Recession in Science: Ex-Advisors Warn of Long-Term Effects

Four former presidential science advisors journeyed to Washington last week to add their voices to the growing chorus of complaints that federal budget cuts may ultimately undermine the world leadership position of American science and technology. The four testified in the eminently friendly forum provided by Senator Edward M. Kennedy's subcommittee on the National Science Foundation (NSF), and, with minimum coaxing from Kennedy, they poured out a tale of woe calculated to justify a substantial boost in funding for NSF. The burden of their testimony was that a variety of actions by the Nixon Administration, the Congress, and various funding agencies have combined to jeopardize the orderly growth of American science. As the hearing proceeded, it became apparent that the Nixon Administration and the scientific community have come up with wildly different assessments of the alleged "crisis" facing American science.

The Administration View

The Administration, for example, has concluded that federal support of graduate students should be cut back sharply because the nation already has plenty of scientists. The Administration also contends that the small increase proposed for NSF's budget in fiscal year 1971 will be enough to support research that is "of high quality." But the four former science advisors—namely, James R. Killian, Jr., and George B. Kistiakowsky, who served under President Eisenhower; Jerome B. Wiesner, who served under President Kennedy; and Donald F. Hornig, who served under President Johnson—were unanimous in declaring that NSF needs at least $50 million more than the Administration has proposed, and probably a good deal more than that if the vigor of American science is to be preserved.

The testimony of the four science leaders was more notable for its pessimistic tone than for any recital of "hard" evidence that the American scientific community is really in trouble. But the testimony was nevertheless significant in that it indicates what four experienced "statesmen of science" feel in their bones about what has been happening to American science. Even applying a generous discount to compensate for the fact that the four were appearing as special pleaders, the picture they painted was gloomy indeed.

"I have been in college administrative work for 30 years, and I recall no time when the financial outlook was so bleak as it is today," said Killian, who is chairman of the board at M.I.T. "We're caught in a vise between inflation and fund cuts, and we fear an unprecedented financial crunch."

Similarly, both Hornig, who is currently a vice-president of Eastman Kodak and will soon take over as president of Brown University, and Wiesner, who is provost at M.I.T., predicted that economies imposed to curb spending today would result in disastrous consequences within 10 years. "The scientific establishment is in considerable trouble—it can't be overstated," said Wiesner. He warned that if the budget stringencies of the past 4 years continue, then the "technological and scientific lead of the United States will not exist in a decade," and American industry will face "very serious economic difficulties." Hornig complained that budget cuts are curtailing the "bold new explorations" which lie "at the heart of scientific advance," and he warned that "in a decade we will pay dearly for the economies made now."

The four former science advisors cited a variety of factors which are allegedly undermining the effective conduct of research. These factors include an effective decline in the level of federal support for R & D in recent years; abrupt changes in federal student aid programs; the impact of inflation; the impact of the so-called Mansfield amendment which requires that the Defense Department abandon support of basic research not directly relevant to military needs; and a tendency for other mission agencies to abandon basic research. Also new cost-sharing requirements adopted by Congress; expenditure limitations imposed on the federal granting agencies; and the Nixon Administration's proposal to set a family income ceiling of $10,000, above which students could no longer receive interest subsidies on guaranteed loans. "It is exceedingly important to look at the additive effect of all these actions, some initiated by Congress and some by the Executive Branch," Killian said. "I salute efforts to tighten up our program, but I submit that an accumulation of uncoordinated actions and uncertainties have brought disorder and dismay to the house of science."

One of the chief points of concern was a sharp drop in federal support of graduate students. According to data released recently by the House Science and Astronautics Committee, the number of new fellowships and traineeships awarded to graduate science students by nine major federal agencies would drop by almost 50 percent—from 6012 in fiscal 1970 to 3069 in fiscal 1971 under the budget proposed by the Nixon Administration. The traineeship programs of NSF would be particularly hard hit, since there would be no new awards in fiscal 1971 while a study of the traineeship concept is carried out. Under the traineeship program, NSF awards money to institutions which in turn select the recipients, while under the fellowship program, NSF awards money directly to students in what amounts to a national competition.

