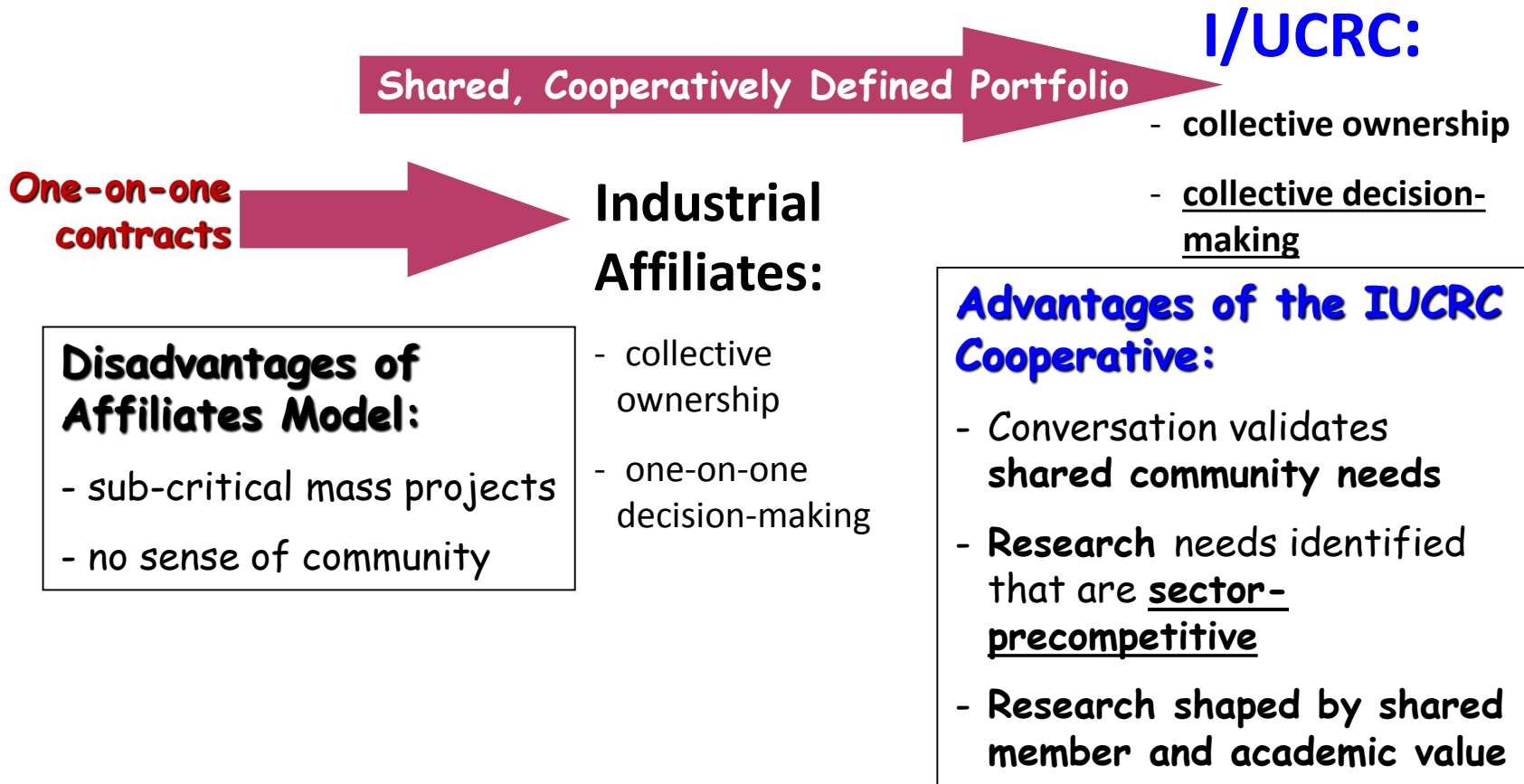- Over 30% hired by members

Sustainability

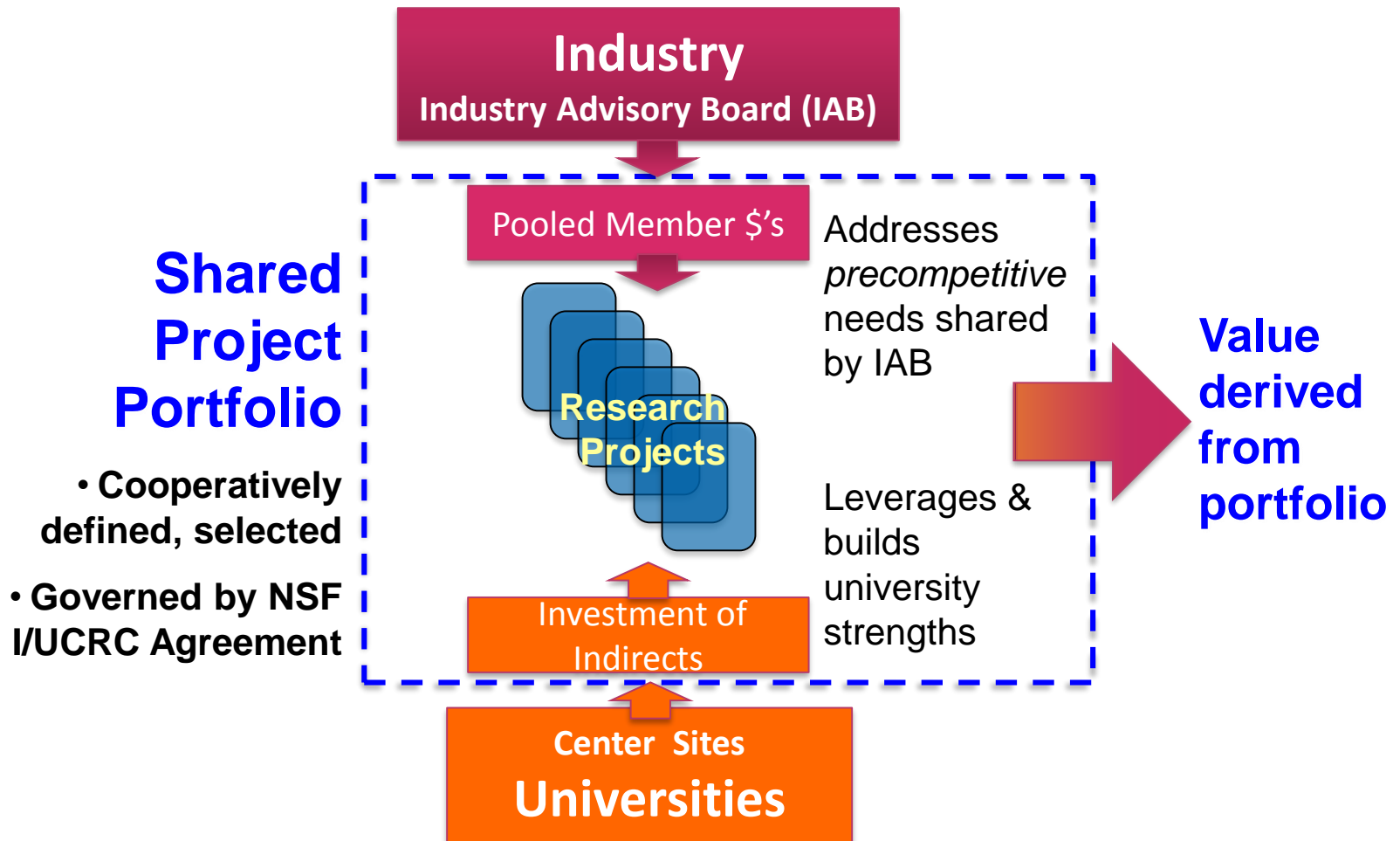- 44 Graduated I/UCRCs remain in operation in 2010 true to model

The I/UCRC Model

- Builds trusted long-term relationships for effective industry linkage to university fundamental research

Shared, Cooperatively Defined Portfolio

I/UCRC:

- **collective ownership**
- **collective decision-making**

One-on-one contracts

Industrial Affiliates:

- collective ownership
- one-on-one decision-making

Disadvantages of Affiliates Model:

- sub-critical mass projects
- no sense of community

Advantages of the IUCRC Cooperative:

- Conversation validates **shared community needs**
- **Research** needs identified that are **sector-precompetitive**
- **Research shaped by shared member and academic value**

Much more than collective ownership: *Collective Value*

I/UCRC Nucleus: A Cooperatively Defined, Funded & Shared Research Portfolio

National Science Foundation
WHERE DISCOVERIES BEGIN

Industry
Industry Advisory Board (IAB)

Shared Project Portfolio

- **Cooperatively defined, selected**
- **Governed by NSF I/UCRC Agreement**

