EPSCoR 2020 Workshop Report

EPSCoR 2020: Expanding State Participation in Research in the 21st Century -- A New Vision for the Experimental Program to Stimulate Competitive Research (EPSCoR)

A report to the
National Science Foundation

August 2006

Prepared by Jerome D. Odom, Ph.D.
Principal Investigator: NSF Award # 0630747

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Over its 25-year lifetime, the EPSCoR Program has made tremendous contributions to U.S. excellence in science and engineering by assisting now over 25 states and 2 territories in building a competitive research infrastructure. I have personally visited several university campuses that were the direct beneficiaries of EPSCoR funding, and can attest to the positive impact that the EPSCoR program has had on those institutions and the students, faculty, and the communities they serve. Despite this record of success, it is important to step back to assess EPSCoR's accomplishments and think strategically about meeting the future needs of the nation, and in particular of the EPSCoR states, for the next 10 to 20 years. In my opinion the strength of the EPSCoR program has been its focused investment in science and engineering research infrastructure, and I encourage you to maintain that focus within the framework of the new vision…I fully expect EPSCoR states to participate in a wide range of research programs that fuel innovation and competitiveness. The nation is also depending on EPSCoR states to continue providing high-quality research opportunities to an increasingly diverse pool of students who will become tomorrow's innovation drivers.

Dr. John H. Marburger, III
Director, White House Office of Science and Technology Policy

Introduction: This report outlines the findings and recommendations of the "EPSCoR 2020: Expanding State Participation in Research in the 21st Century -- A New Vision for the Experimental Program to Stimulate Competitive Research" workshop held on June 15-16, 2006 in Arlington, Virginia. This landmark workshop was convened at the request of the National Science Foundation (NSF) to articulate a new vision for the NSF EPSCoR Initiative. It was sponsored by the NSF's Office of Integrative Activities (OIA).

At this critical moment in history, the need to sustain and accelerate the nation's preeminence in science and technology (S&T) is imperative. The mission of the National Science Foundation is to *"strengthen science and engineering research potential and education at all levels throughout the United States; and avoid undue concentration of such research and education, respectively."* Twenty-seven (27) members of the academic, scientific, business, and government community contributed to the findings and recommendations in this report. Participants included University Presidents/Chancellors, Provosts, Vice Presidents for Research, science and technology faculty, members of the National Science Board, and representatives of the American Association for the Advancement of Science, congressional committees, federal and state government, and business community from both EPSCoR and non-EPSCoR states.

EPSCoR (the Experimental Program to Stimulate Competitive Research) is a program designed to fulfill the NSF's mandate to promote scientific progress nationwide. It is directed at those jurisdictions that have historically received lesser amounts of NSF research and development (R&D) funding. Twenty-five states, the Commonwealth of Puerto Rico and the U.S. Virgin Islands currently participate. Collectively, these jurisdictions receive only 10 percent of total NSF R&D funding annually.

This report is the culmination of the first phase of efforts by the EPSCoR States to address NSF Deputy Director Kathie Olsen's charge to Workshop participants to create a new vision for EPSCoR and a role for the states in implementing a more encompassing NSF Vision 2020. The workshop critically examined the role and success of EPSCoR. More specifically, it provided insights about what works, how the national science and engineering community enterprise is changing, and where NSF and the states should focus their efforts. This report presents a framework for bold action to help the NSF achieve the mission of changing the R&D and education landscape in every state. Quotes appearing in the report are those of the workshop participants.

We would like to look 10-20 years into the future and think strategically about investments that will be needed to create the national research capacity that we would like to achieve – a new vision for EPSCoR.

Kathie Olsen
Deputy Director
National Science Foundation

The National Context. For more than a century, the United States has successfully maintained its preeminence in science and technology (S&T) despite numerous challenges. America marshaled its S&T resources to help our nation prevail in times of both war and peace, developing the tools that brought victory in two World Wars, implementing the world's "Green Revolution," winning the Space Race, and bringing medical care to higher standards. These and other achievements were, in large part, due to the strength and vitality of our country's higher education system and its research components. Together, they have provided the scientific expertise and facilities to address research challenges as well as the mechanism to educate multiple generations of S&T workers, entrepreneurs and business leaders.

Currently, our nation's preeminence in science and technology is being challenged perhaps as never before by: (1) the sheer number of scientists and engineers being educated throughout the world; (2) rapid advances in the quality of the scientific and technological education and research facilities globally; (3) the globalization of science and technology enabled by the Internet and experience with the human genome project and other large databases; (4) the growing number of international collaborations, shared facilities, and other S&T interactions; (5) the lack of interest among U.S. students in pursuing degrees in science, technology, engineering, and mathematics; (6) a complacency that anticipates that America's preeminence will continue; and (7) a failure in the U.S. to develop and utilize the full scientific and technological resources that exist throughout the states. This challenge to America's leading role in the world's S&T enterprise is ultimately a challenge to our nation's quality of life, our economic vitality and our national security. How we live tomorrow will be determined by the S&T decisions and investments that we make today.

Recent studies and reports, including *The American Competitiveness Initiative* (ACI), *NSB 2020 VISION* and *Rising Above the Gathering Storm,* have documented the competitive scientific environment in which we live. The Administration, the Congress, Federal and state governments, the scientific community, the private sector, and the public are increasingly aware of what is at stake. While the roadmap for the U.S. science and technology journey over the next decade and beyond is still being developed, Congress is preparing to make the first down payment on doubling the federal commitment to basic science, particularly in the physical sciences and engineering.

There is little doubt that the next few years are crucial. As noted in the Introduction to the National Science Board (NSB) report, *2020 VISION*, "History suggests that a nation that relinquishes the torch of science puts its future prosperity at risk and jeopardizes its place in the history of civilization." **Accordingly, this report addresses a particular aspect of this debate: How can the United States develop a truly national S&T enterprise and make use of all its resources, regardless of where they may be geographically located? How can we ensure that the torch of science shines throughout the nation? Leaving half the states behind is not acceptable national R&D policy.**

> *When I compare the investment that has been made in these EPSCoR states, grateful though we are, with just some singular institutions around the country, like Johns Hopkins, the amount of disparity is absolutely unbelievable…Attracting that capacity at Johns Hopkins has taken longer than 10 or 15 years. Attracting that capacity within the EPSCoR states will take some period of time as well…and will require additional effort.*
>
> *The Honorable Marc Racicot*
> *Former Governor of Montana*
> *President, American Insurance Association*

The EPSCoR Context. The National Science Foundation Organic Act of 1950 charged the agency with, among other tasks, ensuring the health of science in the nation and avoiding the undue concentration of resources. However, from the onset, the majority of NSF's resources were directed to what were judged to be the most productive scientific institutions and individuals – mostly private universities whose R&D capability had been deployed and further developed during World War II.

The 1960s saw a major effort to build the public academic infrastructure in the more populous states through the NSF Science Development Programs. Most of the 27 EPSCoR jurisdictions were marginalized in this effort. By the late 1970s, after prompting by Congress, NSF recognized the growing disparity in research capabilities among states and created the Experimental Program to Stimulate Competitive Research (EPSCoR). Throughout NSF's history, EPSCoR states have helped educate and export prospective scientists and engineering talent to many other geographic areas, where these students established careers, paid taxes, and helped create wealth. Many moved into the mainstream of American science and have served in major national positions. In spite of their contributions to the nation, little was done to build the basic research infrastructure (i.e., instruments, equipment, facilities, and people) of the EPSCoR states themselves. Since its creation, NSF EPSCoR has invested $920 million in the 25 states and two jurisdictions served by the program. While this investment has been consistent with NSF's original legislation, in which the agency was charged with avoiding "undue concentration" of research funding, it has not been sufficient to meet the objectives.

I think that given the federal structure of the country that when we are talking about addressing issues of health, natural resources development and management, economic development, etc., we have to distribute capacity. The only way to really do that is to find the places where the capacity is lesser and basically build that up. We're not going to make it any other way.

Shirley Malcom
American Association for the Advancement of Science

Today, the 27 EPSCoR jurisdictions account for 20 percent of the U.S. population, 25 percent of the research/doctoral institutions and 18 percent of the employed scientists and engineers. Yet they are not full partners in the U.S. S&T enterprise. These 25 states and two jurisdictions receive only about 10 percent of all NSF R&D funding, a pattern seen throughout the federal R&D agencies. This disparity results from a number of historic, geographic, economic, and other factors. These data, while they reflect the continuing need for further Federal and state investments, obscure the major changes and gains made by the EPSCoR states and their universities over the last decade. In this regard, the Nation and NSF, in particular, are failing to utilize the growing talent and resources of half the states – states that increasingly are winning major NSF awards, expanding their research capacity, producing Goldwater and Truman scholars, and moving into the top Carnegie and other rankings. ACI and other initiatives are not going to be successful if half the states and their citizens, and 25 percent of the Nation's academic institutions do not participate meaningfully. While gains are being made, half the states are not moving at a fast enough pace to develop the S&T infrastructure that will allow them to share in the benefits of a strong research community or fully contribute to a national S&T agenda.

In business, there's always the discussion about small business versus big business. The advantage of small business is that it's more nimble. The same could be said of EPSCoR states as far as meeting some target of the national agenda.

Al Kurtenbach
Daktronics, Inc.

