Science and Technology Centers: Integrative Partnerships Program –- History, Rationale Characteristics, and Issues

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Focus of NSF Programs According to NSB

"The Foundation must both continue to support academic research through grants to individual investigators and to support centers and large facilities when it is clear that there is added value in doing so."

NSF Centers, NSB

“This mode of research support is intended to enhance research activity in an intellectual field … by providing resources in a planned, organized, and focused way.”

-- (NSB-88-35)

General Rationale for Centers by the NSB

Exploit opportunities in science where the complexity of the research problem can benefit from the sustained interaction among disciplines and/or sub-disciplines.

Stimulate new directions and styles of inquiry in research including collaborative, cross-disciplinary, and interdisciplinary approaches.

Provide experimental facilities, professional staff, technical and support services, and related infrastructural support.

Conduct research that is impossible or unfeasible under traditional support, such as research on large systems, centered on a major experimental capability, or requiring extensive regional coordination.

General Rationale for Centers by the NSB Continued

Assist the educational programs of the institution including research training and exposure to multidisciplinary approaches.

Enhance the visibility of the activity to provide a focus for interactions with the academic communities, industrial interests, and national or local government agencies.

Respond to identified national concerns or the furtherance of specific national goals and priorities.

NSF Centers: Distinguishing Features

- Complex research and education activities – scope, scale, duration, equipment
- Ambitious, transformative, and risky research agenda
- Disciplinary/Interdisciplinary
- Integrative approaches, especially in learning, discovery, and innovation
- Leadership in strategies to increase diversity
- S&E in service to society, including workforce development, innovative technologies and instrumentation
- Alignment with NSF mission and strategic goals
- Strong partners and organizational linkages, including international
- Planned phase-out of NSF support after ten years
- Legacy - people and ideas

Why NSF Focuses on Partnerships/Centers?

- Is a small Agency with a big mission,
- Use of funds as a catalyst,
- Involvement of more individuals and institutions,
- Synergistic effect on research and education,
- Integration of activities, and
- STC: Integrative Partnerships, exemplar.

The STC Program supports innovation in the integrative conduct of research, education and knowledge transfer through partnerships.

Science and Technology Centers: Integrative Partnerships

- ✓ To support research and education of the highest quality;
- ✓ To exploit opportunities in science, engineering and technology where the complexity of the research agenda requires the advantages of scope, scale, change, duration, equipment and facilities, that a Center can provide;
- ✓ To support frontier investigations at the interfaces of disciplines, and/or fresh approaches within disciplines;
- ✓ To engage the Nation's intellectual talent, robustly drawn from its full human diversity, in the conduct of research and education activities;

Science and Technology Centers: Integrative Partnerships Continued

- ✓To promote organizational connections and linkages within and between campuses, schools and/or the world beyond (state, local, Federal agencies, national laboratories, industry, international);
- ✓To focus on integrative learning and discovery and the preparation of U.S. students for a broad set of career paths; and
- ✓To foster science and engineering in service to society especially with respect to new research areas, promising new instrumentation and potential new technologies.

STC History

- First STC Competition -- 1987
- Current Funding - 17 STCs
- Evaluation of Program in 1996 yielded STC: *Integrative Partnerships*
- NSB Approval: STC Program Competitions Every 2-3 Years if Budget Permits
- Funding Range: $1.5 Million to $4 Million per Year
- Award Duration: 10 Years Maximum

Portfolio of STC Characteristics

Based at universities to leverage established research and education linkages

Variety of configurations - lead university with a number of core partners, consortia, virtual centers

Diverse partnerships - academic institutions, national laboratories, industrial organizations, other public/private entities

High levels of integration among research, education and knowledge/technology transfer activities

STCs

- Research efforts not possible in the past
- Involvement of researchers in education efforts at a different level
- Cultural change agent on campuses

STC Core Strategies

Core Strategies

- strengthening physical infrastructure,
- integrating research and education,
- promoting partnerships,
- developing intellectual capital.

Equal value for research and education.