Pooled Member $'s

Addresses *precompetitive* needs shared by IAB

Research Projects

Leverages & builds university strengths

Investment of Indirects

Center Sites
Universities

Value derived from portfolio

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

Industry/University Cooperative Research Centers

Advanced Electronics, Photonics Fabrication and Processing

Berkeley Sensor & Actuator Center – UC-Berkeley, UC-Davis

Center for Advanced Vehicle and Extreme Environment Electronics – Auburn

Center for Design of Analog Digital Integrated Circuits – WSU, OSU

Center for Dielectric Studies – PSU

Center for Electromagnetic Compatibility – MUST, Clemson, Oklahoma, Houston,

Center for Optical Wireless Apps – PSU, Georgia Tech

Cooling Technologies Research Center - Purdue

Sensor **bonded** to shaft

Circuits fixed to bearing block
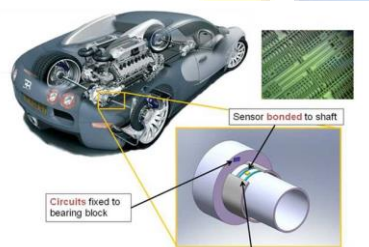
Capacitively coupled rings **wirelessly** transmit power and signal. Independent of rotation.
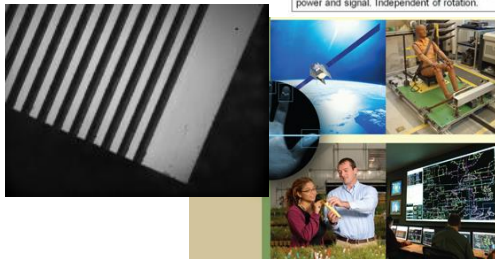
Advanced Manufacturing

Center for Friction Stir Processing – BYU, MUST, South Carolina , SDSMT, Wichita State

