Approved 2-11-92
Date

MINUTES OF THE House COMMITTEE ON Computers, Communications&Technolog

The meeting was called to order by George Dean
Chairperson

12:00 Noon on January 28, 1992 in room 529-S of the Cap

All members were present except: Representative Patrick, Excused

Committee staff present: Jim Wilson, Revisor
Julian Efird, Research
Diane Duffy, Research
Donna Stadel, Committee Secretary

Conferees appearing before the committee: Ted Kuwana, Project Director, EPSCoR

Others attending: See attached list.

Chairman Dean announced a change in the agenda for Thursday, January 30. KFIS Post Audit Review will replace previously scheduled agenda.

Mr. Ted Kuwana, Project Director, Experimental Program to Stimulate Competitive Research (EPSCoR) was introduced by Chairman Dean. After presenting background of EPSCoR, (attachment 1), Mr. Kuwana explained why Kansas was invited as the eighteenth state to join EPSCoR. It was recognized majority of research money to the universities and colleges from federal sources was going to five to ten states. The objective of EPSCoR was to bring science and research endeavors in EPSCoR states to nationally competitive levels. In 1989, Kansas ranked 17th from the bottom among 50 states in federally supported science and research. In 1990, Kansas and Nebraska were invited to compete for EPSCoR funds.

Federal agencies award 2% to 3% of their budgets towards Small Business Innovation and Research (SBIR) awards. In 1990, the State of Kansas submitted 42 SBIR applications and had 3 awarded. This is below even EPSCoR states. A study over approximately ten years indicate the companies who have been successful and have made it, seem to be those who have innovation and been associated with a university. For the period 1982 to 1989, Kansas compared to neighboring states on a per capita basis very low. Not only are we not getting our share of federal research and development dollars in science and engineering, but our federal tax dollars are going to other states.

Except for Ft. Hays, which has two or three educational National Science Foundation (NSF) grants, all of the NSF grants in this state come to the three regients PHD granting institutions; KU, K-State and Wichita State. Our success rate of receiving these NSF dollars amounts to an averate of only 10%; however, the average success rate of proposals submitted to those awarded were 47% for the three institutions over five year period. National average is approximately 28%. We are only getting 10% of the money, but receiving way above national average in number of grants applied for.

Additionally, we have no national labratory in Kansas. This is an important factor, as institutions reap benefits from national labs. The academic science and engineering faculty for four year colleges, including junior colleges for the state is below that of our neighboring states. The faculty capacity becomes an even more important factor when considering no national labratory or research driven organization funded by industry exists, consequently, science and engineering research is done totally at the institutional level.

MINUTES OF THE House COMMITTEE ON Computers, Communication & Technology

room 529-S, Statehouse, at 12 Noon ~~a.m./p.m.~~ on January 28, 19 9.

Kansas Science and Technology Advanced Research Program (K*STAR) was developed for advanced research from the NSF program and distributed to the three major institutions for proposals with requirements for participation defined, along with the EPSCoR program. A basic premise was established that faculty be comprised of those who desire to rise to a competitive level; who have vision as well as motivation to look around themselves and determine who else they might work with at other regional institutions; and younger faculty must be integrated. Those who are successful and nationally recognized are to lead this effort as mentors. Emphasis must be on building capacity. In summary, the EPSCoR program is to underpin the basic science university, link path-roads together in cooperative programs and maintain educational programs from kindergarden through grade twelve.

Discussion followed regarding what action Oklahoma had taken in building their faculty and involvement of the Oklahoma Legislature. Mr. Kuwana said this was documented in a report and would provide to the Chairman.

Also discussed, were scholorships for science teachers as an add on. This will be done primarily through their women/minority summer programs.

Motion made to adopt minutes of January 22, meeting; seconded and carried. Meeting adjourned at 1:15 P.M., until Wednesday, January 29.