These relatively small states and their research institutions have developed unique S&T related abilities and expertise that can contribute to national issues. The EPSCoR states and universities are positioned to help address a number of our contemporary national concerns. Some are among the top net energy exporting states, some have the advantage of being at the forefront of knowledge of coastal and ocean issues, still others can best undertake work in homeland security and national defense areas. In all EPSCoR jurisdictions, state committees have been created that usually

comprise senior representatives from the states' research institutions as well as representatives with links to the governor, the state legislature, and the business community. These committees facilitate communications within the state with those organizations that control resources for higher education. EPSCoR state committees encourage universities to work together in bringing increased awareness of the role of scientific research and education to legislators, business leaders, and citizens, leading to S&T plans that fit the state's research and economic development agenda.

…when the Vice Presidents of Research get together in Oklahoma…they literally leave all their turf behind them. They do work collectively, and I think that's the only venue in Oklahoma where that really happens…That's a value of EPSCoR, which is pretty invaluable.

Paul G. Risser
The Oklahoma State System of Higher Education

The essence of the EPSCoR experiment is to catalyze an S&T cultural transformation that is systemic and jurisdiction-wide and that will result in a highly competitive S&T enterprise. Given the limited funds available to the EPSCoR jurisdictions, through EPSCoR and EPSCoR-like funding, it has always been evident that the funding has to be used in a catalytic manner to create crucial S&T infrastructure and to achieve coherence among key stakeholders at the local, state and federal levels.

The task now is to accelerate the positive trends in building research infrastructure and capacity in the states, and to incorporate the expertise and capabilities of these states into the larger national research arena. As we move into a time of doubling the federal commitment to basic research, it is particularly critical and appropriate to make a new commitment to the EPSCoR states that have been left behind in the S&T community. At the same time, it is important to remember that in a doubling context, NSF has an opportunity to focus new resources on those programs that not only offer science and engineering excellence, but which also are most relevant to the goals and objectives of the ACI and other national initiatives where NSF plans to play a vital role. It is imperative that all of NSF's science, engineering, and education programs adopt the concept of broadening geographical and cultural participation in NSF activities as part of their objectives. Programmatic planning should consider how best to include all states and their research institutions as potentially important S&T resources.

General EPSCoR 2020 Workshop Issues and Recommendations. There was great enthusiasm among workshop participants for the accomplishments of the NSF EPSCoR program in the states and for creating a model within the U.S. Government that has generated six EPSCoR-like programs in other agencies. NSF, in full partnership with the states, needs to renew and strengthen its commitment to the broader EPSCoR goals of stimulating further improvements in emerging state R&D cultures by engaging the agency as a whole in this effort and better using the talent and resources resident in the states to achieve the NSF agency-wide 2020 Vision. We envision a coordinated three-pronged approach to help the NSF achieve the mission of ensuring a high-quality R&D and education landscape within every state.

It is no longer feasible to expect a single office or the NSF EPSCoR program to effect the changes needed to develop further and deploy more effectively the S&T talents and resources of half the nation. A more integrated approach is necessary.

Jerome "Jerry" D. Odom
University Foundations
University of South Carolina

Workshop participants envision: 1) a stronger, more flexible EPSCoR program, driven by state/community needs and resources; 2) integration of NSF's EPSCoR goals into the mission statements and performance metrics of every NSF Directorate; and 3) compelling long-term, state strategic "S&T business plans" that guide and set standards against which a state's S&T progress, including EPSCoR, would be measured.

The EPSCoR community truly appreciates the NSF's "bottoms up" approach articulated by NSF Deputy Director Olsen in her letter of February 27, 2006 (see Appendix C), and is grateful to have the opportunity to provide the summary recommendations on the following pages. Detailed priorities and actions can be found on pages 8-14.

- **Strategic Priority 1: Provide more flexible EPSCoR Research Infrastructure Improvement (RII) awards that focus foremost on building infrastructure to do basic competitive research. Awards should have a duration of up to five years, with an award range of $3-$5 million per year, per state.**

The principal difference between good and great universities is the extent and quality of their infrastructure - for example, the people (faculty, post-docs, and graduate students), facilities, computing and communications, and libraries. Investing in infrastructure is thus the most effective strategy for enhancing research capacity and competitiveness. This historic EPSCoR strategy must be retained and strengthened.

EPSCoR states are not homogeneous. A one-size program does not fit all states. The EPSCoR program should acknowledge the very different needs of the states and allow the states to propose to the NSF what they consider to be the most effective strategy for advancing R&D in their state. The current RII award offers up to $9 million to each state over a three-year period. Over the last two years, of the over 21 states applying for EPSCoR awards, only 6 were fully funded at the $9 million level. Coupled with the NSF's elimination of matching funds, the EPSCoR award size and duration in many states are no longer adequate to move selected research focus areas to the next competitive level. The states recognize that a significant investment is needed on their part if the EPSCoR award is to have a major impact on the areas selected for infrastructure improvement.

When the federal government built the national labs in the '40s, '50s, and '60s, they didn't build them in the EPSCoR states. That's largely why we have 'EPSCoR states.' So, as the NSF invests in new initiatives, e.g. cyberinfrastructure and environmental observatories, we've got to put it back on NSF's plate to say, 'You can't leave us behind.'

Jean Toal Eisen
Senate Committee on Commerce, Science, and Transportation

- **Strategic Priority 2. Emphasize the imperative for a more geographical dispersion of funding and increased geographical participation by infusing EPSCoR goals into all of the NSF's programs and initiatives.**

...thinking about the new things that we want EPSCoR to become, it is appropriate that this office reside within a central location that has close access and affiliation with the Research Directorates.

Kelvin K. Droegemeier
University of Oklahoma

The goal of establishing geographic balance in research funding is clearly expressed in the NSF statutory mission. Success in achieving this goal can be achieved only by clear and strong leadership and participation throughout the entire Foundation. A series of recommended actions is presented on pages 8-14 to make the Foundation's EPSCoR goals a component of every Directorate's 2020 Vision implementation plan. Of particular importance in the coming years is ensuring that the EPSCoR states have full access to emerging cyberinfrastructure initiatives and other transformative tools and strategies essential to doing competitive science. The NSF Organic Act makes the NSF responsible for the health of science in the entire Nation. The whole of NSF must embrace this to meet NSF's mission in the years ahead. While there have been benefits from EPSCoR's location within the Education and Human Resources Directorate (EHR), **EPSCoR should be relocated to an Office within the Office of the Director where its "research" focus and cross-directorate interactions will be maximized and integrated with the Research Directorates.**

- **Strategic Priority 3: Revitalize and extend other components of EPSCoR.**

  Other components of EPSCoR—co-funding, planning grants and outreach -- remain important, but require improvement and clear links to the state's research infrastructure planning and implementation. Co-funding should not be limited to the research thrusts in a state's current EPSCoR RII proposal. The success of EPSCoR has been its focus on research infrastructure.

- **Strategic Priority 4: Restore the "Experimental" nature of EPSCoR by using it as a "test bed" for new strategies.**

  In its early years, EPSCoR was truly an "experimental" program, exploring potential opportunities to increase capacity and competitiveness. Now, as a more mature program, its well-established structure offers an opportunity to test programs addressing other NSF and national goals. Developing expertise in topics of national importance will enhance success of proposals in other competitions. EPSCoR states should be used as testbeds for additional experimental strategies, including support for transformative research and innovation through additional EPSCoR grants in areas of national priority: homeland security, energy independence, climate change, and perhaps others where EPSCoR states have unique resources and talent related to their geography.

- **Strategic Priority 5: Develop "state strategic S&T business plans" for state EPSCoR Programs, where appropriate.**

  Some states have recently developed strategic business plans for science and technology in which EPSCoR is a catalytic agent for policy changes that support a competitive R&D and education environment. These plans should have clear goals, timelines, required commitments, and progress metrics. Successful plans have included efforts to change the academic environment by developing campus policies that promote entrepreneurial activity, develop and mentor new faculty, increase interactions with local and national "high tech" companies, and structured evaluation that can enable rigorous examination and documentation of EPSCoR accomplishments at both the federal and state levels. States should be encouraged to develop longer-term "S&T Business Plans" that fully integrate EPSCoR into their plan. Information on successful plans should be disseminated to other states.

- **Strategic Priority 6: Create a shared understanding and definition of success.**

  There is not, at present, a commonly held view of what should be understood as success for EPSCoR. Clearly, metrics for success must go beyond the flow of funding and include educational and economic outcomes. The EPSCoR 2020 Workshop served as an excellent mechanism to seek broad input to shape the definition of success for EPSCoR and make recommendations on the future direction of the EPSCoR program. Workshop participants and NSF representatives should reconvene in the spring of 2007 to review progress, make adjustments and sustain an active and continuing dialogue of the importance of a more balanced geographic dispersion of national resources and funding, leading to a shared understanding of goals and metrics and the most effective actions.

If this Nation is to fully address international competitiveness through fundamental and transformative research, innovation, workforce development, and education, it must draw on resources in all parts of the country. And if NSF is to fully address its three Strategic Priorities in its 2020 Vision, it must address regional needs and contributions in all of its programs. EPSCoR is the principal existing program that the Foundation can use for this purpose.

EPSCoR 2020 WORKSHOP REPORT:

Expanding State Participation in Research in the 21st Century -- A New Vision for the Experimental Program to Stimulate Competitive Research (EPSCoR)

In his 2006 State of the Union Address, President Bush announced his American Competitiveness Initiative (ACI), "to encourage innovation throughout our economy, and to give our nation's children a firm grounding in math and science."

