

## NSF: Is Applied Research at the Take Off Point?

America might drown in sewage, choke on polluted air, run out of fuel, or fall into chaos from crime in the streets. But nobody will be able to say the National Science Foundation didn't try to help.

The NSF's new and controversial program, titled Research Applied to National Needs (RANN), is searching for technological weapons to fend off these and other potential catastrophes. In doing so, the program has encountered an enthusiastic Administration, some irate scientists, and a skeptical Congress. But RANN's greatest trials lie in the months ahead, when NSF will try to cajole more scientists into problem-oriented research teams and to manage their progress; and in the years ahead, when Congress will ask: "Now that we've given you all that money, what problems have you solved?" The RANN program could mark the beginning of a change in federal support for science in the universities. Or it could wind up as a fiasco in NSF management—one on the order of the Mohole project.

### House Limits RANN

Despite some reports to the contrary, Congress has not yet smitten the RANN program dead. In fact, Senator Edward M. Kennedy's (D-Mass.) Special Subcommittee on Science left the Administration's \$81 million request for RANN intact in its version of the fiscal 1972 NSF authorization bill, which was reported out of committee last week. However, the House version (*Science*, 21 May), limiting RANN to \$50.4 million, a respectable 47 percent increase over the current budget, is likely to prevail when House and Senate representatives meet to iron out their differences in conference committee.

The House limitation on RANN was based not so much on disapproval of the program as on a wait-and-see attitude. As Representative James G. Fulton (R-Pa.), ranking minority member of the House Science and Astronautics Committee, said during debate over the NSF bill, "We recognize the appropriate nature of this program,

but we are not satisfied that the Foundation can handle such a large increase efficiently. Moreover, this program carries a high percentage of applied research, which is not the real mission of NSF. Other federal agencies are putting vast sums into applied research. While NSF is authorized to do some of this work, we feel that they are moving into this area too rapidly. It is something the committee intends to review during the coming year."

Much of the distinction between basic and applied research is in the eye of the beholder. Officials of RANN emphasize that their program will support approximately 40 percent basic research. Nevertheless, what makes RANN unique and controversial is not its support of applied work, but its orientation toward problems. As NSF Deputy Director Raymond L. Bisplinghoff said in testimony before Congress, "It is unlikely that our present methods of managing basic research, largely through the quality and natural curiosity route, would give us all the fundamental knowledge we would need to tackle a particular national problem. So, one of the unique aspects of the RANN program will be to allow us to answer the question: What fundamental knowledge do we need in order to tackle some of these new national problems we are facing?"

Asking such questions implies setting research priorities—a prospect that many basic researchers fear almost as much as having no grant at all. But an enduring belief in the support of science for science's sake has long since vanished in Washington. And the objections raised against RANN challenge not so much the type of research that the program intends to support, as the notion of the NSF, the last bastion of basic research, funding goal-directed projects.

The NSF's role in applied research, as seen by the Administration, is to fill in areas where the potential for useful results exists, but the project is attractive neither to industry nor to other government agencies. "In keeping their nose to the mission grind-

stone," said Presidential science adviser Edward David, Jr., in congressional hearings on the NSF budget, "the [other Federal] agencies are under severe pressures which dictate against development of comprehensive and long-range research. NSF with its tradition of contacts with the universities is in a position to augment mission agency efforts with higher risk, longer range, and more speculative efforts. It is from such efforts," David concluded, "that the possibilities for creating a different and better world come."

For each of their projects, RANN staff members contact representatives of other Federal agencies in an attempt to coordinate the project plan and disseminate the results. Ranging from investigation of alternative supplies of energy to a RAND Corporation study of the city manager's office in San Jose, California, the projects supported to date have been both diverse and imaginative. Large grants awarded recently under the RANN program include a \$2 million award to Carnegie-Mellon University to establish an interdisciplinary laboratory for materials processing research, and \$1.5 million to the Center for Advanced Study in Behavioral Sciences, Palo Alto, for "Studies of the Social Consequences of Technology."

### Basis in 1968 Amendments

The statutory basis for the RANN program is in the 1968 NSF amendments, which, among other things, strengthened the agency's authority to support applied research. Reluctant at first to commit any of its limited resources to applied studies, NSF, under prodding from the Nixon Administration, established its pilot project, IRRPOS (*Science*, 9 October 1970, p. 144), in 1969. The RANN program, established at the beginning of the current fiscal year, incorporates the research efforts funded under IRRPOS, as well as two of NSF's major problem-focused projects: earthquake engineering and weather modification.