GUEST LIST

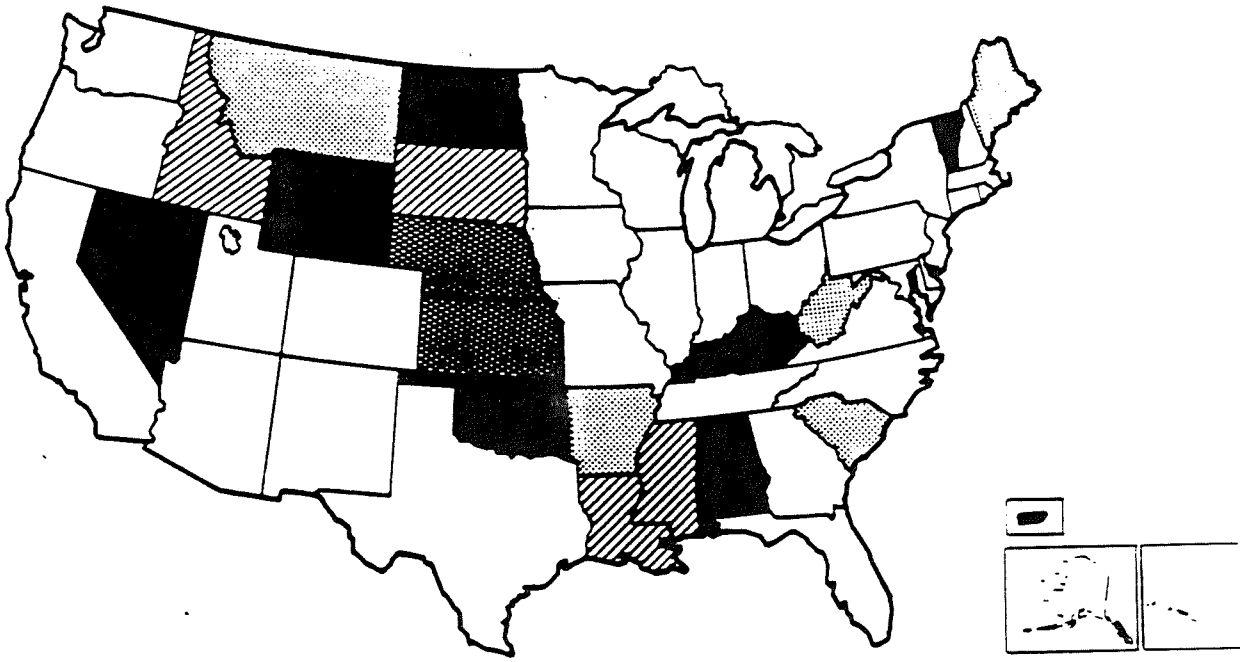
COMMITTEE: Computers, Communication & Technology DATE: 1-28-92

NAME (PLEASE PRINT)	ADDRESS	COMPANY/ORGANIZATIC
ERIC Sexton	Wichita	WSU
Jon Josserand	Lawrence	KU
Bob Wunsch	Lawrence	KUMC
Martin Rein	KC	KUMC
Ladislado M. Hernandez	~~9136~~ 5136 Sargent Topeka	Gov. Office
Dave Larson	LAS	Legislature

11/15/91

EPSCoR

Experimental Program to Stimulate Competitive Research



National Science Foundation
Washington, D.C.

House CCT
Attachment
1-28-92

EPSCoR

BUILDING ACADEMIC RESEARCH CAPACITY

Background

The National Science Foundation (NSF), an independent Federal agency, has a mandate to promote and advance scientific progress nationwide. The Foundation's Directorate for Scientific, Technological, and International Affairs (STIA) administers programs designed to: encourage small business science and technological innovations, promote international scientific cooperation, provide information for public policy formulation, and stimulate competitive research. The STIA Office of Experimental Programs to Stimulate Competitive Research (EPSCoR) is responsible for developing the scientific and technological (S&T) capacity of less competitive states possessing high quality science and engineering (S&E) talent; the capability to effect significant improvements in their research infrastructure; and the will to increase support of S&T endavors as an investment in their economic well-being.

EPSCoR is a merit-based program initiated in 1979 to assist less competitive states meet the challenge of increased competition for federal R&D funds. *EPSCoR* brings a states's academic research endeavors to nationally competitive levels by enhancing selected research areas and by stimulating local action to effect lasting improvements in the S&E infrastructure of its research universities.

Participant Eligibility

Since 1979, eligibility for *EPSCoR* grant competitions has been restricted to those states receiving a lesser amount of NSF's scientific research project support. This amount, initially set at one million dollars per year in 1980, has increased over the decade to the current limit of approximately five million dollars per year.

Qualifying states are ranked ordered on both their federal and NSF academic research obligations in three categories: (1) total obligations; (2) total obligations per academic scientist and engineer; and (3) total obligations per capita. A final rank is assigned to each state based upon the sum-of-ranks for the six indicators and the NSF invites the lowest ranking states to participate in *EPSCoR*. During the period 1980-1990, sixteen states and the Commonwealth of Puerto Rico have competed for EPSCoR awards. The states are: Alabama, Arkansas, Idaho, Kentucky, Louisiana, Maine, Mississippi, Montana, Nevada, North Dakota, Oklahoma, South Carolina,

South Dakota, Vermont, West Virginia, and Wyoming. Two additional states, Kansas and Nebraska, became *EPSCoR* participants in 1991 and will compete for awards in 1992.

