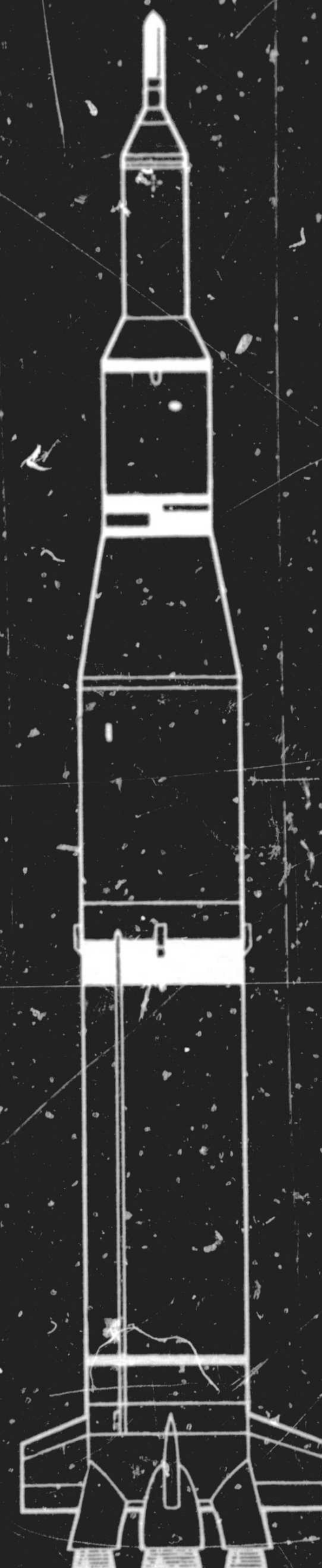

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PUBLIC ADMINISTRATION AND SCIENCE AND TECHNOLOGY

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Public Administration in a Time of Turbulence
Panel No. 14-E
Public Administration and Some Basic Challenges

PUBLIC ADMINISTRATION AND SCIENCE AND TECHNOLOGY

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During a series of briefings on science and public policy held for academicians by federal officials in July, 1969[1] one government representative observed that if those attending had detected evidence of paranoia in some of the statements made earlier by National Science Foundation officials they should not be shocked. It was not that the NSF people were imagining somebody was out to get them. Somebody really was!

The point being made was that NSF is viewed by some as a prime target for budget-cutting as the federal government looks more and more for economies. Not just NSF is threatened. Much of the budget that goes for research and development -- science and science-based technology -- is under a squeeze. The Viet Nam war and the social problems in the cities push for support and science and technology is caught in the middle. Agencies formerly able to spend virtually unlimited funds for R & D -- Defense Department and National Aeronautics and Space Administration, for example--are cutting back in this area.

But the problem of science and technology is only in part financial. In a speech May 10, 1968, Donald Hornig, President Johnson's Science Advisor, asked, "Is there a crisis in science?" He answered by saying that, in an immediate sense, there was a crisis in financial support. In a long-term sense, however, he pointed out that there was a crisis rooted in the fact that members of Congress and of the public see "a scientific community which, insisting on its purity, will not deign to communicate with the public and justify itself, but prefers to believe that its virtues are so self-evident that a right-minded society must necessarily support it on its own terms." He suggested that the scientific community through its pride and aloofness had "done much to alienate itself from the society which supports it."[2]

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1. Washington Seminars for Affiliates, Science and Public Policy Studies Group, July 16-18, 1969.

2. D. F. Hornig, Science, Vol. 161, p. 248 (1968). Cited by James Carroll, "Science and the City: The Question of Authority," Science, February 28, 1969, p. 902.

Hornig was arguing that something more fundamental was affecting the present funding and immediate future of science and technology than Viet Nam stringencies. The old basis upon which a government-science relationship had been forged following World War II is in transition. The scientific establishment that Don K. Price described in 1965 as "a set of institutions supported by tax funds, but largely on faith, and without direct responsibility to political control"[3] is no longer so privileged. It faces a new political environment part of which is hostile, and which accuses science and technology of bringing harm to man in the name of progress.[4]

In adapting to new conditions as the price of continuing and strengthening the relationship, the scientific community will have to change. So also will the government. Scientific attitudes and bureaucratic processes that sufficed during a period of rapid growth and widespread public support will no longer do. The administrative pluralism that served to carry out federal science policy in the past will be retained but a much stronger effort by President and Congress will have to be made to manage the overall enterprise. The scientific community will have to move to apply itself more consciously to improving the human condition.

