NSF Puts Big Stake On Research Centers

Increase in multidisciplinary research facilities seen as response to change in organization of science

EVER since President Reagan said in his State of the Union message that he would propose creation of new science and technology centers as part of his economic competitiveness initiative, National Science Foundation director Erich Bloch has spent a lot of time explaining what the centers mean for the initiative and for NSF.

The emphasis on the centers has stirred old fears in the foundation's traditional constituency, academic scientists. Their concern is that support of the centers will absorb an increasing share of NSF resources at the expense of grants to individual investigators. Some critics have objected to a rapid increase in the number of centers, arguing that there has not been enough experience with them to justify a major redeployment of resources.

In recent testimony to Congress and contacts with the scientific community, Bloch has given assurances that the foundation is not abandoning investigator-initiated research, but minced no words in stating that multidisciplinary research centers will play an expanding role in the NSF's future. As Bloch said in an interview, "The idea of centers is central to economic competitiveness. It's also central to what's happening at the agency."

Bloch sees the need for centers "to tackle problems that you are not able to tackle on an individual grant basis." These require a multidisciplinary approach or "big instrumentation," or need a bigger mass of researchers than can be mustered under an individual grant.

Asked if that meant NSF's constituency better adjust to a different style of conducting research, Bloch replied, "I'll say it differently. If all that we are doing is the individual research grant approach to science, then I think this country is going down the drain. Science is changing, the tools of science are changing. And that requires different approaches. Yeah, it will make some people nervous. Well, they don't have to participate in it. But that doesn't mean that the country doesn't need that approach. It does need it. And it should have started earlier, in my opinion."

Bloch goes on to say that it is the balance between the two modes of research that is important. He notes that "65 or 66% of the foundation's dollars go into individual grants. And they haven't decreased. And the size of the grants hasn't decreased. So I'm impatient with that argument, because it really denies reality."

To carry through on Reagan's call for new science and technology centers NSF plans to take the model of its engineering research centers and extend it across all disciplines represented in the foundation. A major purpose of the centers is to link engineering research and education more closely with industry. What distinguishes the engineering research centers from other NSF centers is the requirement of industry participation. As partners in the centers, industry contributes financially to center operations and sends scientists and engineers to work directly with university researchers at the centers. Each center concentrates on a particular research area. There are 11 of the engineering research centers now; another 3 are expected to be established in the current budget year and 5 or 6 more are in the plans for next year. NSF provides support of $2 million to $5 million a year over a 5-year period, and industry is currently paying half the operating costs of the centers.

Erich Bloch. *The NSF director is a strong advocate of the new science centers.*

Bloch says that the engineering research centers will foster economic competitiveness because they not only perform NSF's main functions of creating new knowledge and providing education, but also bring industry researchers into the process. They focus on something the United States is doing poorly, says Bloch. "Namely, transferring that information to where it can do the most good"—in industry.

Godfather of the centers idea in the Reagan Administration was former presidential science adviser George A. Keyworth II. In a speech at about the time the first engineering research centers were being launched, Keyworth said perhaps the most important feature of the design was the demand "that universities and industry work together to define the technological opportunities and approaches to take. Our objective was to change the very fabric of research in our universities. It was to create a problem-solving environment, to replace the bureaucratic resistance to change by the stimulus of competition imparted by industry."

Keyworth went on to depict the response as "humbling." Some 150 proposals requesting more than $2 billion were submitted for $10 million available for the first six centers.

As for the presidentially endorsed science and technology centers, Bloch says NSF is "focusing on the first half of that—science centers." NSF has indicated that it intends to establish new science centers in biology and biotechnology, social and behavioral sciences, computer and information sciences, and materials science under the 1988 budget, but has arrived at no specifics. Bloch has asked the National Academy of Sciences to advise the foundation on a broad range of issues affecting the projected centers in the same way that the National Academy of Engineering did in the planning stages for NSF's engineering research centers. The academy has named Stanford chemistry professor Richard N. Zare chairman of a panel that is scheduled to report by 1 June. The group has been asked to make recommendations on such matters as the areas of science in which the centers could make the most significant contributions, how the centers should be organized and administered, and the terms on which industry and state governments should participate.

Bloch has also asked the academies' Committee on Science, Engineering, and Public Policy to look at trends and styles of research by individuals, groups, and centers over the past decade and advise the foundation on policies to adopt for the new science centers. A report is anticipated in the fall.

The National Science Board (NSB) has

been conducting its own inquiry into the subject since last June. A panel headed by Charles Hess of the University of California, Davis, has been considering the advantages and disadvantages of centers and individual grants and is scheduled to report in June.

Centers are hardly a new idea at NSF. They date back nearly to the agency's beginning and cover a wide range in size and purpose. Bloch cites the National Center for Atmospheric Research at Boulder, Colorado, as an early example. But Bloch says that the antecedents for the new generation of university-based centers trace back to the materials research laboratories that NSF began supporting in the early 1970s. The Industry/University Cooperative Research Projects Program, that since 1978 has enabled university and industry scientists to carry out joint research projects, is in the line of descent. Also under the center rubric are the advanced scientific computing centers, now operating at five universities, that were established by NSF to make supercomputers available to university researchers. The first of these began operation in 1985 as did the engineering research centers.