Program Description

EPSCoR seeks to broaden the Nation's base of high quality science and technology by effecting lasting improvements in the quality and capability of academic S&E research and training in the Nation's less competitive states. It achieves its goal within a state by establishing a long-term partnership with broad-based, state-wide *EPSCoR* committees including representatives of the academic S&E community, state government, and the private sector. The committees are responsible for developing a comprehensive S&E research improvement plan for the state's research universities. It is expected that *EPSCoR* will play a central role in a plan that will:

- *develop increased public and private support for high quality science and technology;*
- *effect improvements in the quality of the academic research environment that will ensure increased competitiveness for additional R&D funds by the state's research universities;*
- *ensure that improvements achieved through EPSCoR-initiated activities continue beyond the end of the EPSCoR grant period.*

Program Process

The general *EPSCoR* procedure initiated in 1979, remains essentially intact. It begins with the NSF contacting leading members of the state's S&E research community, distinguished academic administrators, governmental leaders, and influential members of the business community to form an *ad hoc* state-wide *EPSCoR* committee.

The state's *EPSCoR* committee submits a proposal to the NSF to initiate a six-to-nine month planning process to be jointly funded by NSF and the state. During the planning period the committee examines the status of S&E research, training, and related activities within the state. Their analysis of current strengths and weaknesses leads to the development of state-wide improvement strategies and a comprehensive multi-year S&E improvement plan for the state's research universities. The NSF assists the *EPSCoR* committee to implement their plan through the award of a multi-year grant. Receipt of an award depends upon the results of merit competition among *EPSCoR* proposals submitted by the participanting states.

The *EPSCoR* awards support (1) improvements in the S&E research environment in the state's research universities and (2) enhancement of research areas with the potential to become nationally competitive. Therefore, an *EPSCoR* proposal consists of two distinct parts: (I) a state self-improvement plan and (II) S&E research enhancement proposals describing specific projects selected for enhancement

by the state. The complete proposal is evaluated by a three-stage merit review that includes: panel review of the improvement plan; standard NSF disciplinary merit review of the S&E research proposals; and final panel review of the complete *EPSCoR* proposal.

State Contribution

The total amount of financial support required to meet each state's EPSCoR objectives will depend upon its size, the number and type of S&E projects designated for enhancement, the current status of its research environment, and the scope and magnitude of the proposed improvements. However, the Foundation's current contribution, through an *EPSCoR* award for the implementation of a state's improvement plan is generally limited to $1,500,000 per year and three (3) years, respectively. Therefore increased local support of S&E research and training is imperative. Since its inception in 1979, EPSCoR has awarded a total of $51.7 million to the states through research improvement grants of approximately $600,000 per year over a three to five-year period. The participants have matched this amount with a total non-federal contribution of $156.2 million for a total program expenditure of $207.9 million.

In addition, broad-based support of S&E research and training developed through *EPSCoR* has resulted in the creation of state government and private agencies (e.g., the Arkansas Science and Technology Authority, the Oklahoma Center for the Advancement of Science and Technology and the Kentucky Council on Science and Technology). Several of the *EPSCoR* states have subsequently chosen to use these newly formed entities to provide leadership and additional financial support for S&T development within the state. This type of ongoing support of science and technology within a state is a distinguishing characteristic of a successful *EPSCoR* effort.

Summary

Thus far the *EPSCoR* initiative has succeeded in increasing the effectiveness of individual university researchers and departments to compete for federal research support and increased local awareness and support of S&E research, education and related activities. Many examples of nationally competitive research and individual professional accomplishments may be found in all of the participating states. In addition, departmental and institutional development has occurred as a result of changing institutional attitudes toward the support of research (i.e., Mississippi and Montana State Universities were awarded Engineering Research Centers in the Foundation's 1989 nation-wide competition). In recognition of its accomplishments the Congress and the National Science Board have cited the *EPSCoR* initiative as a model for building regional research capacity.

26 EPSCoR: A Model for Federal-State Partnerships?

Joseph G. Danek

Introduction

For the past ten years I have been concerned with the development of states that traditionally have been less competitive in science and technology; the states that have become known in recent years as the "EPSCoR" states. The National Science Foundation's (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) has used federal-state partnerships to create support for science and engineering (S&E) research within these states and to help them develop a high quality science and technology (S&T) base. My paper will focus on this model NSF program, its rationale, principles, and its impact on science and technology policy both within and outside of EPSCoR states.