In dropping the emphasis on interdisciplinary research, RANN officials hope to support a variety of problem-oriented projects, ranging from one-investigator studies to large-scale undertakings involving combinations of universities, government laboratories, and industries. The industrial involvement would be particularly significant because NSF has traditionally shied away from grants to private corporations. But both NSF officials and Ad-

## The RANN Program

Target areas for research under the RANN program, including the amounts allocated to each one in the Administration's \$81 million budget request for RANN.

### *Advanced Technology Applications*

Energy Resource Research and Analysis (\$12 million)  
Earthquake Engineering (\$3 million)  
Fire Research (\$2 million)  
Enzyme Technology (\$2 million)  
Urban Engineering Problems (\$2 million)  
Particle Accelerator Applications (\$2.8 million)  
Excavation Technology (\$2 million)

### *Environmental Systems and Resources*

Weather Modification Research Program (\$4.5 million)  
Biome Analysis Applications (\$4.5 million)  
Regional Environmental Systems Research (\$10 million)  
Environmental Aspects of Trace Contaminants (\$5 million)

### *Social Systems and Human Resources*

Social Indicators Research (\$2 million)  
Municipal Systems Operations and Services (\$7 million)  
Social Data and Community Structure (\$3 million)  
Criminology (\$1.5 million)  
Evaluation Methodologies for Social Programs (\$2.5 million)

[*Exploratory Research and Problem Assessment (\$12.2 million)*]

ministration science advisers point to the necessity of industry involvement in a genuine assault on national problems, as opposed to university-based investigative studies. And NSF is currently conducting a series of academic-industrial conferences to explore means of cooperation.

Basing their conclusions on a seven-

point set of criteria, including urgency of the problem, potential for results, and the availability of resources, RANN officials have named 16 target areas for the program to attack. These are divided into three categories, each administered by a separate office of RANN (see box). The section titled "Advanced Technology Applications"

concentrates on areas such as enzyme technology and excavation technology, where research might lead to commercially attractive processes, hopefully with social benefits. Attempts at quantification characterize much of the work listed under "Environmental Systems and Resources" and "Social Systems and Human Resources," with the ultimate goal of constructing models for various forms of social and environmental interactions.

In addition to the major target areas, RANN will support a program of "exploratory research and problem assessment" designed to ferret out areas that might be ripe for large programs in the future. Already funded under this category are projects searching for better techniques of extracting metals, studying the behavior and attitudes of members of minority groups, and recycling of wastes.

To administer the RANN program, NSF established its sixth research directorate, the Office of Research Applications, and appointed Alfred G. Eggers, Jr., an ex-NASA Deputy Associate Administrator for Advanced Research Technology, to head it. Assisting Eggers is Joel A. Snow, the 33-year-old theoretical physicist who devised and administered the IRRPOS program. In an interview with *Science*, Eggers and Snow reported their greatest challenges as getting researchers and institutions working in genuine team efforts.

On paper, a problem-oriented project can appear to promise the New Jerusalem within a month. But in fact, the project may turn out to consist of a number of individual investigators, each doing his own thing, with little communication and little goal-orientation. Many of the scientists involved show a natural inclination toward this kind of behavior, and this has already created problems in some of the RANN projects, for example, the Chesapeake Bay study (*Science*, 21 May, p. 827).

Criticizing the concept of applied research in the NSF, Frederick Seitz, former president of the National Academy of Sciences and now president of Rockefeller University, said recently that the new programs "may well bring about a widespread change in the relationships between the scientific officers in the agencies and the scientific community. The former," said Seitz, "may well begin to feel a far greater sense of command and be much more inclined to insist that the scientific community do its bidding."

## Kennedy Proposes Urban NASA

A massive program of RANN-type research and development, aimed at building new cities, is Senator Edward M. Kennedy's (D-Mass.) solution to the problem of unemployment among scientists and engineers. Speaking last week in Washington before a session of the National Society of Professional Engineers, which was called to discuss unemployment, Kennedy said that \$6 billion in federal expenditures would be required to generate jobs for the 200,000 technical personnel expected to be out of work by the end of the year.

"What is needed," he said, "is a major new civilian program which can absorb the nation's technical talent, respond to our unmet social needs, and enlist widespread enthusiasm and support."

To these ends, Kennedy proposed a civilian agency to oversee all aspects of the construction of the 100 to 200 new cities that he says will have to be constructed by the end of the century.