The Experimental Program to Stimulate Competitive Research (EPSCoR) is a National Science Foundation (NSF) program designed to stimulate research in regions of the United States that have been less successful than others in competing for federal research funding. The National Science Board (NSB) authorized the program in 1978, in response to concerns expressed by Congress and following a study of the issue by the NSB. Congress subsequently directed that, "…*it shall be an objective of the Foundation to strengthen research and education in the sciences and engineering, including independent research by individuals, throughout the United States, and to avoid undue concentration of such research and education*." Since its inception, NSF EPSCoR has invested $920 million for research and education in the 25 states and two jurisdictions that comprise the EPSCoR "community."

In fiscal year 2006, the EPSCoR program received 1.8 percent of NSF appropriations.

I know that there are 25 states and some of the territories that are now participating in EPSCoR, but when you take a look at what it is that they've done with the funding provided to them over the course of these years, I think it would be universal at the end of the day, based on the opinions of all of those who had the chance to look at these particular situations objectively, to draw the conclusion that in fact they have done an extraordinary job with those assets that have been provided to them.

The Honorable Marc Racicot
Former Governor of Montana
President, American Insurance Association

Programs similar to the NSF EPSCoR program were later established in six other Departments and Agencies: the Departments of Defense, Energy, and Agriculture, the National Aeronautics and Space Administration, the National Institutes of Health, and the Environmental Protection Agency. Though some of these programs use the EPSCoR name, the scope of this document is limited to the NSF EPSCoR program.

The EPSCoR 2020 Workshop Background

Though NSF EPSCoR is now 26 years old; it was initiated in 1980 with only five states. Funding levels for the program only became significant in the mid-1990s, and true infrastructure building (as opposed to individual investigation) is a recent focus. Over the past few years, the structure of EPSCoR has stabilized and progress has become evident. Now is an appropriate time to examine the program, understand its contributions, and consider potential improvements. It is in that spirit that NSF supported the Workshop that led to this document. The Workshop was organized under an NSF grant to the University of South Carolina and chaired by Dr. Jerome D. Odom. The 27 academic, industry, and government leaders who participated in the Workshop and contributed to this report are listed in Appendix B.

In early 2006, the NSF requested that the University of South Carolina (USC) conduct a workshop to review the EPSCoR program and develop a vision for the future. In her letter regarding the Workshop, NSF Deputy Director Kathie Olsen stated:

> *"Because EPSCoR has been operating for more than 25 years, [NSF Director] Dr. Bement and I believe it is time to step back and consider where we have been and what we have accomplished. Simultaneously, we would like to look 10 - 20 years into the future and think strategically about investments that will be needed to create the national research capacity that we would like to achieve – a new vision for EPSCoR.*
>
> *NSF takes a 'bottoms-up' approach to all our program planning – we rely on our community to give us their insights about what works, how the national science and engineering enterprise is changing, and where we should focus our efforts."*

The University of South Carolina surveyed Presidents and Vice Presidents of Research of EPSCoR state universities and colleges as well as EPSCoR state Project Directors and other key staff to determine the key issues confronting the community (See Appendix D). From these responses, an agenda and Workshop participants list (Appendix A and B, respectively) were developed. There was an effort to bring a diverse group of nationally regarded academic S&T experts together for this meeting.

EPSCoR must be catalytic. That means that we have to optimize all our resources – EPSCoR and state.... This is not a simple trick and requires a long-range plan.

Manuel Gomez
University of Puerto Rico

Participants were chosen from both within and outside of the EPSCoR community. In addition to EPSCoR leaders, leaders from the U.S. and state governments, national S&T organizations, and the private sector were selected. All of the participants had some knowledge of EPSCoR.

I believe it's time for academia to establish different types of long range plans with clearly defined goals, broader metrics and effective assessment strategies. UK's "The Dream and the Challenge" is an ambitious undertaking and has energized faculty, administrators and most importantly the general public. All parts of the University and the state are actively engaged and vested in the outcomes. That's the way the NSF has to view the attainment of the EPSCoR goals---- all parts of the organization must be energized and vested in the outcomes.

Lee Todd
University of Kentucky

Context: Concern about America's International Competitiveness

Over the past few years, the American business community has become increasingly concerned about its competitiveness in the global economy. Leaders of major American businesses have begun to speak more clearly and forcefully about international competitiveness, and policy makers are increasingly responding.

In 2004, the Council on Competitiveness[1] released a report, *Innovate America*, in which it identified global competitiveness and the pace of innovation as threats to future American prosperity and made 10 recommendations related to talent development, R&D investments, and infrastructure.

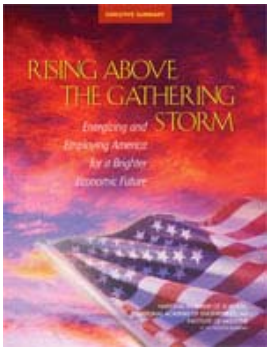
In July 2005, the Business Roundtable[2] released a report, *Tapping America's Potential, Education for Innovation Initiative*, in which it called for a national goal of "doubling the number of science, technology, engineering and mathematics graduates by 2015." Seventeen specific recommendations in the areas of building public support,

attracting students into science and engineering professions, education, and investments in basic research were included.

In May 2005, not long after Thomas Friedman's book, *The World is Flat*[3], renewed public interest and concern about issues of global competitiveness, Senators Lamar Alexander (R-TN) and Jeff Bingaman (D-NM), and Congressmen Sherwood Boehlert (R-NY) and Bart Gordon (D-TN), asked the National Academies of Science and Engineering to conduct a formal study of American competitiveness, "to assist in Congressional deliberations." A committee of experts was assembled under the leadership of Norman R. Augustine, former Chairman and CEO of Lockheed Martin. The result of their study, *Rising Above the Gathering Storm, Energizing and Employing America for a Brighter Economic Future*[4], was released in October 2005 and became one of the principal guides for policy making in both Congress and the Executive Branch.

In the *Gathering Storm* report, the Committee stated:

> *The Committee is deeply concerned that the scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength. We strongly believe that a worldwide strengthening will benefit the world's economy—particularly in the creation of jobs in countries that are far less well off than the United States. But we are worried about the future prosperity of the United States. Although many people assume that the United States will always be a world leader in science and technology, this may not continue to be the case inasmuch as great minds and ideas exist throughout the world. We fear the abruptness with which a lead in science and technology can be lost—and the difficulty of recovering a lead once lost, if indeed it can be regained at all.*



The Committee further identified two key challenges—"creating high quality jobs for Americans and responding to the nation's need for clean, affordable, and reliable energy"—and made four general recommendations supported with 20 proposed actions. The four recommendations speak to improving education in science and mathematics, increasing investments in basic research, enhancing the science and technology workforce, and stimulating innovation.

In 2006, President Bush called for an *American Competitiveness Initiative* (ACI). The ACI included proposals to double funding for "innovation-enabling research" at NSF, the National Institute of Standards and Technology (NIST), and the Department of Energy's Office of Science over a 10-year period. It also includes proposals to make permanent the R&D tax credit and address K-12 science and math education as well as immigration issues.

The studies and proposals described above, along with substantial reporting and media coverage, have resulted in the strongest consensus supporting Government action to address international competitiveness in the past two decades. In the 109th Congress, more than a dozen authorizing bills addressing competitiveness issues have been introduced.

Context: The National Science Foundation

As a consensus on competitiveness and innovation was emerging, the National Science Board was reexamining the future of the National Science Foundation. In December 2005, the Board described its conclusions in *2020 Vision for the National Science Foundation*[5]. Three strategic priorities for NSF were defined, as follows:

1. Ensure the Nation maintains a position of eminence at the global frontier of fundamental and transformative research, emphasizing areas of greatest scientific opportunity and potential benefit.
2. Sustain a world-class S&E workforce and foster the scientific literacy of all our citizens.
3. Build the Nation's basic research capacity through critical investments in infrastructure, including advanced instrumentation, facilities, cyberinfrastructure, and cutting-edge experimental capabilities.

In summary, if this Nation is to fully address international competitiveness through fundamental and transformative research, innovation, workforce development, and education, it must draw on resources in all parts of the country. And if NSF is to fully address its three Strategic Priorities in its *2020 Vision*, it must address regional needs and contributions in all of its programs. EPSCoR is the principal existing program that the Foundation can use for this purpose.

EPSCoR History: Twenty-Six Years of Progress, but More Is Possible

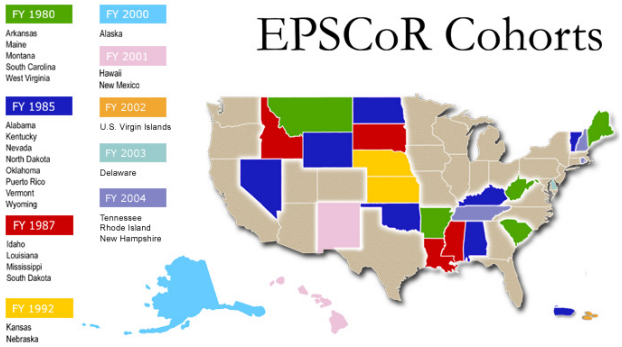
Since its inception, EPSCoR has evolved substantially and grown dramatically, though, at 1.8 percent of the NSF budget, it remains a very small part of the Foundation's portfolio. The first grants, in 1980, were "planning grants" of $125,000 made to seven states for the purpose of "identifying the barriers to research competitiveness and suggesting possible remedies." These states were selected on the basis of a complex analysis of their success in competing for federal scientific research support in fiscal years 1974-1976. State EPSCoR coordinating committees were established, proposals were submitted, and five of the states received grants of $600,000/year for five years. These early years were used primarily for individual investigator support. In 1985, 12 additional states and Puerto Rico competed in a similar manner, with eight jurisdictions receiving 5-year, $600,000 per year grants. In 1988, four states that had not been successful in the 1985 competition received 3-year, $600,000 per year awards, and in 1989, the original five recipients received additional 2-year, $600,000/year grants. Altogether, between 1980 and 1990, 17 states received a total of only $51 million. In all competitions, except for the initial planning grants, states were required to provide equal matching funds.