Spending on the centers has been increasing significantly in recent years, but remains a modest proportion of the current $1.6-billion NSF budget. Funding for the engineering research centers is $30 million this year with an increase to $48 million requested for next year. The five advanced scientific computing centers designated for a second phase of the program are budgeted for $37.7 million this year and a projected $46.6 million next year.

The additional support for centers requested for next year is about $50 million, with $8 million to $10 million of that going to existing centers and the balance to establishment of new ones. New starts include $4 million for the first minority centers of excellence to strengthen the research capacity of institutions with predominantly minority enrollments, and $8 million for the first biological facility centers to provide access to sophisticated instrumentation to researchers. The first of a new group of biotechnology research centers are also scheduled for funding in the 1988 budget for which a total $2.2 billion is asked.

NSF controller Sandra D. Toye estimates that total spending on centers large and small at NSF currently would amount to some $250 million at the outside. This total is exceeded by the support going to a category of research intermediate between individual grants and the centers—group research involving more than three researchers. Some $360 million goes to such research.

A clear picture of funding trends as they affect groups and centers versus individual awards is hard to form in part because the categories lack tidy boundaries. NSF data indicate, however, that funding for multi-investigator research, which includes groups and the engineering research centers, increased from 7% to 11% of the agency's research budget between 1985 to 1987 and is the fastest growing sector of that budget.

Anxieties about the implications of the growth in funding of the centers were expressed inside as well as outside NSF when the engineering research centers were launched (*Science,* 4 January 1985, p. 38) and staff members of congressional science committees confirm that university scientists are continuing to communicate such concerns to Congress. At recent congressional hearings (*Science,* 20 March, p. 1458), legislators have noted that an NSF decision to support a center involves a commitment of funds for 3 to 5 years. They questioned whether the foundation should make major new commitments of funds with budget prospects as uncertain as they are. What has come to be called the "mortgage" problem, denotes a scenario in which maintenance of support for a large number of centers, particularly in the event of a budget squeeze, could create heavy pressure on NSF funding for individual grants.

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Direct criticism from academic scientists of the centers concept is less frequent than warnings to go slow. In testimony on the desirable balance between centers and individual research projects at authorization hearings before the House subcommittee on science, research and technology, Lehigh University vice president for research J. I. Goldstein made this comment. "Center funding should be viewed as experimental with the potential for high payoffs. By that I do not mean to suggest pessimism. My point is that the U.S. does not have a long record of successes with center-type funding for cross disciplinary research involving major industrial participation. I personally am quite positive. . . . I caution, however, that expectation is not fact. I do not think we can expect all the centers to succeed. . . . We do not yet have enough experimental data to predict which ones will fail or why."

NSF clients are habitually sensitive to threats to the individual grant principle. The last time the anxiety level reached the higher ranges was with the advent in the early 1970s of the RANN (for Research Applied to National Needs) program. RANN was a response to the demand in those days for "relevant" research. The concern then was that the foundation would invest heavily in applied research and stint on basic research.

The centers vogue has raised similar questions. In a commentary on an article by Bloch discussing research strategy in the National Academy of Sciences *Issues* quarterly for Spring 1986, University of Michigan president Harold T. Shapiro wrote that, "The key question behind the center-type proposal—whether the team approach is designed primarily for basic research or primarily for applied R&D and technology transfer—has yet to be answered."

In a statement at a Senate appropriations subcommittee hearing on the NSF budget, Roland Schmitt, General Electric chief scientist and current chairman of the NSB, sought to deflect such misgivings. Schmitt noted that science and engineering research are changing, "But one should be clear about the nature of this change. It is a change in emphasis in the organization of research. But it is not a change in the basic mission of the NSF. It is not a shift from basic to applied research. For a long time, NSF has supported centers in such areas as astronomy and materials, and they have always been involved in basic research. The idea of industry-university linkage represented by the centers is also not new. The linkage has traditionally been stronger in the U.S. than in other nations, and this has given us a competitive edge. The centers offer ways to make that linkage even stronger, and take even better advantage of it than we have in the past. But this does not change the basic mission of the NSF or the universities. . . ."

So far, there is little evidence on which to judge the engineering research centers as successful or otherwise. The original six centers are in their third year of operation and will undergo their first serious evaluations this year. As Bloch and others have noted, NSF's prosperity, particularly the Administration's request for a doubling of the foundation's budget over the next 5 years, has raised the agency's visibility. With plans for a great leap forward for centers in the works, it is clear that, despite the President's blessing and Bloch's enthusiastic backing, the centers will have to prove themselves in the glare of what for NSF is unwonted attention. ■ **JOHN WALSH**