"The development of new cities," said Kennedy, "may be the most important challenge we face, because it dramatizes the need for new research and engineering in the way the challenge of the Soviet Sputnik spurred the American space program in the late fifties and early sixties."—R.J.B.

Indeed, much of the success or failure of the program will depend on just how much managerial command NSF is able to exert. And for an agency whose grants have in the past been famous for the lack of strings attached to them, this is quite a challenge.

As for the tensions that might be

created in university science departments by NSF's managerial intervention and insistence on team efforts, Eggers said, "It is understandable that universities have been a traditional place where people gather to work independently. At the same time," he said, "university people are as aware as anyone else of the domestic prob-

lems facing us, and, as they come to grips with these problems, they see that they have to become part of a team."

Then, perhaps reflecting on the duties of an NSF administrator, Eggers added, "a lot of us are involved in things today that are not our first choice in life."—ROBERT J. BAZELL

## Peace Corps and Smithsonian: Deploying Environmental Experts

Before the end of 1971, the Peace Corps expects to have 100 specialists working overseas in a new environmental program launched in cooperation with the Smithsonian Institution. Although recruiting for this program did not reach a significant level until February, about 120 candidates have already applied to the Smithsonian, which handles most applications from environmental specialists who hold, or are currently pursuing, advanced degrees. During the next 3 years, Robert K. Poole, Peace Corps director of the environmental program, expects to place about 500 advanced-degree volunteers in natural resources and environmental projects.

A less specialized program for volunteers with bachelor's degrees is operated directly by the Peace Corps, which has long been engaged in natural resource projects at less sophisticated levels. At present, about 300 volunteers work in such programs. The new environmental operation now getting under way is perhaps the most ambitious effort in the Peace Corps's search for specialized skills, a search intensified since Joseph H. Blatchford was named director in 1969.

### Academic Credit

Recruiting for specialists has been directed primarily at students and faculty in universities. Candidates for master's and doctoral degrees are encouraged to work out arrangements with their institutions to receive academic credit for research and experience overseas. The character of the research and other responsibilities performed by the volunteer, however, is

determined by the host country requesting his service. Experienced senior specialists, as well as young degree candidates, are being recruited for the program. The shrinking of research funds, Poole observed, makes the opportunities in the new program especially attractive at this time.

Regardless of their level of expertise, all volunteers receive the same compensation. Subsistence allowances vary from one country to another, but provide a standard of living roughly equivalent to that of colleagues in the host country. In addition, each volunteer accrues \$75 readjustment allowance per month of service. Married couples, thus, accrue \$150 per month; this figure is increased to \$200 if they have children. Educational as well as subsistence allowances are provided for children overseas. In some areas, however, local conditions make it impossible to assign volunteers with children.

The Peace Corps makes available to host governments lists indicating the qualifications of applicants, while lists of personnel requested from overseas are distributed to universities in this country. The Smithsonian and the Peace Corps, then, try to fit together the man and the job. Sometimes the applicants and the jobs seem made for each other. James Joy wrote his Ph.D. thesis on the bilharzia snail, which Ghana hopes to control through the dispersion and population development of a parasitic insect. His wife Susan has a master's degree in entomology, with specialization in parasites. In response to a request from Colombia for a volunteer experienced in wildlife manage-

ment and park administration to assist the director of its North Coast National Parks, the Peace Corps has found Richard W. Klukas, who has had 5 years of such experience in Everglades National Park.

The Peace Corps is now establishing a special program with the National Park Service. Employees entering the service can spend 1 year in the United States gaining the experience and training appropriate for a specific assignment overseas. After 2 years in their Peace Corps posts, they will return to the Park Service with full credit toward promotions and retirement for their work as volunteers.

A number of international agencies have also been approached to serve as channels through which host country requests might be directed. International agencies can provide a vehicle for environmentalists to work in countries that do not have Peace Corps programs. For example, Madagascar has requested that a volunteer be assigned to the Food and Agriculture Organization of the United Nations for the purpose of surveying the ecosystems of existing and potential national parks.

### Preindustrial Ecological Troubles

The Smithsonian was asked to assist the Peace Corps because of its experience and prestige in international research. At present, the focus of recruitment is on the life sciences, but areas of demand for highly qualified specialists such as geophysicists or even archeologists may develop in the future. Richard L. Jachowski, who directs the Smithsonian's efforts, says there is "no boundary on paper" that might prevent him from recruiting in new fields of specialization.

The need for environmental programs in developing countries is often underestimated, Poole told *Science*. A former Peace Corps director in Malawi and Kenya, Poole attributes this mistake to the popular identification of