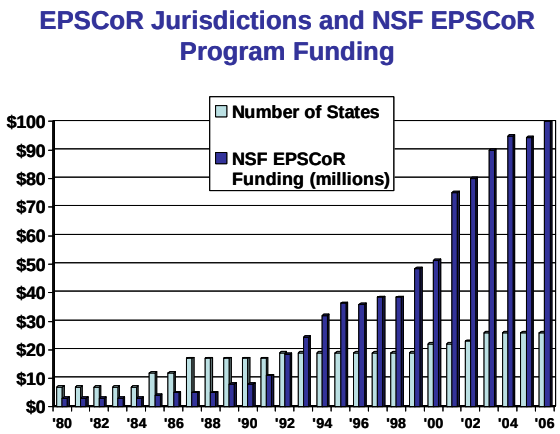
Between 1980 and 1990, 17 states received $51 million- an average of $300,000 per state per year-to build research capacity.

In its second decade, the list of eligible jurisdictions was increased to 20, the amount of awards increased to $1.5 million per year, and the duration decreased to three years. The program matured, with single, state-wide "integrated" proposals for infrastructure development and the support of research clusters. This was a notable change since it marked the first real effort to create and expand the institutional base, as opposed to individual investigators. A procedure for "co-funding" research grants between the Research Directorates and the EPSCoR Office was developed, and a two-year EPSCoR Grant Program, designed to support work that could lead to future non-EPSCoR funding, was started. Between 1991 and 2000, total funding to the 17 eligible states grew to a total of $335 million, again with equal matching by the states.

Since 2000, the program has stabilized and grown further. The Grant Program was discontinued, co-funding was expanded, and the principal focus of EPSCoR shifted to three-year, $3 million/year Research Infrastructure Improvement (RII) awards. Today, the EPSCoR program consists of (a) Research Infrastructure Improvement Grants, (b) co-funding of regular NSF solicitations and (c) outreach and technical assistance as well as SBIR's. NSF has ensured that the SBIR tax from the EPSCoR states is returned to those states. Eligibility for RII funding was set as those jurisdictions that receive no greater than 0.75 percent of total NSF grant funding over the preceding 3-year period. This brought the number of eligible jurisdictions to 25 States, plus Puerto Rico and the Virgin Islands. The matching fund requirement for RII awards was decreased to 50 percent and later the National Science Board eliminated matching for all NSF competitions.

From 1980 though 2006, the total funding for EPSCoR has been $920 million, about $1.74 for each resident of participating jurisdictions.





While significant EPSCoR program funding, as shown above, has only been available in the last decade, substantial improvement has been made in winning regular NSF program funding. EPSCoR states increased their rate of proposal submission, successful proposals, and funding levels significantly faster than the nation as a whole. For example, from 1980 through 2003, the growth in NSF research funding in those 19 EPSCoR states was 736 percent compared to 382 percent for the total NSF budget. This data is supported by anecdotal evidence of the impact of EPSCoR on scientific knowledge, universities, and state economies. Below are several illustrative examples of EPSCoR research accomplishments:

- Improved research programs at the Montana State University and the University of Montana have drawn many high technology companies to the area—where there were 17 in 1990; there are over 175 today, with 150 companies in Bozeman and Gallatin County alone. MSU's Optical Technology Center, by itself, has attracted 17 new startups.
- EPSCoR funding at the University of North Dakota enabled a major collaboration among engineers, chemists, marine biologists, and materials scientists to study the high-strength properties of marine materials. Their results suggest commercial applications in products ranging from armored aircraft to artificial body parts.
- In West Virginia, EPSCoR funding stimulated the establishment of the Center for Identification Technologies Research (CITeR) with applications in homeland security, forensics and medicine, helping WV become a recognized leader in biometrics research. A spin-off from EPSCoR-supported research at West Virginia University has become prominent in medical instrumentation and is now supported by venture capital.
- In South Carolina, EPSCoR funding contributed to the establishment of several major research centers: the Clemson Center for Advanced Fibers and Films, the Clemson Center for Optical Materials Science and Engineering, and the University of South Carolina NanoCenter. EPSCoR is generally credited with raising public awareness of the importance of research and much stronger support by the State Legislature.
- Louisiana has been using EPSCoR funding to expand the participation of groups typically under represented in STEM (science, technology, engineering, and mathematics) fields. Nearly 22 percent of faculty and students involved in RII awards have been from underrepresented groups. In addition, co-funding has enabled NSF to support 95 grants in Louisiana, bringing $27 million to the State.
- In Idaho, it is estimated that EPSCoR-funded researchers have competed for other grants that have brought $18 to the State for each $1 of state money invested.
- Mary Schweitzer of Montana State University was supported by EPSCoR and discovered the first evidence of surviving soft tissue from a dinosaur. Her work was recently featured in Smithsonian Magazine and cited as one of the top scientific discoveries of the decade.

While these and other similar achievements demonstrate the value and effectiveness of the program, especially in the past decade, it is also clear that many EPSCoR states and institutions can contribute much more in stimulating innovation and advancing competitiveness. Though EPSCoR states are home to 25 percent of American doctorate-granting universities, 20 percent of the population, and 18 percent of scientists and engineers, the 27 EPSCoR jurisdictions receive only 10 percent of total NSF R&D funding. In contrast, the10 top NSF funded states receive 60 percent of total NSF R&D funding annually.

SELECTED S&T RELATED CHARACTERISTICS OF EPSCoR STATES

- Workers in EPSCoR states have 81 percent of the average annual pay of the nation. If you live in EPSCoR states, you can expect to make 19 percent less than somebody who might live across the border in a non-EPSCoR state.

- The ratio of high-tech businesses to other businesses in EPSCoR states indicates that they have the same ratio of high-tech business. These states are not afraid of technology- based businesses. EPSCoR states do not hire individuals with bachelor's degrees into their workforce as fast as non-EPSCoR states. This is creating something that economists are now calling the "demographic death spiral." That is, these states are bleeding off their baccalaureate degree holders into states with economies that can hold them.

- EPSCoR states account for about 9 percent of the SBIR funding that is available. There are no EPSCoR states ranked in the "top 10" jurisdictions, and there are 10 EPSCoR states in the "bottom 10" in terms of SBIR funding. When EPSCoR states take the time to initiate a special initiative, huge gains can be made. For example, West Virginia posted a 250-fold increase in the amount of SBIR funds coming into that state. Wyoming had a 215-fold increase in terms of SBIR funding. SBIR becomes very important to EPSCoR states in terms of creating technology-based business.

The EPSCoR states admittedly have fewer resources than some of the non-EPSCoR states do when it comes to the infrastructure that's already in place, but that doesn't mean there can't be a lot of growth and development that goes on not only now but in the future because I've seen it.

Sally Mason
Purdue University

...the thing I love about EPSCoR is the strategic planning part. I think the things that I love about the RII proposals, when they work, is that it's really a realistic perception of here's where we are, here's where we want to go, these are the things that will get us there, and then there's some accountability measures. Those are great, and I think that's something you definitely want to keep in the competition. I think you want to make that as flexible as possible because everybody's environment is different about how they reach those.

Jim Coleman
University of Missouri, Columbia

EPSCoR Future: Resources to Meet National Needs

EPSCoR states are, by definition, underutilized resources in the national technology enterprise, yet they offer many assets that can contribute substantially to stimulating innovation and enhancing American competitiveness.

Many EPSCoR states have strong public school systems and do a better job than many non-EPSCoR states in educating students in science and mathematics. In the most recent National Assessment of Educational Progress (NAEP)[6] study of eighth grade science performance, 8 of the 11 best performing States were EPSCoR States. Studies show that a large percentage of high school graduates study at colleges and universities within a hundred miles of their homes. Thus, strengthening colleges and universities in EPSCoR states is an attractive strategy for encouraging students from EPSCoR states to enter science and engineering fields.

Top States in 2005 NAEP 8th Grade Science Scores

North Dakota
New Hampshire
Vermont
Montana
South Dakota
Massachusetts
Wyoming
Idaho
Maine
Minnesota
Wisconsin

**EPSCoR States underlined*

Undergraduate science and engineering programs at universities in EPSCoR states are already strong. Dramatic evidence is provided by the most recent list of Goldwater Scholars[7]. This highly competitive program provides support for sophomore and junior college students studying science, mathematics, or engineering. Goldwater Scholars have won 63 Rhodes Scholarships, 80 Marshall Awards, and many prestigious fellowships. In the most recent class, 22 percent of the 181 Goldwater Scholars are enrolled at universities in EPSCoR states.