Decline in Demand

Hubert Heffner, deputy director of the Office of Science and Technology, acting as spokesman for the Nixon Administration, testified that NSF's graduate traineeships were reduced because the pool of scientific manpower has been expanding rapidly while the demand for scientists has been declining. "The Ph.D. pool in the engineering, physical, and mathematical sciences has been growing at 9.4 percent per year for the past several years—a rate almost 6 times that of the increase in general population of the country," he said. "This fact, coupled with the reduction in the traditional Ph.D. job opportunities both now and in the relatively near future, has led to a decision to reduce the number of traineeships next year." Heffner said the decision to cut traineeships as opposed to fellowships was made on the recommendation of NSF which felt that, if something had to go, priority should be given to retaining the fellowship program because it has "national visibility" and is of "high quality." Earlier, William D. McElroy, director of NSF, had testified that the

traineeship program was being curtailed because the Nixon Administration "would prefer to look into the mechanism of support of graduate students and particularly . . . the possibility of loans to individuals at a given institution." The Office of Science and Technology, the Budget Bureau, and NSF are all reviewing graduate support mechanisms with a view toward making changes in the fiscal 1972 budget.

The Nixon Administration's opinion that we may already have enough scientists has been given some credence by widespread complaints that newly graduated scientists are having difficulty finding jobs. To hear some people tell it, harried Ph.D. holders are pounding the pavements, unable to find work, or else they are forced to take menial jobs unworthy of their high training. A number of articles to that effect have been published in leading newspapers and magazines, and a number of organizations that have conducted surveys have concluded that the job market is unusually tight. Just last week, for example, the American Institute of Physics (AIP) held a press conference in New York to report that "Ph.D. recipients in science and engineering who have entered the job market during the past 3 years have been having a difficult time finding employment suitable to their training, and the outlook for the future seems to be just as bleak." The AIP reported that while only 2.5 percent of some 1625 young physicists who responded to a survey questionnaire were completely unemployed, a large number had been unable to find suitable outside jobs and so had taken refuge in temporary postdoctoral appointments at universities. The percentage of new Ph.D.'s on postdoctoral appointments jumped from 6 percent in 1958 to 25 percent in 1967 to 46 percent in 1969. The AIP also reported that "it is not unusual today for a young man to apply to over 100 universities and industrial research laboratories and receive only one—or in some cases no—job offer." The AIP added that "very often the job he ultimately accepts makes little use of the specialized research skill which the man, his university, and in most cases the federal government, all contributed much time and money to provide."

However, Philip Handler, president of the National Academy of Sciences and chairman of the National Science Board, the policy-making body for NSF, emphatically disagrees with the notion that "we may have oversaturated the market with scientists." In testimony before a House subcommittee in February, Handler said the "widespread apprehension" that we have produced more scientists than we can usefully employ "rests on a few anecdotes which have spread over the country with respect to a few theoretical physicists who couldn't find employment." Handler cited a survey taken by the Academy in mid-January in which questionnaires were returned by 2330 department chairmen from departments which granted almost 80 percent of all the scientific Ph.D.'s awarded in 1968 and 1969. The results indicated, he said, that for the class of 1968, only 0.4 percent were employed in positions which were irrelevant to their graduate education and only 0.7 percent were actually unemployed. Similarly, for the class of 1969, only 0.7 percent were doing "irrelevant" work and only 1.1 percent were unemployed. Handler said the unemployment figure, small as it

National Academy of Engineering Selects New Members

The National Academy of Engineering (NAE) elected 51 new members on 3 April. Eric A. Walker, president of NAE, said election to NAE honors those who have made "important contributions to engineering theory and practice or who have demonstrated unusual accomplishments in the pioneering of new and developing fields of technology."