National Science Foundation Mandate

The NSF has a mandate to promote and to advance scientific progress nationwide. Sections 3.(a) and (e) of the National Science

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Joseph G. Danek is head of the Division of Human Resource Development at the National Science Foundation. *This paper was presented at the AAAS Science and Technology Policy Colloquium, held April 11–12, 1991, in Washington, D.C.* *The assistance of Dr. Richard Anderson in preparing these remarks is gratefully acknowledged.* *The views expressed in this paper are the author's own and do not necessarily reflect those of the National Science Foundation.*

Foundation Act of 1950 direct the foundation 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.

This mandate is amplified by Sec. 113. (a) Miscellaneous Law 42 U.S.C. 1862.g. of the 1950 act which authorizes the director to operate an Experimental Program to Stimulate Competitive Research (EPSCoR) to assist less competitive states that:

- have historically received relatively little federal research and development funding; and
- have demonstrated a commitment to develop their research bases and improve S&E research and education programs at their universities and colleges.

Federal Research and Development (R&D) Funding Patterns

Historical Distribution of R&D Quality

The rationale for our actions goes beyond meeting the mandate of "avoiding undue concentration" of our research grant dollars. We believe in the need to enhance the nation's science and technology quality through development of an adequate S&E base in all regions of the country. This is certainly not a new idea. Some of the earliest federal involvement in academic R&D was in agriculture, where federal support was provided to states to establish land grant universities. This base of funding encouraged the development of a widespread infrastructure for agricultural research that today includes every state.

In contrast to this broad distribution, the rapid growth of federal R&D support during the 1940–50 period allowed universities which had established distinguished reputations in the biological and physical sciences prior to World War II to develop and strengthen their research capability and quality, and to establish positions of leadership within the national research community. The states in which these institutions are located benefitted not only from federal support for R&D, but also from industrial development that was spurred by the growth of academic research.

The development of a research infrastructure is a costly proposition

requiring a long-term commitment to excellence by both institutions and states. Thus, those states that were economically positioned for development immediately after World War II, and again later during the period of rapid growth in the 1960s, have been able to make significant improvements in the quality and competitiveness of their R&D infrastructure, and thereby have attracted increased federal support.

Throughout this period a strong merit competition process has been the core of the system for allocating federal funds for scientific and technological development. This reliance on existing scien merit and technical quality as the primary criteria for federal R&D support, as a matter of national policy, has produced outstanding research universities and an academic R&D infrastructure that has been the envy of the world. At the same time, however, it has resulted in an uneven distribution of federal academic R&D funding nationwide with S&E resources concentrated in a select number of universities and states.

We all agree that federally supported academic research is integral to the building of a high quality scientific and engineering infrastructure. However, it is now also becoming clear to the public that the existence of major research universities within a state generates activities that undergird and sustain high quality science and engineering education and contribute to its technological development.

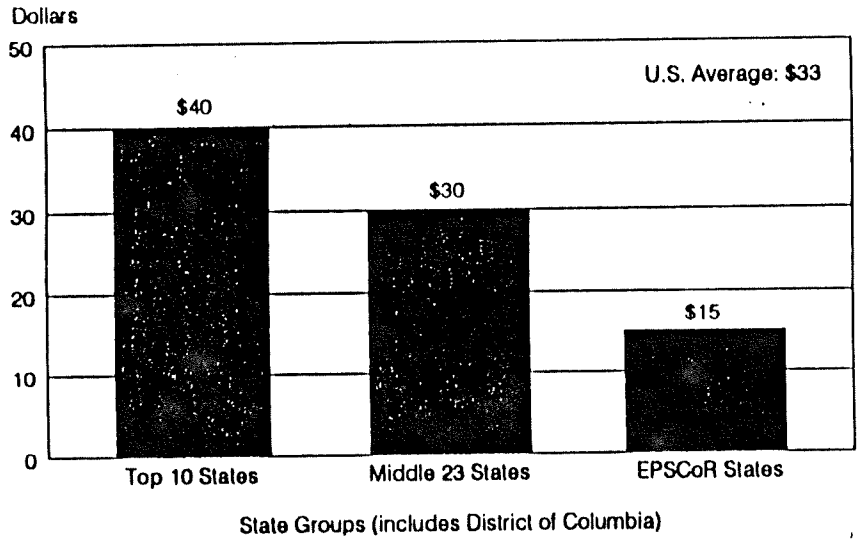
Federal Academic R&D Support

The national distribution of "science and technology quality" can be measured by each state's ability to successfully obtain federal R&D funding. In fiscal year 1989, the federal government obligated approximately $56 billion for R&D by all performers. Of this total, 867 universities and colleges received about $8.2 billion for academic R&D with 301 institutions receiving over $1.0 million each.