There are many good, but few elite, science and engineering graduate programs at universities in EPSCoR states. In this area, NSF EPSCoR can have a large impact by providing added infrastructure to further advance high quality integrated graduate education programs linked to the national priority of a globally competitive American S&T workforce. Several decades ago, rural regions of the United States provided many of the Nation's scientists and engineers[8]. Many were trained at regional universities, which developed some of the strongest engineering colleges in the country, among them Illinois, Michigan, Purdue, Georgia Tech, Texas, and Wisconsin, which are all now ranked among the top 15 engineering colleges in the country[9]. Many universities in EPSCoR states are already training large numbers of engineers for Dell, IBM, Boeing, 3M and other companies.

Minority students are another relatively untapped source of potential scientists and engineers. If the nation is to meet its future high technology workforce needs, these students must be attracted into science and engineering professions. EPSCoR states are particularly well suited to contribute to this. They are home to[10]:

- 50 percent of Historically Black Colleges and Universities
- 23 percent of Hispanic Serving Institutions, and
- 70 percent of Tribal Colleges and Universities.

Perhaps most importantly, however, the EPSCoR states are well positioned to help address a number of the scientific and technological challenges facing our nation. Seven of the top ten net energy exporting states are EPSCoR states. Coal, natural gas and oil lie within a number of EPSCoR states; others are poised to develop alternative fuels from agricultural and forestry products.

...in Wyoming you talk about energy production, but EPSCoR states in general have a lot to give to the nation. For example, if you look at the top 10 energy-producing states in the nation, net energy-producing states, there are some states, like Texas, that produce a lot of energy but they consume more than they produce. So if you look at the net, eight of the top 10 are EPSCoR states. Wyoming and West Virginia are leading the pack there. This also is true for other kinds of extractive industries: timber, fisheries, agriculture, and a lot of things like this. You can see where EPSCoR states have a role.

William Gern
University of Wyoming

A number of the EPSCoR states like Rhode Island, South Carolina, Delaware, and Maine are coastal states, with research varying from ocean currents and patterns, to flooding and weather issues. Other EPSCoR states such as Louisiana deal with hurricanes, tornadoes, drought, and other climate conditions. Many EPSCoR states such as Montana, Vermont, Wyoming, and Idaho are focused on protection of natural resources, including vast national parks and public lands. Science to address water and land use issues is important in other groups of EPSCoR states. Certain participants such as Nebraska, Kansas and the Dakotas have major agricultural research activities, including emphasis on infectious diseases that can be related to bioterrorism. Several states have ports that are vulnerable to the import of terrorist weapons. More people pass through one EPSCoR state, Hawaii, each day than through any other location around the world. Alaska's Anchorage airport is one of the world's great cargo transportation hubs. New Mexico and West Virginia include major national laboratories and federal facilities with major scientific equipment such as telescopes. Many EPSCoR states such as Alabama and Nebraska have nationally recognized medical centers. Mississippi and Nevada, among others, have military installations, some with special requirements in materials, communications technologies, and scientific testing and evaluation. Most are building new capabilities in the physical sciences and engineering. All are seeking high performance computing and networking capabilities. The potential for major collaborations between academic research institutions and the various entities engaged in the above activities is huge and should not be ignored as our nation expands its S&T base.

It's important to focus EPSCoR on research challenges relevant to the people in your state as well as issues that are nationally important. By focusing on Biodiversity in an Island Environment, we found that 'special niche.'

Rose Tseng
University of Hawaii-Hilo

A Vision for EPSCoR through 2020

EPSCoR 2020 Vision

Through EPSCoR, NSF should enlist scientists from all parts of the United States in efforts to strengthen the Nation's international competitiveness by assuring that they will have opportunities to participate in research that can lead to greater prosperity and security for their states, communities and themselves.

In order to develop a vision for EPSCoR 2020, it is necessary to understand: (1) the current state of the U.S. research community and how the EPSCoR states fit, (2) the factors that make the EPSCoR states different from the way they were when they first entered the program, and (3) the current strengths and weaknesses of each state and what goals each of the states has for its research base, its S&T environment and its economy.

We need a larger vision, a longer vision, and a different kind of time horizon. Even though the particulars of it may be on a three-year or a five-year scale, it needs to be on a larger horizon because it takes time to move from where you are to where you really need to be. That's something that really has to be realized.

Shirley Malcom
American Association for the Advancement of Science

One means of addressing this vision is to adopt a process that requires all EPSCoR jurisdictions to: (1) revisit their S&T goals and submit a 5- to15-year strategic plan (the period of the plan is to be determined by the jurisdiction's state of development) to achieve competitiveness and to be evaluated on the adequacy of the plan in the context of the jurisdiction's S&T reality; and (2) to submit a 3-5 year fundable proposal that will constitute its short-term concrete action plan to build competitive research infrastructure and R&D programs. It should have four essential components: R&D infrastructure and programs; human resource development and faculty development in selected research areas; an innovation

component that will contribute to the jurisdiction's economic development strategy; and appropriate milestones and metrics. The component of the short-term plan or proposal must make a persuasive case that the short-term plan contributes in a coherent and systemic manner to the proposed long-range plan. In order to permit the long-range plan to meet its objectives, the NSF should increase the level of funding of the infrastructure awards to make the funding commensurate with size of the jurisdiction and the magnitude of the S&T transformation challenge.

To accomplish the long–term goal of EPSCoR, states need to create state-level R&D culture among policy makers. Without informed supportive and active Governors, legislators, and higher education officials, investments in EPSCoR states will not generate the expected returns. A new vision for EPSCoR must include an accelerated effort to develop S&T policy capacity at the state level.

Jay Cole
West Virginia Department of Education and the Arts

Strategic Priorities for Achieving the EPSCoR Vision

Eight Strategic Priorities should guide NSF and EPSCoR toward this vision. Four should be the primary responsibility of NSF, three should be the primary responsibility of the EPSCoR community, and one requires shared responsibility.

NSF RESPONSIBILITY

- **Strategic Priority 1: Provide more flexible EPSCoR Research Infrastructure Improvement (RII) awards that focus foremost on building infrastructure to do basic competitive research. Awards should have a duration of up to five years, with an award range of $3-$5 million per year, per state.**

The principal difference between good and great universities is the extent and quality of their infrastructure -- for example, the people (faculty, post-docs, and graduate students), facilities, computing and communications, and libraries. Investing in infrastructure is thus the most effective strategy for enhancing research capacity and competitiveness. *This historic EPSCoR strategy must be retained and strengthened.*

1.1. *Recommended Action - Increase the size and duration of Research Infrastructure Improvement (RII) Grants*. RII awards generally involve multiple institutions and typically require a year or more of planning, and months of proposal preparation. In these respects, RII grants are similar to grants for Centers and other major NSF programs, yet RII grants are currently limited to three years at a maximum of $3 million per year. In effect, grants are often much smaller and accompanied by a number of non-research related requirements. The three-year grant restricts the ability of states to plan and implement their strategies. As noted above, awards should have a duration of up to 5 years, with an award range of $3-$5 million per year, per state.

1.2. *Recommended Action - Increase the flexibility of the RII grant to allow states to address their individual needs more effectively*. EPSCoR states are not homogeneous. A one-size program does not fit all states. They vary widely in the number and characteristics of their universities, their areas of established and potential contributions, and their goals. Consistent with merit-based selection,

…states are in different places. Some need more investments in the base level; some need more investments in centers of excellence; some need more investments in all of them. Flexibility is also needed to stimulate changes in the R&D policy culture in the state. That's where the long term pay off is for EPSCoR.

Paul Hill
WV EPSCoR

EPSCoR should provide greater opportunities for states to address their individual needs through RII grants, and establish a review process that reflects their heterogeneity. Present procedures do not permit states to compete for simultaneous or overlapping awards. Periods without RII funding often result, and states thus lose momentum in their development efforts.

1.3. *Recommended Action - In the RII planning and grant review process, incorporate evidence of strong state and/or institutional commitments as a selection criterion. EPSCoR is most successful, particularly with RII grants, when NSF and either the state and/or the research institutions function as partners.* A strong commitment by states and institutions is essential to ultimate success.

1.4. *Recommended Action - NSF should act vigorously to ensure that all EPSCoR states have the cyberinfrastructure necessary to attract and execute advanced research.* Advanced computing and communications are critical enablers of research and research program development, and are an important attraction to high technology business development. Many NSF solicitations and programs now require a certain level of connectivity for participation. EPSCoR states must not be left behind as NSF invests in this area.

... for states like South Dakota... I maintain that our social fabric in the world has always been tied to transportation, since the beginning of time. It's only more recently that we've been able to place equal emphasis on communication and computation... if we don't get broadband highways through South Dakota, we're still going to be left out. Other EPSCoR states are in that same boat. So I think it would be important for us to advocate that the EPSCoR states do get these data highways, do get connected through broadband and that maybe we help map out some methods for our congressional representatives.

Al Kurtenbach
Daktronics, Inc.

1.5. *Recommended Action - Assure that universities in EPSCoR states have full access to the Major Research Instrumentation grant program and, for this purpose, permit and encourage them to partner with other universities, including those in other EPSCoR states.* Smaller universities often need access to major research facilities, but cannot justify the cost of those facilities through the anticipated level of usage. Encouraging regional university partnerships and sharing of resources can address this issue. Building collaborations with the best researchers in one's field, regardless of where they reside, is an important strategy for professional development. In this case, it must be implemented with attention to ensure that EPSCoR resources principally address the development of capacity and competitiveness within EPSCoR states.