Center for Tire Research – Virginia Tech, U Akron

Center for Particulate and Surfactant Systems – UF, Columbia

Laser and Plasma for Advanced Manufacturing – UVa, Michigan , SMU, Illinois

Membrane Science, Engineering and Technology Center – NJIT, Colorado

Intelligent Maintenance Systems – Cincinnati, Michigan, MUST

Smart Vehicles Concepts – Ohio State, Texas A&M

Biotechnology, Health & Safety

Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology – Illinois

Center for Biophotonic Sensors and Systems – Boston University , UC-Davis

Center for Pharmaceutical Development – Georgia Tech, UK

Bio Energy Research and Development – SDSMT, Hawaii-Manoa , NCSU, Stony Brook

Center for Health Organization Transformation – Texas A&M, Northeastern, PSU, Georgia Tech

Child Injury Prevention Studies – UPenn, Ohio State

Industry/University Cooperative Research Centers

Advanced Materials

Advanced Processing and Packaging Studies – Ohio State, UC Davis, NCSU

Center for Advanced Non-Ferrous Structural Alloys – CSM, North Texas

Center for Energy Harvesting Materials and Systems – Virginia Tech, UT-Dallas

Center for Integrative Materials Joining Science for Energy Applications – Ohio State, Lehigh, Wisconsin - Madison , CSM

Center for Metamaterials – CUNY, Western Carolina, UNCC, Clarkson

Computational Materials Design – PSU, Georgia Tech.

Center for Nondestructive Evaluation – Iowa State

Ceramics, Composites and Optical Materials Center – Clemson, Rutgers

Wood-Based Composites Center – Virginia Tech, OSU

Civil Infrastructure Systems

Center for Electric Vehicles - Transportation and Electricity Convergence – UT-Austin, Texas A&M

Center for the Integration of Composites into Infrastructure - WVU, Rutgers, NCSU, Miami

Grid-Connected Advanced Power Electronics - Arkansas-Fayetteville, South Carolina

Sustainable Integrated Buildings and Sites – UNCC, CMU

Energy & Environment

Center for Advanced Forestry Systems – NCSU, Georgia , Idaho , Maine , Washington, Virginia Tech , OSU, Purdue, Florida

Center for Fuel Cells (CFC) – South Carolina, Connecticut

Center for Resource Recovery and Recycling – WPI, CSM, Katholieke Universiteit Leuven

Energy-Efficient Electronic Systems Center – Binghamton, UT-Arlington, Villanova

Next Generation Photovoltaics – UT-Austin, Colorado State

Power Systems Engineering Research Center – Arizona State, UC-Berkeley , CMU, CSU, Cornell, Georgia Tech, Howard, Illinois, Iowa State, Texas A&M, Washington State, Wichita State, Wisconsin

Silicon Solar Consortium – NCSU, Georgia Tech

Water and Environmental Technology – Temple, Arizona, Arizona State

Water Equipment & Policy – Wisconsin-Milwaukee , Marquette

Industry/University Cooperative Research Centers

System Design & Simulation

Advanced Space Technologies Research & Engineering Center – Florida , NC A&T State

Center for e-Design – Virginia Tech, Iowa State, Massachusetts-Amherst , Central Florida, CMU, SUNY Buffalo, BYU, Puerto Rico-Mayaguez , Wayne State

Center for Excellence in Logistics and Distribution – Arkansas , Oklahoma, Oklahoma State, Clemson, Missouri , Virginia Tech, Arizona State, UC-Berkeley

Center for unmanned Aircraft Vehicles – BYU, CSU

Telecommunications (Connection One) – Arizona State, Ohio State, Hawaii, Rensselaer, Arizona

Information, Communication & Computing

Advanced Knowledge Enablement – Florida Intl, Florida Atlantic, Dubna Intl

Autonomic and Cloud Computing – Florida , Mississippi State, Arizona, Rutgers

Center for Identification Technology Research – Clarkson, Arizona, WVU

Center for Research in Intelligent Storage – Minnesota, UC-Santa Cruz,

Center for Surveillance Research – Ohio State, Wright State

Center on Optical Wireless – PSU, Georgia Tech

Embedded Systems – Arizona State, Southern Illinois-Carbondale

Experimental Research in Computer Systems – Georgia Tech, Ohio State

Hybrid Multicore Productivity Research - UMBC, UC-San Diego, Georgia Tech

Net-Centrics System and Software – North Texas , UT-Dallas , Southern Methodist, Arizona State, MUST

Center for High-Performance Reconfigurable Computing – Florida , BYU, GW, Virginia Tech

Center for Visual Decision Informatics – UL-Lafayette, Drexel

Safety, Security, Rescue Research – Minnesota, Denver, UPenn

Visual and Decision Informatics – Louisiana-Lafayette, Drexel,

Wireless Internet Center for Advanced Technology Polytechnic Inst of NYU, UVa, Virginia Tech, Auburn, UT-Austin

What *value* does an I/UCRC offer?

Outcomes from a cooperatively defined and managed, portfolio of industry-precompetitive research.

- New research and education program dimensions
- Student recruitment and placement
- **Leverage POC results** for new funding
- **Trusted relationships with industry**
- **Ready partners** for translation of discoveries
- **Organize industry sector relationships**
- Means to **achieve institutional mission**.