Distribution by State

The graphic depictions in Figures 1 and 2 indicating the distribution of federal academic R&D dollars among three groups of states, "top ten," "middle twenty-three," and "EPSCoR" states,[1] may be used measure of academic research competitiveness and R&D capa. Figure 1 displays the weighted per capita average for each group of states. Figure 2 shows the percent of total federal FY 1989 academic R&D obligations with corresponding percentages of FY 1989 NSF

Figure 1. Fiscal Year 1989 Per Capita Distribution of Total Federal Academic R&D Obligations



obligations for research and related activities, population, number of academic scientists and engineers, number of full-time research equivalents (FTE), and student enrollments for each group of states.

The top-ten states receive about two and one-half times more per capita than the EPSCoR states while the EPSCoR states receive less than one-half of the average amount going to each state ($15 versus $33).

Figure 2 shows a similar trend in the percentages of total R&D dollar amounts, population, number of academic scientists and engineers, number of research scientists and engineers, and student enrollments. The membership of the top-ten has been remarkably stable. The group (California, New York, Massachusetts, Texas, Pennsylvania, Maryland, Illinois, North Carolina, Michigan, and Ohio) accounts for 52 percent of scientists and engineers and 61 percent of the R&D funding. On the other hand, the EPSCoR states account for about 12 percent of academic scientists and engineers and 6 percent of federal R&D funding. This ratio indicates that EPSCoR states are about 50 percent below the top-ten states in the amount they receive per number of academic scientists and engineers.

A closer examination of the distribution of R&D funding among states *within* each major R&D agency, shows that a similar group of states is consistently among the least competitive. That is, they occupy the lowest ranks of those receiving federal academic R&D support in a majority of the federal agencies. For example, in fiscal year 1989 thirteen states appear among the bottom twenty within seven

agencies, a fact that indicates that the concentration of S&E research quality in the top states appears to transcend research disciplines.

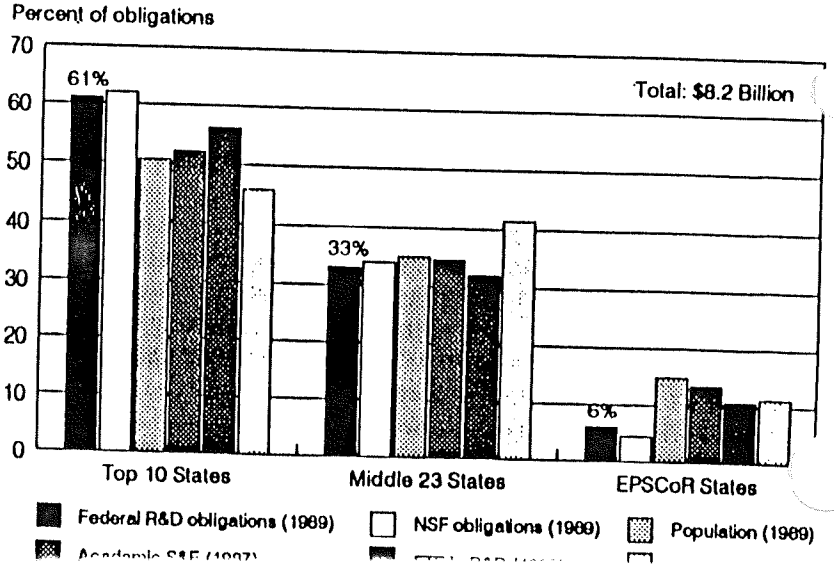
In summary, fifty years of federal R&D funding based on merit competition has produced an outstanding national R&D establishment. However, the resulting distribution of federal R&D funding, high quality academic institutions, and academic scientists and engineers is clearly unevenly distributed across the nation. The EPSCoR states receive less R&D funding than the national average and considerably less than most states on a per capita basis.

We know that strong research infrastructures have been integral to success in the leading states and institutions. Previous federal intervention through selected capacity-building programs indicates that adequate research infrastructure capable of supporting high quality science and engineering research and training may be developed in less competitive institutions and geographic regions.