- **Strategic Priority 2: Emphasize the imperative for a more geographical dispersion of funding and increased geographical participation by infusing EPSCoR goals into all of the NSF's programs and initiatives**.

The goal of establishing geographic balance in research funding is clearly expressed in the NSF statutory mission. Success in attaining this goal can be achieved only by clear and strong leadership throughout the Foundation.

2.1 *Recommended Action - Incorporate the mission of attaining increased geographical participation into the mission statements, agendas, and culture of the NSF Research Directorates and Offices.* EPSCoR continues to be a research infrastructure development program. EPSCoR contributes to the state and its economy, and its universities' faculty and students by providing the research opportunities and discoveries that propel S&T development and innovation. EPSCoR states will develop their S&T capabilities and contribute to the ACI and other national initiatives only if they keep their focus on the importance of the research base. Toward this end, the principal components of the EPSCoR program are designed to make EPSCoR states more competitive for NSF's research and research-related programs. EPSCoR states have made progress in research infrastructure development and anticipate further success. However, there is a need for additional and better integration of EPSCoR researchers into projects and new initiatives supported in NSF's research solicitations. The future EPSCoR envisioned in this report is dependent upon a close and solid working relationship with those at the forefront of academic research.

About a year or more ago, the NSF created the Office of Cyberinfrastructure in the Office of the Director. Previously, the activities of that office had been in the CISE Directorate and it was, for a variety of reasons, viewed as wise to move it into the Office of the Director because cyberinfrastructure is a very crosscutting activity… I think [EPSCoR is] an equally broad transformative activity, transformative not just in the research but actually the process itself is transformative.

Kelvin K. Droegemeier
University of Oklahoma

2.2 *Recommended Action - Relocate the EPSCoR program to the Office of Integrative Activities in order to ensure cross-directorate involvement in the program and integration into the cutting edge NSF initiatives.* The management structure for promoting increased geographical inclusion in NSF-funded activities throughout the agency's Directorates requires that EPSCoR be located in an organization that can facilitate program interactions with all Directorates and Offices. Similar to NSF's cyberinfrastructure activities, EPSCoR funded research reaches across many disciplines, and EPSCoR co-funding has involved more than 100 NSF programs. A more central and research-oriented parent organization would improve EPSCoR planning, co-funding, outreach and technical assistance efforts, and enable better coordination efforts throughout the agency.

2.3 *Recommended Action - Monitor progress in attaining better geographic distribution through annual analyses of the Merit Review Process.* Issue a Dear Colleague Letter to the S&T community on this issue and systematically employ the merit review criteria on geographic distribution throughout the Foundation. Annual reports by the Foundation to the National Science Board routinely contain the statement: *Reviewers also consider how well the proposed activity fosters the*

…EPSCoR program officers shouldn't just be the reviewers. They should also be advocates within the Foundation. We ought to put that forward as one of their key job descriptions. I think, over the years, that has been true of them, but they ought to be listening out for when somebody says, 'Oh, I need a reviewer.' 'I've got a great person for you.' They ought to be giving a list of people to the Director and the Deputy Director who should be on advisory panels because they're really great. They ought to call when there's an IPA open that somebody in our state should fit into. So I think putting that advocacy back on NSF's plate is something important.

Jean Toal Eisen
Senate Committee on Commerce, Science, and Transportation

integration of research and education and broadens opportunities to include a diversity of participants, particularly from underrepresented groups. There is no evidence that similar monitoring occurs with respect to the distribution of funds on a geographic basis.

2.4 *Recommended Action - Develop new questions for Committees of Visitors (COVs) regarding the distribution of awards by state to elicit quantitative information.* Currently, COV's are asked vague questions about regional competitiveness and participation and usually return vague answers. For example, *"Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?"* These should be replaced with questions that permit the quantitative assessment of progress over time.

2.5 *Recommended Action - During annual budget submissions, NSF should intensify its advocacy for EPSCoR.* The Foundation's contributions to the Administration's science and technology agenda, particularly the American Competitiveness Initiative, can be substantially enhanced by a stronger emphasis on achieving regional competitiveness and participation through EPSCoR. This is consistent with the NSF Statutory Mission, "…to avoid undue concentration of such research and education."

2.6 *Recommended Action - Reconvene the EPSCoR Workshop in the Spring 2007* to determine the progress that has been achieved in implementing the recommendations of this report.

- *Strategic Priority 3: Revitalize and extend other components of EPSCoR.* **Other components of EPSCoR -- co-funding, planning grants, outreach -- remain important, but require improvements, including, in the case of Planning Grants and Outreach, clear links to infrastructure planning and implementation. NSF also must ensure that EPSCoR states have adequate access to new initiatives such as Cyberinfrastructure**.

3.1 *Recommended Action – Strengthen the co-funding program by providing more information about awards granted, and by increasing the flexibility of the EPSCoR Director and Program Managers to make awards in all disciplines* – not just those supported by the current RII in a state. EPSCoR co-funding is valued by both the EPSCoR community and by NSF Program Managers, but a lack of transparency in the awards process concerns potential recipients. Granting the EPSCoR Director and the Program Manager the flexibility to reach further into the list of highly qualified proposals could add to the number of awards made. All NSF program officers should be made aware of the EPSCoR co-funding effort periodically.

Over the years, co-funding has become a bit more mysterious and less transparent as to how it works at NSF. Certainly, it's a struggle to keep the faculty aware that there is such a thing as co-funding, especially outside the main research university.

But when they do find out and they ask their project director at NSF, 'Well, I'm close to the borderline. Can I get co-funding?,' and that person responds with, 'What's co-funding?' then that's a problem. I know it's a constant struggle in NSF EPSCoR because there is a turnover.

Judith Van Houten
University of Vermont

3.2 *Recommended Action - Improve coordination with departments and agencies that have EPSCoR-like programs.* Communication between NSF and the other six EPSCoR-like programs occurs now, but there is little evidence of collaboration. NSF should be more proactive in identifying, facilitating and sponsoring synergistic activities.

3.3 *Recommended Action - Use the Planning Grant process to nurture State "S&T business plan" development.* States and EPSCoR can benefit greatly by developing longer–term "S&T Business Plans," that incorporate EPSCoR. The Planning Grant process could be an important stimulant to the development of these plans and entirely consistent with Priority 1, above. These plans should include evaluation strategies with benchmarks and metrics, appropriate to the state, to measure and document progress toward established goals.

3.4 *Recommended Action - Expand efforts to promote SBIR development*. A number of EPSCoR jurisdictions have successfully utilized SBIR awards to assist with small business creation and expansion. By providing early support and technical assistance, the states have proven that they can improve the success rate of Phase I and II SBIR awards. In addition, NSF has ensured that the dollars that are taxed from the EPSCoR Office for the SBIR program are actually used to fund meritorious SBIR awards in the EPSCoR states. Current efforts should be expanded and new means explored for further accelerating the use of the SBIR program in the EPSCoR states. Coordination of the NSF SBIR effort with those of other federal EPSCoR-like programs and with SBA could prove useful.

- *Strategic Priority 4: Restore the "Experimental" nature of EPSCoR by using it as a "test bed" for new strategies.* **In its early years, EPSCoR was truly an "experimental" program, exploring potential opportunities to increase capacity and competitiveness. Now, as a more mature program, its well-established structure offers an opportunity to test programs addressing other NSF and national goals. Developing expertise in topics of national importance will enhance success of proposals in other competitions.**

4.1 *Recommended Action - Provide more flexibility to the RII structure so that multiple strategies can be explored, including support for transformative research and innovation.* Supporting transformative research[11] and stimulating innovation are priorities established in the Foundation's *2020 Vision.* The NSF-State partnership inherent in EPSCoR provides an excellent opportunity to experiment with the design of grant programs in these areas.

4.2 *Recommended Action - Develop additional EPSCoR programs of grants in areas of national priority: homeland security, energy independence, climate change, and perhaps others.* The NSF-State partnership established by EPSCoR provides many opportunities to develop additional strategies for meeting these national priorities.

EPSCoR Community (States) Responsibility

- *Strategic Priority 5: Develop "state strategic S&T business plans" for state EPSCoR Programs, consistent with state needs.* Some states have recently developed strategic business plans for their EPSCoR program, with clear goals, timelines, required commitments, and progress metrics. Successful plans have included efforts to develop and mentor new faculty, increase interactions with local and national "high tech" companies, and structured evaluation that can enable rigorous examination of EPSCoR activities at both the federal and state levels. Information on successful plans should be disseminated to other states.

5.1 *Recommended Action - The EPSCoR Office should provide a forum for discussing "best practices" of S&T business plans by convening a workshop of State Directors and other national leaders in this area and provide resources for consultation in plan development.* Many of the EPSCoR jurisdictions lack a fully developed institutional and state cultural environment that nurtures and promotes S&T, R&D, and the human resources needed to achieve competitive S&T activity. Furthermore, they may also fall short of having an innovation ecosystem that will convert S&T

activity into economic development for the jurisdiction. NSF could use information from states with long-range plans to guide the re-design and development of the EPSCoR Office; to educate the Research Directorates of the Foundation on the visions and goals of the EPSCoR jurisdictions; and to obtain buy-in from the Directorates to support the EPSCoR 2020 Vision.