IAB Research Needs

I/UCRC Research

Center Faculty Research

Value to IAB

Academic Value
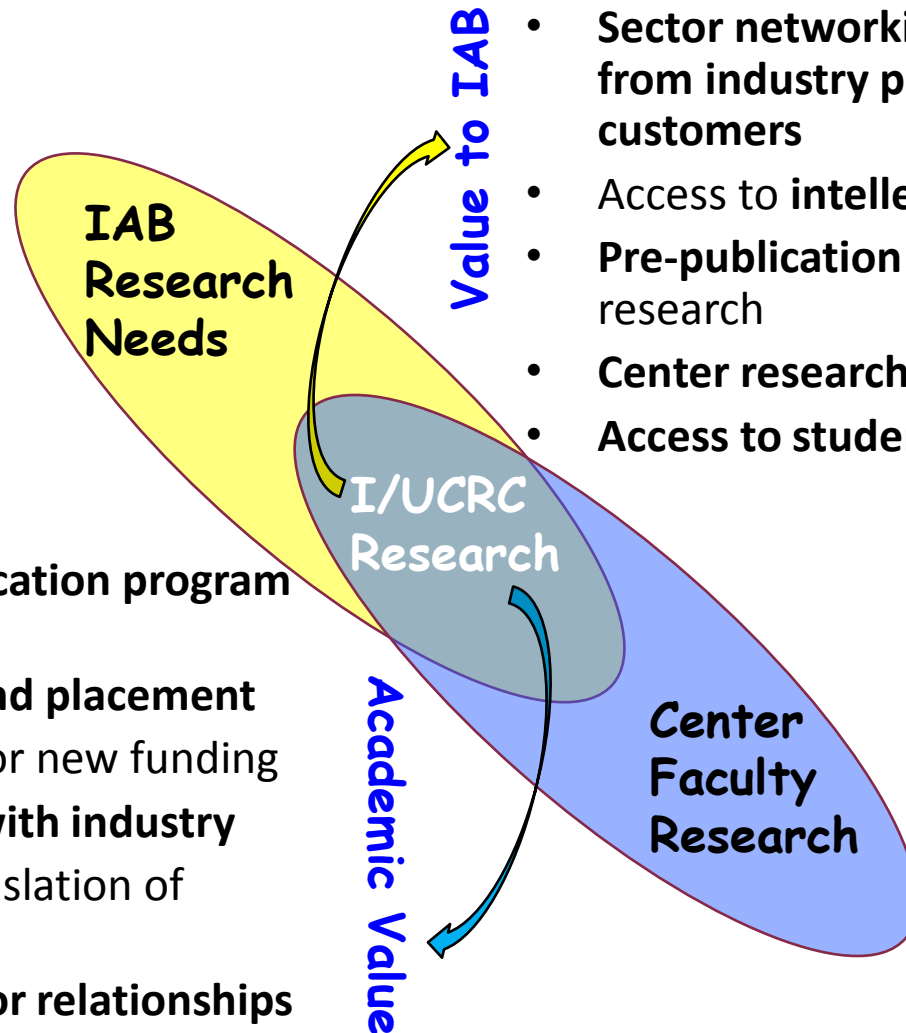
- High value **research projects**
- **Investment leveraging**
- **Sector networking, learning from industry peers and customers**
- Access to **intellectual property**
- **Pre-publication access** to research
- **Center researchers & facilities**
- **Access to students**

The NSF's Role

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

- **Cooperative Agreement & Operational Framework**

- **Franchise of centers for collaboration**

- **Best practices based on decades of evaluation**

- **NSF Award - Funding Opportunities**
  - CORBI Projects – Between I/UCRC Centers (NSF matching!)
  - Fundamental Research (Industry Defined)
  - Research Experience for Undergraduate Students (REU)
  - Research Experience for Teachers (RET)
  - Federal Government Interagency Exchange of Funds
  - International Collaboration/Projects
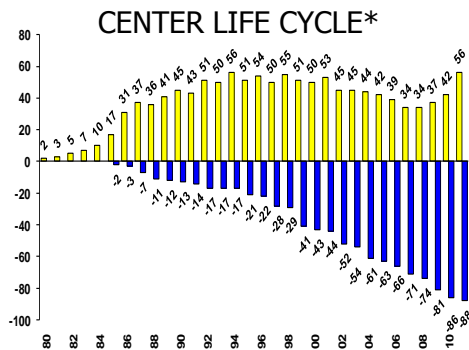 - Supplemental Opportunity for SBIR/STTR Memberships
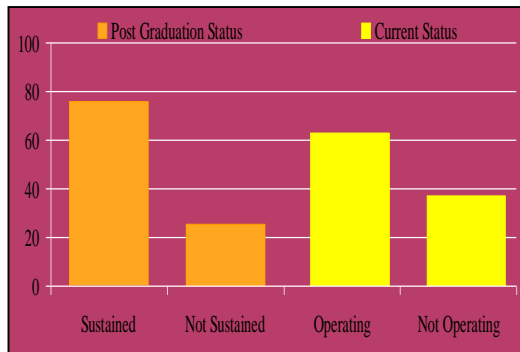
I/UCRC Evaluation & Assessment

30 + year commitment to integrating evaluation with program planning, implementation and operation . *Local Evaluation – Global Assessment*
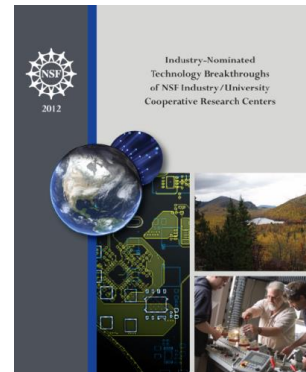