Impact of Merit Competition

The principal mechanism for making funding decisions throughout the government is the "merit competition" system. This takes multiple forms, ranging from exclusively internal review by federal employees

Figure 2. State Distribution of Federal R&D Funding, Academic Scientists and Engineers, Population, and College Enrollment



to extensive use of nonfederal scientists and engineers. Typically the following criteria are used to determine scientific and technical merit:

1. *Research performance competence* pertains to the capability of the investigator, the technical soundness of the proposed approach, and the adequacy of the institutional resources available.
2. *Intrinsic merit of the research* pertains to the likelihood that the research project will lead to new discoveries or fundamental advances, or have substantial impact on progress within its field of science or engineering.
3. *Utility or relevance of the research* pertains to the likelihood that the research project can contribute to the achievement of an extrinsic goal, and thereby serves as the basis for new or improved technology or assist in the solution of societal problems.
4. *Effect of the research on the infrastructure of science and engineering* pertains to the potential of the proposed research project to contribute to better understanding or improvement of the quality, distribution, or effectiveness of the nation's S&E research, education, and personnel base.

The extent to which the above criteria are used in making decisions is directly related to an agency's scope and mission. The NSF is the only federal R&D agency that officially defines "quality" in terms of all four criteria. It is within this context that its special initiatives such as EPSCoR are operated.

National Science Foundation EPSCoR Initiative

The Office of Experimental Programs to Stimulate Competitive Research carries out the NSF mandate through EPSCoR, a merit-based program initiated in 1979 as a means to assist less competitive states in meeting the challenge of increased competition for federal R&D funds. The EPSCoR program is designed to enhance a state's research capability and stimulate local action to effect lasting improvements in its S&T infrastructure (i.e., research, education, and technology).

Eligibility for participation in EPSCoR has been limited to those states that receive less than $5 million per year in NSF research project support and also rank low on both total federal and NSF academic research obligations in three categories: (i) total obligations; (ii) total obligations per academic scientist and engineer; and (iii) total obligations per capita. During the period 1980–1990, sixteen states and the Commonwealth of Puerto Rico have competed for EPSCoR awards. The

states are: Alabama, Arkansas, Idaho, Kentucky, Louisiana, Maine, Mississippi, Montana, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming. Two additional states, Kansas and Nebraska, became EPSCoR participants in 1991 and will compete for awards in 1992.

Program Description

The EPSCoR program establishes a long-term partnership with representatives of the academic S&E community, elected officials, and business leaders to bring about significant improvements in S&T capacity and increased access to federal R&D programs. EPSCoR provides assistance in developing long-range, self-improvement strategies for science and technology involving: federal and state governments; academic institutions; and the private sector.

The goal of EPSCoR is to broaden the nation's base of high quality science and technology by effecting lasting improvements in the quality and capability of academic S&E research and training in the nation's less competitive states.

The strategies employed by EPSCoR to achieve its goals within a state include:

- establishing and interacting with broad-based, state-wide EPSCoR committees to develop increased state, institutional, and priv[illegible] support of S&E research and training;
- stimulating enhancements in the academic research environment that will ensure increased competitiveness for additional federal R&D funds;
- using the state's EPSCoR infrastructure to stimulate improvements in S&E education and its technology infrastructure; and
- cooperating with other federal agencies, as well as international organizations, concerned with strengthening science and technology in less competitive regions.

Program Process

The general EPSCoR procedure initiated in 1979, remains essen[illegible] intact. It begins with the NSF contacting members of the sta[illegible] academic S&E research community, distinguished academic administrators, governmental leaders, and influential members of the business community to form an ad hoc state-wide EPSCoR committee.

The state's EPSCoR committee submits a proposal to NSF to initiate a six-to-nine month planning process to be jointly funded by NSF and the state. During the planning period the committee examines the status of S&E research, training, and related activities within the state. Their analysis of current strengths and weaknesses leads to the development of state-wide improvement strategies and a comprehensive multi-year science and technology improvement plan. Funds to implement the plan are requested from the NSF in a state-wide EPSCoR Implementation Proposal. The proposal consists of two parts: (i) an overall improvement plan; and (ii) specific initiatives in S&E research. Before receiving EPSCoR funding, a proposal must undergo a three- stage merit review including: (i) merit review of the state's overall research improvement plan, including site visits by leading S&E researchers and academic administrators from outside the EPSCoR state; (ii) merit review of the proposed S&E research enhancements by disciplinary experts; and (iii) comprehensive review and selection by a final blue-ribbon panel consisting of leaders in the sciences, engineering, and academe.

State Contribution

By adopting a proactive relationship with a state's leadership, the NSF has established productive long-term partnerships with the participating states. The foundation's role has been to catalyze change, which has increased local support of S&E research and training. Since its inception in 1979, EPSCoR has awarded a total of $51.7 million to states through research improvement grants of approximately $600,000 per year over a three- to five-year period. The participants have matched this amount with a nonfederal contribution of $156.2 million. These funds are used for a variety of research enhancement activities and S&E infrastructure development. These may include: financial support of faculty and students; purchase of specialized research equipment; conduct of research seminars, meetings and conferences; faculty and student travel to meetings, conferences, and national centers of research activity; physical preparation of research laboratories; employment of research support personnel; and the purchase of special library or computing materials.