5.2 *Recommended Action - The EPSCoR community should develop resource and training materials related to grant development, and organize events to introduce faculty to NSF Program Managers.* The strategy with the quickest return in increased funding is developing the skills of faculty in research program development, including fundraising. Acquiring and enhancing new faculty talent can result in immediate improvements in competitiveness and cultural change. Workshops based on these training materials should be offered at all major EPSCoR universities.

5.3 *Recommended Action - Develop industry funding for university infrastructure. The EPSCoR community should convene a workshop on the development of industrial funding for university research, especially focusing on small and mid-sized universities*. EPSCoR universities are becoming increasingly successful in attracting industrial research support. Local industry has a strong interest in supporting university education as a source of new employees and intellectual property. A thorough discussion of this topic among university administrators in EPSCoR states could provide a significant boost to their efforts.

If you were to look at industry-performed R&D, which is a really critically important indicator as we talk about the American Competitiveness Initiative, you see again that EPSCoR states only hold 6.78 percent of the reported industry R&D. There are no EPSCoR states in the top 10 and there are nine EPSCoR states in the bottom 10, keeping in mind that we are talking about a small population. Nevertheless, we're talking about 25 states, Puerto Rico and the Virgin Islands.

William Gern
University of Wyoming

SHARED NSF AND EPSCOR COMMUNITY RESPONSIBILITY

- *Strategic Priority 6: Create a shared understanding and definition of success.* **There is not, at present, a commonly held view of what should be understood as success for EPSCoR. Clearly, metrics for success must go beyond the flow of funding and include educational and economic outcomes.**

6.1 *Recommended Action - NSF and representatives of EPSCoR stakeholders, among others, Federal elected officials, State elected officials, and universities in EPSCoR States, should undertake an active discussion of the importance of a more balanced geographic dispersion of national resources and funding, leading to a shared understanding of goals and metrics.* The flow of research funding to EPSCoR states is an essential input toward higher-level National goals. However, dollars are not a sole measure, and in a time of doubling of the NSF budget, the EPSCoR states will have to work hard just to maintain current percentages. Articulating these broader goals and desired outcomes -- some of which will be related to faculty enhancements, numbers of new programs accessed for the first time, workforce development and economic growth -- is important in achieving a broader understanding of the contributions and success of the EPSCoR program.

References

[1]The Council on Competitiveness (http://www.compete.org) is an organization of about 130 members, primarily industry CEOs, university presidents, and leaders of labor organizations that "…addresses cutting-edge issues that drive our nation's ability to compete successfully in the global marketplace, while increasing the standard of living for our citizens." *Innovate America* is available at http://innovateamerica.org.

[2]Business Roundtable (http://www.businessroundtable.org) is an association of chief executive officers of leading U.S. companies "…committed to advocating public policies that ensure vigorous economic growth, a dynamic global economy, and the well-trained and productive U.S. workforce essential for future competitiveness." *Tapping America's Potential* is available at http://www.tap2015.org/about/index.html.

[3]Thomas L. Friedman, The World is Flat, A Brief History of the 21st Century, New York, Farrar, Straus, and Giroux, 2005.

[4]*Rising Above the Gathering Storm, Energizing and Employing America for a Brighter Economic Future*, National Academies Press, 2005. Available at http://fermat.nap.edu/catalog/11463.html.

[5]The National Science Board's 2020 Vision for the National Science Foundation can be found at http://www.nsf.gov/publications.

[6]NAEP data is available at http://nationsreportcard.gov/science_2005/.

[7]Congress established the Barry M. Goldwater Scholarship and Excellence in Education Program in 1986 to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students who intend to pursue careers in these fields. For more information see http://www.act.org/goldwater/.

[8]It is interesting to note that four recent NSF Directors and two recent Deputy Directors are either natives of EPSCoR states or received part of their training in EPSCoR states.

[9]U.S. News and World Report Rankings of Engineering Schools, 2006 Edition.

[10]Source: NSF EPSCoR Office.

[11]NSF describes transformative research as research that has the capacity to revolutionize existing fields, create new subfields, cause paradigm shifts, support discovery, and lead to radically new technologies.

Appendix A

Agenda

June 15-16, 2006

Arlington Hilton and Towers | Master's Ballroom | Arlington, VA

June 15, 2006

11:30 a – 11:45 a **WELCOME AND INTRODUCTION**

Jerome "Jerry" D. Odom, Ph.D.
Executive Director, University Foundations, University of South Carolina
Chair, EPSCoR/IDeA Foundation Board of Directors

11:45 a – 12:15 p **OVERVIEW OF EPSCOR PROGRAM**

Royce C. Engstrom, Ph.D.
Provost and Vice President for Academic Affairs, University of South Dakota

William A. Gern, Ph.D.
Vice President for Research and Economic Development, University of Wyoming

12:15 p – 12:35 p **PERSPECTIVES FROM OSTP AND NSF**

Kathie L. Olsen, Ph.D.
Deputy Director, National Science Foundation

12:35 p – 1:00 p **PERSPECTIVES FROM THE STATE**

The Honorable Marc Racicot
Former Governor, State of Montana
Former Chair, National Republican Committee
President, American Insurance Association

1:00 p – 1:10 p **QUESTIONS**

1:10 p – 2:00 p **LUNCH AND SMALL GROUP DISCUSSION**

This discussion will focus on three questions: (1) What elements of the current EPSCoR framework are effective, and should be retained? (2) What are the major issues/concerns in the current framework? (3) What possible new elements would enhance the current framework?

2:00 p – 5:00 p **ROUNDTABLE DISCUSSION**

This discussion will: (1) examine the characteristics, challenges and issues in the EPSCoR States; (2) discuss the contributions of the EPSCoR States to the American Competitiveness Initiative (ACI) and the responsibility of the nation to foster innovation in all states and territories; and (3) articulate a vision and framework for the next generation EPSCoR.

5:30 p – 7:30 p **RECEPTION**

June 16, 2006

8:30 a – 11:30 a **ROUNDTABLE DISCUSSION (CONT.) AND RECOMMENDATIONS TO NSF**

11:30 a – 12:00 p **SUMMARY AND CONCLUDING REMARKS**

Appendix B

Participant List

EPSCoR 2020 Workshop
June 15-16, 2006
Arlington Hilton and Towers | Arlington, VA

Peter Alfonso
Vice President for Research
University of North Dakota
103 Twamley Hall
PO Box 8367
Grand Forks, ND 58202-8367
701-777-6736
peteralfonso@mail.und.nodak.edu

Jay Cole
Education Policy Advisor to the Governor
Deputy Secretary, WV Department of Education and the Arts
Department of the Cabinet Secretary
State Capitol Building Five, Room 205
1900 Kanawha Boulevard East
Charleston, West Virginia 25305
304-558-3152
jcole@wvgov.org

James S. Coleman
Vice Chancellor for Research and Professor of Biological Sciences
University of Missouri – Columbia
Office of Research Department
205 Jesse Hall
Columbia, MO 65211
573-882-9500
colemanjs@missouri.edu

Joseph G. Danek
Executive Director
EPSCoR/IDeA Foundation
101 Constitution Avenue, NW
Suite 650 East
Washington, DC 20001
202-639-0671
jdanek@tigdc.com

Gordon Day
Division Chief Emeritus
Optoelectronics Division
National Institute of Standards and Technology
1470 Findlay Way
Boulder, CO 80305
303-499-9307
g.day@ieee.org

Kelvin K. Droegemeier
Associate Vice President of Research
Regents Professor of Meteorology
Roger and Sherry Teigen Presidential Professor
Director, Center for Analysis and Prediction of Storms
Director, Sasaki Institute
University of Oklahoma
Sarkeys Energy Center, Room 1110
100 East Boyd
Norman, OK 73019
405-325-0453
kkd@ou.edu

Royce C. Engstrom
Provost and Vice President for Academic Affairs
University of South Dakota
414 East Clark Street
Slagle 103
Vermillion, SD 57069
605-677-6497
rcengstr@usd.edu

William A. Gern
Vice President for Research and Economic Development
University of Wyoming
Office of Research
1000 E. University Avenue
Laramie, WY 82071
307-766-5353
willger@uwyo.edu

Manuel Gómez
Director
Resource Center for Science and Engineering
University of Puerto Rico – Río Piedras
Facundo Bueso Bldg., Office 304
San Juan, PR 00931
787-765-5170
mgomez@hpcf.upr.edu

Peter Goodwin
Professor, Hydrology, Ecohydraulics
University of Idaho, Boise
Center for Ecohydraulic Research
College of Engineering
322 E. Front St., Suite 340
Boise, ID 83702
208-364-6164
pgoodwin@uidaho.edu

Paul Hill
Chair, EPSCoR State Project Directors
1018 Kanawha Blvd E, Suite 1101
Charleston WV 25301-2825
304-558-4128
hill@wvepscor.org

Aelred "Al" Kurtenbach
Chairman and President
Daktronics, Inc.
331 32nd Avenue
Brookings, SD 57006
605-697-4212
akurten@daktronics.com

Shirley M. Malcom
Director, Education and Human Resources Programs
American Association of the Advancement of Sciences
1200 New York Avenue, NW
Washington, DC 20005
202- 326-6680
smalcom@aaas.org

John H. Marburger, III
Science Advisor to the President
Director, Office of Science and Technology Policy
Executive Office of the President
US Climate Change Science Program
1717 Pennsylvania Ave, NW, Suite 250
Washington, DC 20006
202-223-6262
John_H._Marburger@ostp.eop.gov