NAE was established on 5 December 1964 as an organization of distinguished engineers sharing with the National Academy of Sciences the responsibility for advising the federal government on scientific and technical matters. Elected were:

Neal R. Amundson, University of Minnesota
Phillip M. Arnold, Phillips Petroleum Co.
Holt Ashley, Stanford University
Samuel S. Baxter, Water Commissioner, Philadelphia
Bernard P. Bellport, Chief Engineer, Bureau of Reclamation, Interior Department
Robert A. Bowman, Bechtel Corp.
Arthur E. Bryson, Jr., Stanford University
Adolf Busemann, University of Colorado at Boulder
Spencer H. Bush, Battelle-Northwest
Carl C. Chambers, University of Pennsylvania
Francis H. Clauser, California Institute of Technology
Edward N. Cole, President, General Motors Corp.
John P. Craven, Deep Submergence Systems Project, U.S. Navy
A. Earl Cullum, Jr., of A. Earl Cullum, Jr., and Associates
Cassius C. Cutler, Bell Telephone Laboratories
Willard K. Davis, Bechtel Corp.
Alton C. Dickieson, Bell Telephone Laboratories
Ernst R. G. Eckert, University of Minnesota
Bob O. Evans, President, Systems Development Division, IBM Corp.
Maxime A. Faget, Director of Engineering and Development, NASA
James C. Fletcher, President, University of Utah
John C. Geyer, Johns Hopkins University
Earnest F. Gloyna, University of Texas at Austin
Albert C. Hall, Martin Marietta Corp.
William H. Huggins, Johns Hopkins University
Wendell E. Johnson, Office of the Chief of Engineers, U.S. Army
Raymond W. Ketchledge, Bell Telephone Laboratories
Christopher C. Kraft, Jr., Deputy Director, Manned Spacecraft Center, NASA
Frank W. Lehan, Consultant, Santa Barbara, Calif.
Humboldt W. Leverenz, RCA Corp.
George M. Low, Deputy Administrator, NASA
James R. Macdonald, Texas Instruments Inc.
John J. McKetta, University of Texas System, Austin
Robert C. McMaster, Ohio State University
Gerhard Neumann, General Electric Co.
Kendall Perkins, McDonnell Douglas Corp.
William J. Perry, President, Electromagnetic Systems Laboratory, Inc.
Calvin F. Quate, Stanford University
Louis T. Rader, University of Virginia
Robert B. Richards, General Electric Co.
Denis M. Robinson, President, High Voltage Engineering Corp.
Gerard A. Rohlich, Director, Water Resources Center, University of Wisconsin
Paul Rosenberg, President, Paul Rosenberg Associates
Karl Schwartzwalder, AC Spark Plug Division, General Motors Corp.
Harry B. Seed, University of California at Berkeley
Mark Shepherd, Jr., President, Texas Instruments Inc.
Louis D. Smullin, Massachusetts Institute of Technology
Mott Souders, Consultant, Piedmont, Calif.
Harvey A. Wagner, The Detroit Edison Co.
Albert D. Wheelon, Hughes Aircraft Co.
George Winter, Cornell University

is, is an "exaggeration" because it includes "ladies who had taken time off because they were pregnant or just had children, . . . people who decided to travel for a year . . . people who were wondering whether or not they had made their proper choice of a career, and so forth." Handler said he had found it "very difficult" to view a 1 percent unemployment figure "as any kind of a national tragedy or a genuinely serious situation." He said it is true that not all scientists landed the jobs to which they aspired, but he considered that more a "mark of success" than a tragedy since it indicates that we are now producing enough scientists to staff not only the major universities, but also smaller colleges and the laboratories of industry and government.

The upshot of Handler's testimony was that "we are in no danger of overproducing scientists." Rather, Handler warned, the apprehensions now afflicting young students may drive them away from science, with the result that "in the future we may be in jeopardy for the lack of size of a scientific community." Somewhat similar views were expressed, though less forcefully, by the four former science advisors who testified last week. They disagreed somewhat on the relative importance of the NSF's traineeship programs, but the consensus seemed to be that there is no good reason for a precipitous drop in federal support of graduate students.