Current Status of EPSCoR

Thus far, the EPSCoR initiative has succeeded in increasing the competitiveness of individual university researchers and departments

for federal research support, and improved local awareness and support of S&E research and education. Many examples of nationally competitive research and individual professional accomplishments may be found in the participating states. In addition, there has been measurable change in academic departments and institutions as a result of changing institutional attitudes toward the support of research. For example, Mississippi and Montana state universities were awarded Engineering Research Centers in the foundation's 1989 nationwide competition. In addition, EPSCoR's success has spurred other federal agencies such as National Aeronautics and Space Administration (NASA), Department of Energy (DOE), Environmental Protection Agency (EPA), and Department of Defense (DOD) to experiment with the EPSCoR concept to enhance regional science and technology capacity in support of their missions.

In some states EPSCoR has been instrumental in developing broad-based support of S&E research and training, and state government and private agencies have been created (e.g., the Arkansas Science and Technology Authority, the Oklahoma Center for the Advancement of Science and Technology and the Kentucky Council on Science and Technology). Several of the EPSCoR states have subsequently chosen to use their newly formed science authorities, commissions and/or technology centers to provide leadership and additional financial support for science and technology development within the state. This type of ongoing support of science and technology within a state is a distinguishing characteristic of a successful EPSCoR effort.

EPSCoR Measures of Success

An EPSCoR initiative can demonstrate achievement in at least three ways.

- State S&E Infrastructure Improvement: Improvements to the research environment generally result from cooperation among various constituencies on the state and institutional levels. Improvements must benefit many researchers and must go beyond efforts to make a few individual researchers or research groups more competitive for federal R&D funding.
- S&E Research Performance: Increases in research productivity are perhaps the most directly measurable aspect of EPSCoR success. The productivity of researchers or departments receiving EPSCoR support may be monitored (e.g., the NSF is currently compiling an electronic database for EPSCoR participants).

- Human Resource Development: Increases in human resource development and science education related activities. The impact of EPSCoR can be measured directly — by the number of people affected and the degree to which it stimulates competitive proposals to federal and private educational programs.

To the NSF, success in EPSCoR means first and foremost improvement in research quality to a level that will result in increased R&D competitiveness by national standards of excellence. However, achieving this objective may require significant advances in all three areas. There are several quantitative measures by which EPSCoR performance may be judged. The EPSCoR staff have developed a set of indicators to track academic R&D resources and performance at the local and state levels. These indicators may be used to: (i) show patterns of academic R&D performance and funding sources; (ii) track state-level performance patterns in academic R&D; and (iii) develop research improvement strategies that can assist state and institutional decisionmakers in formulating a long-range research improvement strategy for public institutions within their state.

The EPSCoR experience has demonstrated that by adopting a proactive stance with a state's leadership and research universities and maintaining high quality standards, you can catalyze significant change. Through its major research universities and state-wide EPSCoR committees, EPSCoR has the potential to initiate systemic improvements in research and education and technology infrastructure. In addition, EPSCoR has been able to build science and technology policy awareness and leadership in many states where it was previously absent.

All fifty states have launched some form of state-based initiative with varying components in the last ten years, and many of these organizations are suffering from current financial setbacks. It is clear that the growth of these initiatives is directly linked to a new found belief on the part of business and political leaders as well as the public that science and technology are a major component of a strong economy.

Not many people doubted the linkage between science and technology capability and the national well-being. What is new is the widespread — in most legislatures and governors' offices around the country — belief that science and technology hold at least a partial answer to local economic woes. This was clearly not the case ten years ago. The scientific community has come a long way in convincing the American public in many less competitive regions, such as the EPSCoR states, that their health and their quality of life are being affected profoundly by science and technology and that increased efforts to

enhance S&E research quality in EPSCoR states will benefit the states and the nation.

The scientific community can take pride in these changes and for the increased awareness and stronger public support that we share today. But, it must also accept the consequences and the responsibilities that increased awareness and support bring — more groups, regions, and states are willing to invest public and private resources into science and technology. These states are now aware of the benefits that accompany S&T development and want to be a more active partic it in federal R&D programs.