CENTER INPUTS AND OUTPUTS ASSESSMENTS

CENTER LIFE CYCLE*

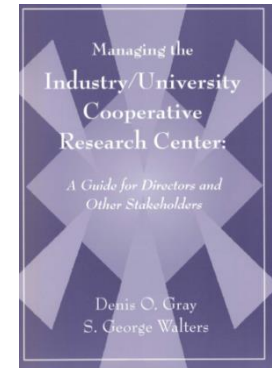IP EVENTS

FUNDING SOURCES
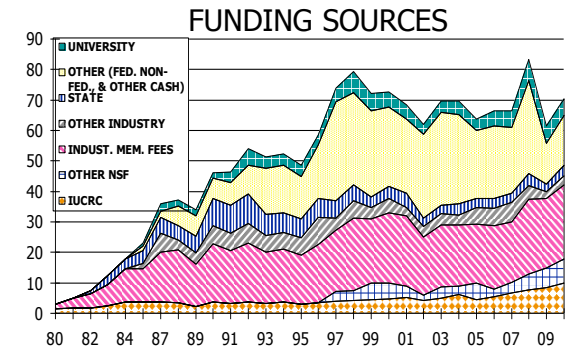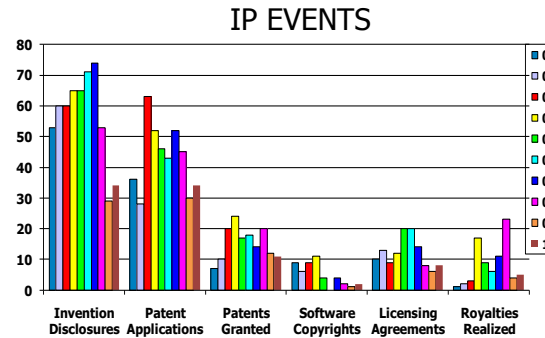
TARGETED ASSESSMENTS AND RELATED WORK PRODUCTS

IUCRC GRADUATION STATUS

Breakthrough Compendium
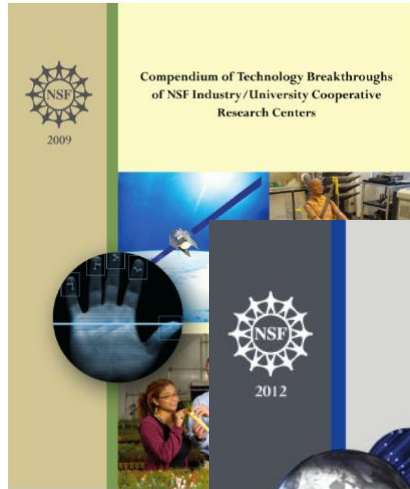
Gray & Walters Director's Guide

Plus publication in open literature: > 80 publications in journals, national & international conferences: *Research Policy*; *AAAS*; *Journal of Technology Transfer*; *Sc. Public Policy*; *New Directions in Evaluation*
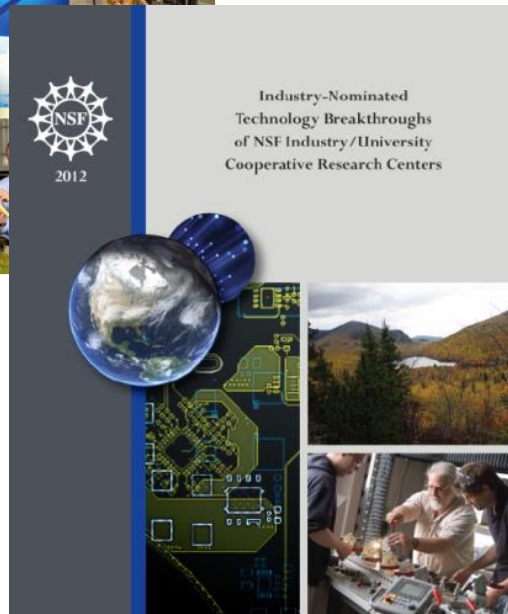
I/UCRC Outcomes
From Trusted, Long-Term Center Relationships built on Industry-University Research
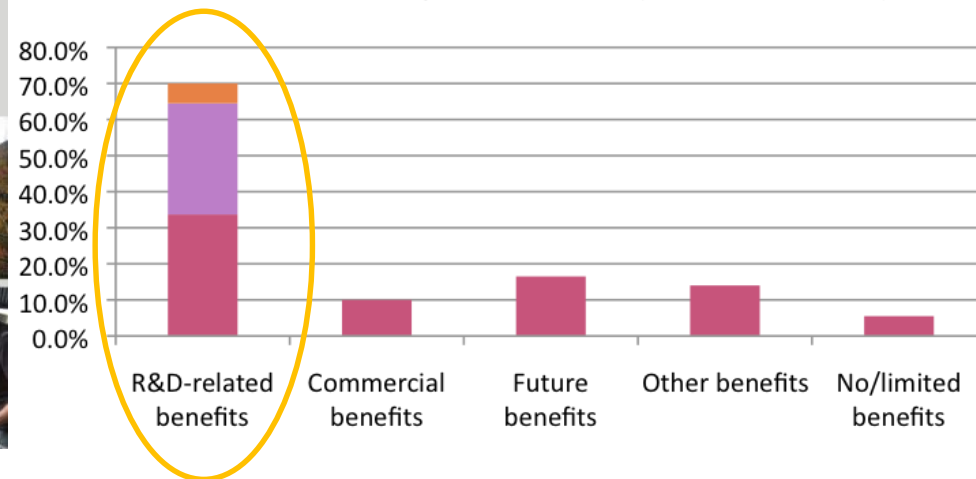
2009