Sally Mason
Provost
Office of the Provost
Purdue University
610 Purdue Mall, Room 100
Hovde Hall of Administration
West Lafayette, IN 47907-2040
765-494-6835
sfmason@purdue.edu

Thomas J. McCoy
Vice President for Research, Creativity, and Technology Transfer
Montana State University
207 Montana Hall
Bozeman, MT 59717-2460
406-994-2891
tommccoy@montana.edu

Keith McDowell
Vice President of Research
University of Alabama
201 Rose Administration Building
Tuscaloosa, AL 35487
205-348-4566
keith.mcdowell@ua.edu

Jerome D. Odom
Executive Director, University Foundations University of South Carolina
Chair, EPSCoR/IDeA Foundation Board of Directors
Osborne Administration Building, Room 208
University of South Carolina
Columbia, SC 29208
803-777-9795
odom@sc.edu

Kathie L. Olsen
Deputy Director
Chief Operating Officer
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, Virginia 22230
703-292-8001
kolsen@nsf.gov

Nathaniel G. Pitts
Director
Office of Integrative Activities
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, Virginia 22230
703-292-8040
npitts@nsf.gov

The Honorable Marc Racicot
Former Governor, State of Montana
President, American Insurance Association
1130 Connecticut Avenue, NW
Suite 1000
Washington, DC 20036
202- 828-7100
aodom@aiadc.org

Paul G. Risser
Chancellor
Oklahoma State Regents for Higher Education
655 Research Parkway, Suite 200
Oklahoma City, Oklahoma 73104
405-225-9120
prisser@osrhe.edu

Thomas N. Taylor
Department of Ecology and Evolutionary Biology
University of Kansas
Haworth Hall
1200 Sunnyside Avenue
Lawrence, KS 66045-7534
785- 864-3096
tntaylor@ku.edu

Jean Toal Eisen
Senior Professional Staff Member
United States Senate
Committee on Commerce, Science and Transportation
560 Dirksen Senate Office Building
Washington, DC 20510
Jean_ToalEisen@commerce.senate.gov

Lee T. Todd Jr.
President
President's Office
101 Main Building
University of Kentucky
Lexington, KY 40506-0032
859-257-1701
jquire@email.uky.edu

Rose Tseng
Chancellor
University of Hawaii at Hilo
200 West Kawili Street
Hilo, HI 96720-4091
808-974-7444
rtseng@hawaii.edu

Judith Van Houten
State Project Director, Vermont EPSCoR
University of Vermont
Cook Physical Science Building
82 University Place
Burlington, VT 05405
802-656-2922
judith.vanhouten@uvm.edu

David S. Weir
Director
Delaware Biotechnology Institute
University of Delaware
Delaware Technology Park
15 Innovation Way
Newark, DE 19711
302-831-1818
weir@dbi.udel.edu

Appendix C

Appendix D

[Survey to EPSCoR University Presidents/Chancellors]

Dear Colleagues:

You should have recently received an e-mail from me announcing that a June workshop is being planned focusing on the future of NSF EPSCoR.

While we are still awaiting final NSF approval, the workshop is tentatively titled "NSF EPSCoR 2020," and is scheduled to be held June 15-16, 2006 in Washington, DC. In my previous correspondence, I attached a short (three-question) survey designed to elicit your thoughts about the role of EPSCoR in developing the research infrastructure at your institution in the next 10 - 20 years. It is crucial that we have your input as we plan for the workshop. Again, I ask that you e-mail your survey responses by April 28, 2006 to Dr. Jerry Odom at odom@sc.edu or Dr. Scott Little at little@scra.org. The survey is attached. I thank you all in advance for your support.

Sincerely yours,
Andrew A. Sorensen

Name:
Institution:

1. What are your goals/objectives for research at your institution over the next 10-20 years?

2. What are the principal challenges/obstacles to accomplishing your goals?

3. What role can/should EPSCoR play in developing research infrastructure at your institution over the next 10-20 years.

Please email survey to Dr. Jerry Odom at odom@sc.edu no later than April 28, 2006.

[Survey to EPSCoR Participating University Vice Presidents of Research]

Dear Colleagues:

I am writing to you as the research leaders at institutions that participate in the National Science Foundation's (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR). We need your help in determining long-term goals and objectives for the NSF EPSCoR program.

As you know, the EPSCoR program is designed to assist states to become more competitive for federal research and development funding, both at NSF and throughout the government. In fact, EPSCoR currently operates not only at NSF, but also at six other departments and agencies. Currently 25 states, the Commonwealth of Puerto Rico and the Virgin Islands participate in the EPSCoR program. These states -- half the states -- account for about 20 percent of the U.S. population, 25 percent of all doctoral/research universities, and 18 percent of all scientists and engineers; but, collectively, receive only about 10 percent of all NSF research funding, a percentage that is generally reflected throughout the federal government.

Over the years, EPSCoR has helped our universities develop research infrastructure – hire additional faculty, purchase state-of-the-art research equipment, develop research clusters, expand our computing and networking capacity, and undertake related activities. NSF's Research Infrastructure Improvement (RII) awards have supported basic research infrastructure development and NIH's COBRE grants have provided some of our institutions with the largest federal research grants they have ever received. Many of our institutions performed very well in the recently-announced Carnegie rankings, a testimony to our achievements.

Consequently, we were extremely pleased when the National Science Foundation indicated that it would "like to look 10-20 years into the future and think strategically about investments that will be needed to create the national research capacity that we would like to achieve – a new vision for EPSCoR." Dr. Kathie Olsen, Deputy Director of the National Science Foundation, has requested that Dr. Jerome Odom of the University of South Carolina and the Chair of the EPSCoR/IDeA Foundation work with Dr. Nathaniel Pitts, Director, Office of Integrative Activities, to hold a workshop in June on the future of EPSCoR.

As you will note from Dr. Olsen's letter, a copy of which is attached, "NSF takes a 'bottoms up' approach to all our program planning – we rely on our community to give us their insights about what works, how the national science and engineering enterprise is changing, and where we should focus our efforts." In order to prepare for this workshop, we have also asked the presidents of institutions in EPSCoR states to provide us with guidance on overall goals and objectives for the program. We are writing to you to seek input on mechanisms and approaches needed in the upcoming years. We will also be in touch with EPSCoR project directors, members of the EPSCoR/IDeA Coalition and Foundation Boards, and others about state and institutional needs, implementation mechanisms, and other specifics of the program. We would very much appreciate your response to the attached questionnaire at your earliest convenience.

If you or your staff has any questions, please do not hesitate to contact me at 803-777-2958 or Dr. Scott Little at 803-733-9060.

Thank you for your help with this important opportunity for EPSCoR.

Sincerely,

Jerome D. Odom
Distinguished Professor
Chair, EPSCoR Foundation Board of Directors

tsl

Name:
Institution:

1. How effective are the current components of the EPSCoR program, i.e., (a) Research Infrastructure Improvement Awards, (b) Co-funding, and (c) Outreach?

2. What are the major research infrastructure needs of your institution at this point in time if your institution is to continue to build its research base and become more competitive?

3. How do you see your research infrastructure needs evolving over the next 10 years and how will you seek to meet these needs?

4. What new mechanisms, support or technical assistance will you need?

5. What recommendations would you like to see emerge from this workshop?

Please email survey to Dr. Jerry Odom at odom@sc.edu no later than May 1, 2006.

[Survey to EPSCoR Project Directors]

Dear EPSCoR Project Directors:

As Dr. Sherry Farwell (NSF EPSCoR) shared with you, the National Science Foundation (NSF) will be sponsoring a workshop to discuss the future of NSF EPSCoR. The workshop -- titled "EPSCoR 2020" -- is scheduled to be held June 15-16th in Washington, DC. The workshop will serve as a platform for us to come together and "think strategically about investments that will be needed to create the national research capacity that we would like to achieve -- a new vision for EPSCoR."

In response to an invitation from Dr. Kathie Olsen, NSF Deputy Director, the University of South Carolina (USC) submitted a proposal to NSF's Office of Integrative Activities to conduct this workshop. Jerry Odom is the proposed PI; Scott Little the co-PI. While the proposal is still under review by the agency, it is our understanding that NSF wants to limit participation to a total of 20-25 participants, including NSF staff, national scientific leaders, and representatives from the EPSCoR community.

In order to ensure that a complete range of EPSCoR state officials comment on the future of NSF EPSCoR, we are soliciting input and advice from all EPSCoR university/college presidents, Vice Presidents/Chancellors of Research, and the RII Project Directors. As Project Directors, we seek your views on the following matters:

1. the effectiveness of the current program structure and funding mechanisms as well as areas for improvement;

2. needed changes that can better serve your institution(s);

3. developing research areas (i.e., related to people, equipment, etc.) that require new funding mechanisms;

4. types of relevant requests that you receive from faculty that you are unable to accommodate within the existing program; and

5. any other ideas that you believe will strengthen NSF EPSCoR over the next 10-15 years.

In order to incorporate your responses into materials being prepared for the Workshop, we would appreciate if you would email your responses to Scott Little at little@scra.org by COB Friday, May 19th.

If you have any questions, please do not hesitate to contact Scott at 803-733-9060.

Sincerely,

T. Scott Little
State Manager, SC EPSCoR/IDeA

Jerome D. Odom
Chair, EPSCoR Foundation Board of Directors