Members of Congress from less competitive states and regions have expressed serious concerns about the imbalances in federal R&D funding among states. The issue of equity in the geographic distribution of federal R&D funds is often used to justify congressional earmarks of facilities and research funds. For example, in FY 1991 congressional earmarks exceeded $490 million.[2] However, it must be noted that a vast majority of earmarked funds goes to the more competitive institutions and states.

One of EPSCoR's most impressive characteristics is that it has effectively blended politics and merit review. In successful states, a creative and powerful alliance has been established between political, business, and academic leaders to "do something now." EPSCoR is often cited as a model for dealing with the issue of capacity building and geographic distribution. In the national debate on science and technology distribution, the questions raised must focus not on "entitlement" to federal R&D funds, but on "capability to compete e - tively" for such funds. While most leaders are opposed to direct earmarking of funds, many support NSF's EPSCoR approach as a way of developing national R&D capacity. The recent Office of Technology Assessment (OTA) report, *Federally Funded Research: Decisions for a Decade,*[3] on the future of research endorses the EPSCoR program and encourages other agencies to examine its applicability to their goals.

In the FY 1991 budget cycle, Congress mandated new capacity-building initiatives in five federal agencies and instructed the National Institutes of Health (NIH) to report in FY 1992 its plans for fostering science and technology in less competitive institutions and states.

With the recent congressional interest in EPSCoR and EPSCoR-like programs one may ask, "Why EPSCoR?" As a federal R&D manager I can offer three possibilities for the popularity of EPSCoR.

- Support for science and technology that has been developed on a local level and has been marshalled to support national science and technology priorities.

- As the intellectual and cultural center of the state the key EPSCoR universities and their leaders have the potential to exert significant influence over science and technology issues within the state and talent to contribute to our national S&T enterprise.
- EPSCoR has leveraged not only significant financial support for science and technology, as well as broad-based public and political support.
- EPSCoR works. It builds S&E quality and has documented results. It blends politics and merit review into an effective amalgam.

These attributes help to make it an appealing program not only to the members of the national scientific community, but also to all those who are dedicated to improving the science and technology infrastructure of these less competitive states.

Summary

Federal funding patterns clearly show a relationship between high quality S&E research capability and the level of federal funds received by a state in support of research. Therefore, the principal question is not one of institutional or geographic equality, but rather one of research infrastructure improvement for less competitive academic institutions.

The tradition of high quality R&D performance through a system of national research universities has served our country well and must be sustained. National science and technology policies cannot be driven by regional or institutional "myopia" and long-term federal policy cannot be based on distributing resources on a formula basis. Policy makers must concentrate not on seeking uniform distribution of federal R&D funds across the nation, but rather on providing incentives and opportunities for less competitive states to develop well conceived plans for building their academic research capacity.

I believe that in formulating public policy recommendations for national science and technology development, several fundamental questions concerning science and engineering research and training should be taken into account. These most important questions are the following:

- What should be the appropriate federal role in addressing the issue of building science and engineering research capacity in institutions and states that have traditionally been less competitive in federally funded programs?

- Given the statutory missions of federal agencies and the need to base efforts on merit, what are the most effective strategies to build science and engineering research capacity within less competitive states and institutions and to change state and institutional policies to ensure long term improvements? What are the roles, if any, to be played by the specific federal agencies in this effort?
- What safeguards should be established to ensure that the research quality and capability of existing centers of R&D excellence are not adversely affected by agency attempts to develop increased research capability at less-competitive institutions?
- What actions can federal agencies take to ensure that the scientific and engineering capability throughout the nation will be develo[illegible] and effectively utilized in support of established national R&D go[illegible] and policies? Should the federal agencies emphasize the development and distribution of researchers in specific disciplines or research areas within less competitive institutions and states?
- Does the country need to build more academic S&E research capacity? If this last question cannot be answered affirmatively, then many beliefs about funding for academic science and engineering research become questionable. Some argue that the conventional attitude towards funding academic S&E research is one of an entitlement program where the federal government guarantees research support for all who are in academe.

References and Notes

1. The states include: Alabama, Arkansas, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, North Dakota, O[illegible]homa, South Carolina, South Dakota, Vermont, West Virginia, and Wy[illegible]ming.
2. Colleen Cordes, "Congress Earmarked $493 Million for Specific Universities; Critics Decide Much of the Total as 'Pork Barrel' Spending," *The Chronicle of Higher Education*, vol. 37, no. 24, February 27, 1991, p. A1.
3. Congress of the United States, Office of Technology Assessment, *Federally Funded Research: Decisions for A Decade*, OTA-SET-490 (Washington, D.C.: U.S. Government Printing Office, May 1991), p. 31.