2012

Percentage reporting different benefits from IUCRC participation
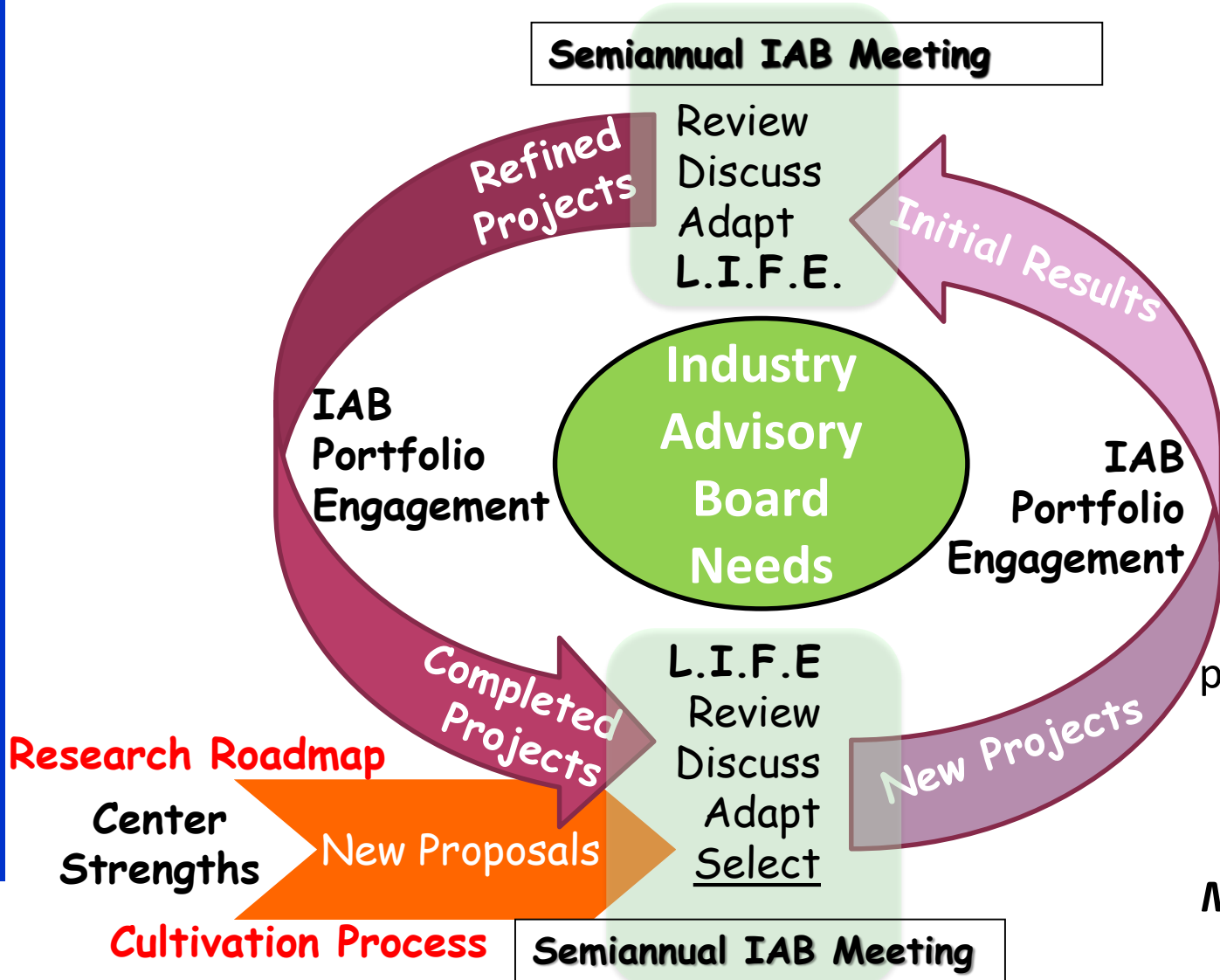Process/Outcome, open comments (2008-2009, n=91)

See the IUCRC Compendia at
www.nsf.gov/eng/iip/iucrc/tech_breakthroughs.jsp

The I/UCRC Portfolio Cycle: Maximizing Value while Building Trust

National Science Foundation
WHERE DISCOVERIES BEGIN

Semiannual IAB Meeting

Review
Discuss
Adapt
L.I.F.E.

Refined Projects

Initial Results

IAB Portfolio Engagement

Industry Advisory Board Needs

IAB Portfolio Engagement

Completed Projects

New Projects

L.I.F.E
Review
Discuss
Adapt
Select

Research Roadmap

Center Strengths

New Proposals

Cultivation Process

Semiannual IAB Meeting

The co-operative process focuses & aligns the Shared Portfolio with *Member Needs* and *University strengths*

LIFE Form for Project Feedback

The LIFE process ensures quality and stimulates continued interest in the program.

Comments should include:
- Precompetitive suggestions
- Applications & Industry Benefits
- Suggested changes
- Innovativeness of Research
- Industrial relevance
- Similar work done elsewhere
- Offers of help (mentoring?)

Level Of Interest Feedback Evaluation (LIFE)

To facilitate scientific and technical interaction between Center Faculty and Industrial Member Representative, each company represented is requested to rank their company's level of interest and the research relevancy of each presentation. Please mark an X below to reflect the opinion of your company.