STCs...A VERY RISKY BUSINESS

- Risk in Research Outcomes
- Risk in Educational Results
- Risk in the Development of Spin-Off Businesses
- Management Risk

Awardees

- Value Added
- Regional or National Impact
- Demonstrated Commitment of Institutions
- Leadership

Most Recent STC Awardees

Case Western Reserve University STC, 2006: "Center for Layered Polymeric Systems (CLiPS)"

Colorado State University, 2006: "Center for Multi-Scale Modeling of Atmospheric Processes (CMMAP)"

Oregon Health and Science University, 2006: "Coastal Margin Observation and Prediction (C – MOP)"

University of California at Berkeley, 2005: "Team for Research on Ubiquitous Secure Technology (TRUST)"

University of Hawaii, 2006: "Center for Microbial Oceanography: Research & Education (C-MORE)"

University of Kansas, 2005: "Remote Sensing of Ice Sheets (CReSIS)"

Be a Success

STCs Should

- Think of themselves as small businesses.
- Seek sound external advice.
- Keep their strategic plans updated and use them appropriately.
- Institutionalize education and diversity initiatives that are successful.
- Communication, Communication, Communication!

STC Business Concept

- Good Management Principles
- Communication considerations
- Strategic Planning
- Accountability Issues
- Board of Directors (Advisory Body)
- Research and Student Products
- True Partnerships

Selected Issues

- Maintaining Status on the Frontiers of S&E
- Connectivity of the Community (Research, Education, Communications)
- Broadening Participation – Women, Underrepresented Minorities, and Persons with Disabilities
- Maintain Viable Partnerships & Collaboration Competencies
- Review Types and Number of Reviews
- Available Funds for Centers
- Education Models versus What Is Possible

Selected Issues Continued

- International Involvement While Focusing on Americans First
- Ethics in S&E Research, Education, and Knowledge Transfer
- Intellectual Property
- Models for Information Dissemination
- Innovative and Non-traditional Uses of Technologies/Communications
- Productivity

STC Complexity

- In research problems approached
- In student products prepared - the next generation
  - U.S. Students, the minority population
  - Underrepresented groups in science and Engineering
  - Education of general population
- In partnership, management and communication
- In coordination of a multifaceted enterprise

A Quote from the American Competitive Initiative

"In the years to come, the United States will face increased economic competition from a number of countries around the world. We will have to work harder to maintain our competitive edge. By laying the foundation today for expanded scientific and technological excellence, we will continue to lead the world tomorrow in inquiry, invention, and innovation. …"

Success

We want, need, and expect Science and Technology Centers to be successful!

Question and Answer Period

Background Slides Follow.

STCs

- **Support research and education of the highest quality;**
- **Exploit opportunities in science, engineering and technology where the complexity of the research agenda requires the advantages of scope, scale, change, duration, equipment and facilities, that a Center can provide;**
- **Support innovative frontier investigations at the interfaces of disciplines, and/or fresh approaches within disciplines;**
- **Engage the Nation's intellectual talent, robustly drawn from its full human diversity, in the conduct of research and education activities;**

STCs Cont'd

- **Promote organizational connections and linkages within and between campuses, schools and/or the world beyond (state, local, federal agencies, national laboratories, industry, international collaborations);**
- **Focus on integrative learning and discovery and the preparation of U.S. students for a broad set of career paths; and**
- **Foster science and engineering in service to society especially with respect to new research areas, promising new instrumentation and potential new technologies.**

NSF Merit Review Criteria

Criterion 1: What is the intellectual merit of the proposed activity?

- How important is the proposed activity to advancing knowledge and understanding within its own field or across fields?
- To what extent does the proposal suggest and explore creative and original concepts?
- What will be the significant contribution of the project to the research and knowledge base of the field?
- How well conceived and organized is the proposed activity?
- Is there sufficient access to resources (equipment, facilities, etc.)?
- How well qualified is the team (the Principal Investigator, co-PIs, sub-contracts, etc.) to conduct the proposed activity?

NSF Merit Review Criteria

Criterion 2: What are the broader impacts of the proposed activity?

- How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?

Evaluation Criteria

- What is the intellectual merit of the proposal activity?
- What are the broader impacts of the proposed activities?
- Integrating Research and Education.
- Integrating Diversity into NSF Programs, Projects, and Activities.
- Value-added of funding the activity as a Center.
- Proposed Leadership and Management Plan.
- Integrative nature of the Proposed Center.