Though all four of the emeritus science advisors were gloomy about the prospects for science, they were unable to cite much in the way of dramatic evidence, already visible, that American science has been damaged. Wiesner claimed that radioastronomy, computer sciences, and mathematics have all been "badly slowed" in recent years, and he said that whereas the United States used to be the best instrumented country in the world, it is starting to fall behind other nations in a number of fields. But, for the most part, the four witnesses were warning about damage that will take a few years, at least, to show up. And they were particularly concerned, as Wiesner said, that "the exciting new gambles" will not be taken because of the budget squeeze.

The one bright spot about the current budget crunch, from NSF's point of view, is that it may provide the agency with an unusual opportunity to increase its stature. The Foundation in recent years has generally provided less support for basic research than have four of the mission agencies, namely the Defense Department, the National Aeronautics and Space Administration, the National Institutes of Health and the Atomic Energy Commission. But this year, while the mission agencies are cutting back on support of basic research, NSF is moving ahead slightly. The Nixon budget would give NSF about $50 million more in 1971 than in the current year ($513 million, up from $463 million). And both the House and Senate authorizing committees are trying to give NSF substantially more than the Administration has requested. The House Committee on Science and Astronautics has already recommended that NSF receive $27.6 million more than requested, and Senator Kennedy, chairman of the authorizing committee in the Senate, has introduced a bill to give NSF $50 million more than requested. The actual amount that Congress grants NSF will be determined by the two appropriations committees, which have not yet been heard from, but the budget boosts recommended by Kennedy and by the House authorizing committee reflect a feeling that NSF, in a period of declining science budgets, must assume a more central role in preserving the scientific establishment.

That NSF is eager to fulfill such a function was readily apparent at the hearings before the Kennedy subcommittee. At one point McElroy, the NSF director, suggested that NSF might need "on the order of" $800 million in fiscal 1972 to fill the gaps left by the mission agencies. And Handler, in his role as head of the National Science Board, expressed a belief that NSF must become *the* science support agency. "For the first time I think one can state quite clearly that the strength of the American scientific enterprise in the years ahead really will rest on the programs of the National Science Foundation," he said. "This is not a statement I could have made equally confidently in the past . . . [But] as the mission agencies increasingly use their resources . . . to deal with the applied problems which are their principal concern, if we are to have a long-range scientific venture, and if it is to be as strong as we would like . . . then the federal government will have to support the Science Foundation as it was intended to be—the principal instrument by which the federal government supports the basic science endeavor." What's good for NSF, in other words, is good for the country.—PHILIP M. BOFFEY

NEWS IN BRIEF

● **CALL FOR BAN ON PCB'S:** Congressman William F. Ryan (D–N.Y.) has called for a ban on polychlorinated biphenyls (PCB's), an ingredient used in plastics, adhesives, aluminum foil, cellophane, and insecticides. The chemical, manufactured solely by the Monsanto Company under the trade name of AROCLOR, has been found to be chemically similar to DDT according to some scientists. PCB's are believed to enter the environment through the weathering or friction wearing of AROCLOR materials and through the burning of those materials at high temperatures releasing possibly toxic vapors and fumes to the atmosphere. The Congressman has asked the Department of Agriculture to ban the use of PCB's in insecticides. He also asked the Food and Drug Administration to set food tolerance levels for PCB's and to conduct a study to determine if a ban is necessary.

● **POPULATION COMMISSION:** The President has signed a bill establishing a Commission on Population Growth and the National Future. The Commission will be composed of two Senators from different parties, two Representatives from different parties, and up to 20 others named by the President, who will designate the chairman. The Commission will study the probable course of population growth between now and the year 2000; inquire into the public resources required to deal with the anticipated growth; and determine the ways in which population growth may affect the activities of government. It will have 2 years to complete its work.

● **CANADA TO BAN DETERGENT PHOSPHATES:** J. J. Greene, Canadian Minister of Energy, Mines, and Resources, promised recently to introduce legislation banning phosphates from detergents within 2 years. Greene said the government would offer aid and incentives to provinces cleaning up their waters, and would join the United States in a drive against phosphates contaminating boundary waters such as the St. Lawrence River and the Great Lakes. Representative Henry Reuss (D-Wis.) introduced a similar bill in the House last year, and Senator Gaylord Nelson (D–Wis.) introduced a similar bill recently in the Senate.