Level of Interest:

_____	Very Interested
_____	Interested
_____	Interested with Change
_____	Not Interested
_____	Abstain

Comments: _____

_____

_____

Comments, questions, and concerns from the transcribed LIFE forms are discussed during the IAB meeting prior to making project funding recommendations.
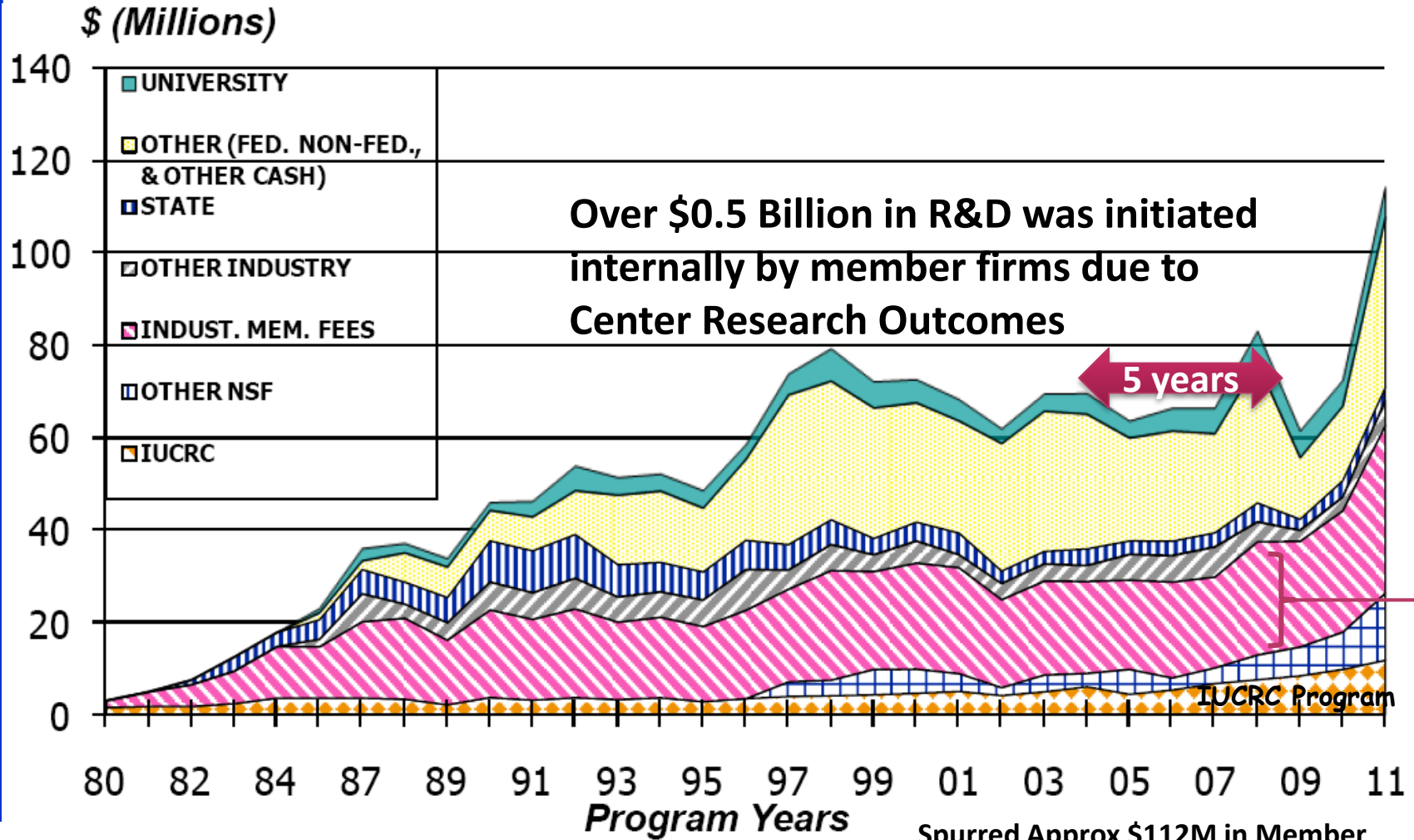
Bottom Line:
- **What makes the project so "hot" or "transformational"?**
- **How can we improve this project?**
- **Real-time project revisions are encouraged if needed**.

Building Innovation Capacity

TOTAL FUNDING BY SOURCE BY YEAR IN DOLLARS

20

IUCRC Evaluation Team (D. Gray, et al.)

Impact vs. Investment: 3 Centers

Industry Sector Impacts, NSF IUCRC Investments since center inception

IMS: Intelligent Maintenance Systems (2001)
CPaSS: Center for Particulates & Surfactants (1998)
BSAC: Berkeley Sensors and Actuators Center (1986)

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

- 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.)

I/UCRC Membership Agreement

- **Parties to Agreement, University and Center**
- **Annual membership fee structure**
- 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
- March-in Rights
- Publication delay policy
- Industrial Advisory Board – one representative from each company per membership
- **Indemnification clause(s)**

- Must sign the membership agreement form
- ONE center, and ONE membership agreement form

I/UCRC tools help guide industrially relevant research

Centers provide industry with the right information to guide project selection including:

- Project description
- Research analysis
- Project duration
- Project cost
- Annual Deliverables
- Milestones

EXECUTIVE SUMMARY
PROJECT OVERVIEW

PROJECT NAME: _____   **PROPOSAL:** _____

PROJECT MANAGER: _____

PROGRAM NAME: _____   NEW _____

PROGRAM MANAGER _____   CONT._____

DESCRIPTION:

EXPERIMENTAL PLAN:

RELATED WORK ELSEWHERE:

HOW OURS IS DIFFERENT:

RELATED WORK WITHIN THE CENTER:

MILESTONES:

DELIVERABLES:

BUDGET:

POTENTIAL MEMBER COMPANY BENEFITS:

NSF I/UCRC Funding Formula

Phase 1: First five years

- $60 – $80k each year based upon industrial membership level ($150k - $300k)
- Lead university receives $10K for each additional research partner, annually
- Lead receives up to 20K for operations and communications, annually
- NSF provides funds for an evaluator

Phase 2: Second five years

- Universities receive $40K-$60K each year depending upon industrial support
- Lead university receives $10K for each additional research partner
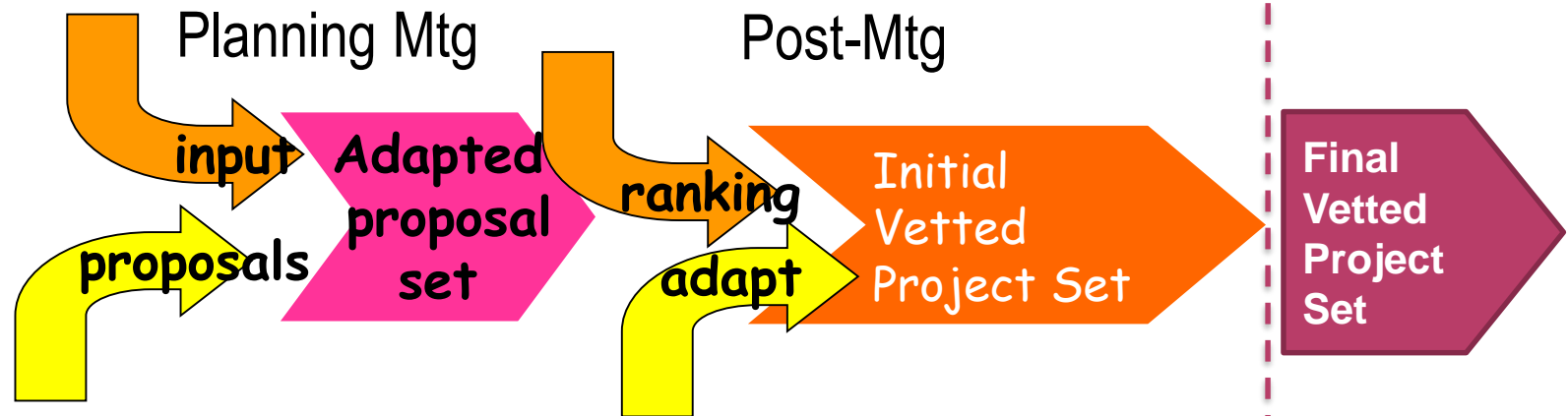- NSF provides funds for an evaluator

Phase 3: Third Five Years

- $15K each year based upon industrial membership level ($175k minimum)
- Lead university receives $25K
- NSF provides funds for an evaluator

Priming the IUCRC Shared Portfolio

- The Planning Meeting process develops vetted projects for the NSF proposal and 1st IAB meeting

Prospective UAS IAB Members

Proposal for Drexel UAS Site

Planning Mtg

Post-Mtg

input

proposals

Adapted proposal set

ranking

adapt

Initial Vetted Project Set

Final Vetted Project Set

Proposed Drexel Site

National Science Foundation

WHERE DISCOVERIES BEGIN

What Else Do You as Prospective IAB Members Need To Know?

- This is going to be <u>your</u> center.

- An engaged, proactive IAB is essential to center success.

- The planning meeting will result in
  - a proposed center project set and
  - a refined vision of the center itself.

- The top 5 vetted projects plus firm letters of membership commitment will be the nucleus of the UAS Sites' I/UCRC proposal.
  - Letters must state your organization "Will become a member of the UAS"
 - Projects chosen for proposal will reflect commitments received

What Else Do You as Prospective IAB Members Need To Know?

- What do you need to make a compelling case to your organization for Center membership?
  - Clear and compelling marketing materials
    - Clear succinct statement of center goals, objective and value to members
    - ROI Model for members
  - Executive summaries of project set
  - Membership agreement
  - NSF I/UCRC Program Materials (Compendium, presentation)
- Additional Items from this meeting
  - Project Presentations – Brief and Clear (quad charts??)
  - Milestones/Deliverables for year 1
  - Attendee List, plus prospects
  - Examples of successful centers, aspirational

Post-Meeting Timeline

- – UAS will generate executive summaries for the project set (+ other materials) and distribute them to prospective members by _??_.

- – Prospective members will provide their ranking of the project set by __??_____.

- – UAS will complete and inform all of the project ranking by _??___ .
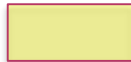
What Else Do Prospective IAB Members Need To Know?

- Expectations of the Center as a whole
  - Cooperative center operation consistent with
    - NSF requirements
    - Member agreement
    - Best Practices
    - Effective Project Management Practices
  - Open and regular member communications
  - Comprehensive semi-annual reporting (technical, financial, etc.)
  - *In summary, operation of the Center*
    - *In a way that builds trusted relationships; and*
    - *Results in a research portfolio and outcomes that are of value to your organization.*

National Science Foundation I/UCRC Contacts

Rathindra (Babu) DasGupta, I/UCRC Program Director - rdasgupt@nsf.gov

Larry Hornak, Program Director, lhornak@nsf.gov

Rita Rodriguez, CISE Program Director – rrodrigu@nsf.gov

Alex Schwarzkopf, Consultant – aschwarz@nsf.gov

Mary Konjevoda, Program Assistant, mkonjevo@nsf.gov

for more information: http://www.nsf.gov
and: http://www.nsf.gov/eng/iip/iucrc

Program phone: (703) 292-8383

Note: The best way to contact us is via e-mail. Many are on the road frequently