Broadening Participation

- **To broaden the reach and effectiveness of our programs**
- **The NSF Strategic Plan**
  - Provide the S&E workforce for the 21st century
  - Individuals
  - Institutions
  - Collaborations
- **Catalyze the production of the S&E workforce for the 21st century**
  - That includes Americans
  - That is globally competitive
  - That is racially and ethnically diverse
  - That builds on and enhances the current and developing institutions

Complexity of the Project

- Why are we involved in this project?
- Why do we care about the issue(s)?
- What is the research community's expectation of NSF relative to this project?
- What does NSF expect of itself?
- What are the Congressional expectations?

"Realizing America's Potential"

National Science Board Report (2003)

- Global competition for S&E talent is intensifying;
- The number of native-born S&E graduates entering the workforce is likely to decline unless the nation intervenes.
- Recommendations:
  - *Support to students and institutions in order to improve success in S&E study by American undergraduates;*
  - *Attract and retain well-prepared pre-college teachers of science, math, technology;*
  - *Retain international competitiveness with regard to research talent.*

Year One Site Visit Primary Focus

- Management
  - All Aspects of the STC Project
    - Good Management Principles
      - Research
      - Education
      - Knowledge Transfer
    - Communication Considerations
    - Strategic Planning
    - Accountability Issues
    - Board of Directors (External Advisory Body)
    - Research and Student Products

Current NSF Funded STCs

Adaptive Optics

http://cfao.ucolick.org/

University of California at Santa Cruz (lead)

California Institute of Technology; Indiana University; Lawrence Livermore National Laboratory; Michigan Technical University; Montana State University; University of California at Berkeley; University of California at Irvine; University of California at Los Angeles; University of Chicago; University of Houston; University of Rochester

Advanced Materials for Water Purification

http://www.watercampws.uiuc.edu/

University of Illinois at Urbana-Champaign (lead)

Clark Atlanta University; MTR, Inc.; Ohio State University; Rose Hulman Institute; Stanford University; University of California at Berkeley

Behavioral Neuroscience

http://www.cbn-atl.org/

Georgia State University (lead)

Clark Atlanta University; Emory University; Georgia Institute of Technology; Morehouse College; Morehouse School of Medicine; Morris Brown College; Spelman College

Biophotonics

http://cbst.ucdavis.edu/

University of California at Davis (lead)

Alabama A&M University; Lawrence Livermore National Laboratory; Mills College; Stanford University; University of California at Berkeley; University of California at San Francisco;
University of Texas at San Antonio

Earth-surface Dynamics

http://www.nced.umn.edu/

University of Minnesota at Twin Cities (lead)

Fond du Lac Tribal and Community College; Massachusetts Institute of Technology; Princeton University;
Science Museum of Minnesota; University of California at Berkeley; University of Wyoming

Embedded Networked Sensing

http://www.cens.ucla.edu/

University of California at Los Angeles (lead)

Buckley School; California Institute of Technology;
California State University at Los Angeles;
New Roads School; University of California at Merced;
University of California at Riverside;
University of Southern California

Environmentally Responsible Solvents and Processes

http://www.nsfstc.unc.edu/

University of North Carolina at Chapel Hill (lead)

Georgia Institute of Technology; North Carolina A&T State University;
North Carolina State University; University of Texas at Austin

Integrated Space Weather Modeling
http://www.bu.edu/cism/
Boston University (Lead)

Alabama A&M University; Dartmouth College; National Center for Atmospheric Research; Science Applications International Corporation; Space Science Institute; Stanford University; University of California at Berkeley; University of Colorado at Boulder; University of Texas at El Paso; William Marsh Rice University

Materials and Devices for Information Technology Research
http://stc-mditr.org/
University of Washington (Lead)

California Institute of Technology; Georgia Institute of Technology; University of Arizona; University of California at Berkeley; University of California at Santa Barbara University of Southern California

Nanobiotechnology
http://www.nbtc.cornell.edu/
Cornell University (lead)

Clark Atlanta University; Howard University; Oregon Health and Science University; Princeton University; Sciencenter; Wadsworth Center

Sustainability of semi-Arid Hydrology and Riparian Areas
http://www.sahra.arizona.edu/
University of Arizona (lead)

Arizona State University; Desert Research Institute; New Mexico Institute of Mining and Technology; Northern Arizona University; Pennsylvania State University; University of California at Irvine; University of California at Los Angeles; University of California at Merced; University of California at Riverside; University of California at San Diego; University of Colorado; University of New Mexico; Utah State University