THE RESEARCH PARTNERSHIP IN TRANSITION

What has come to be known as the government-science marriage grew out of the experience of war. During the Second World War science and technology was mobilized "on the spot" for public service. Scientists and engineers in universities and industrial laboratories throughtout the country stopped what they were doing and diverted their attention to helping the military defeat the enemy. Today the military agencies remain the pricipal single supporter of the nation's research establishment. As during World War II, the government supplies most of the money while private institutions provide the bulk of the manpower.

The federal government supports two-thirds of all expenditures in the United States for research and development. Only 20 percent of the government contribution is spent in its own laboratories; two-thirds of the funds go to industry; universities and non-profit organizations receive the remainder. Industry performs most of the nation's applied research and development (technology). Universities do the largest proportion of the basic

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3. Don K. Price, The Scientific Estate (Cambridge, Mass.: Belknap Press of Harvard University Press, 1965), p. 12.

4. Dwight Waldo, discussing "Public Administration in a Time of Revolutions," in the Public Administration Review of July/August 1968, p. 363, noted the "growing reaction against science

(continued on the bottom of page 3.)

research (science). Approximately three-quarters of the total federal R & D budget is spent by three agencies -- Defense, NASA, and the Atomic Energy Commission. The basic divisions in public and private roles in the partnership have been stable over the years--as has been the domination of agencies with a national security flavor. Fear in hot war was the shotgun that brought about the marriage. Faith during Cold War that science could safeguard America was the sustaining force. And national pride--bruised by Sputnik-- was the consummation. Whatever their merit, such stimuli provide an uncertain basis for a successful marriage involving enormous impacts upon higher education and the economy.

Budgetary trends indicate the speed with which government and science drew together, as well as their present estrangement. In 1940 the United States government spent about $75 million on research and development. By 1953 this figure rose to $2 billion. By 1966[5] federal expenditures stood at $16 billion. There seemed no end in sight to the increases; various administrative agencies projected spending would reach $22 billion by 1970.[6]

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4. (Continued from bottom of page 2.) and technology" and declared: "I refer to a mounting feeling that science and technology create a cold, artificial, impersonal, dehumanized, and even monstrous world. On one level it is a revolution against the machine and everything machine-like and machine-made. But it is much more, and at another level is a revolution against a 'system' that sustains and promotes a machine technology. The revolution against science and technology is seen positively as a revolution on behalf of the individual and individualism, against the invasion of privacy and for individual rights. The IBM card is often a symbol of the enemy, and beards and bare feet are seen as the symbols of emancipation and rebellion."

5. In this and succeeding cases budget figures are for fiscal rather than calendar years and derive from the Bureau of the Budget's Special Analysis Q for Federal Research, Development, and Related Programs (January, 1969).

6. William Carey, "Science Policy Making in the United States," Ciba Foundation and Science of Science Foundation Symposium on Decision Making in National Science Policy, A. deReuck, ed. (London: J. & A. Churchill Ltd., 1968), p. 138.

Some scientists spoke unabashedly of a 15 percent annual increment in basic research support by the federal government.[7]

But events did not proceed as proponents of science spending expected or hoped. In 1967 federal expenditures topped those of the previous year only slightly--going from $16 billion to $16.8 billion. The figure remained at $16.8 billion in 1968. It is expected to decline to $16.4 billion in 1969 and still be below the 1967 figure in 1970, at which time federal obligations of $16.7 billion are forecast.

The funds for basic research--which is what the scientific community cares most about--have levelled off. In 1968, funds for research in colleges and universities--almost entirely basic research and related expenditures--stood at $1.4 billion; in 1969, the estimate is $1.4 billion again; with spending slated to go up to $1.5 billion in 1970. The 15 percent annual increment thought necessary if science is to keep up with increasing costs in equipment, students, and inflation is far from being attained.

Many universities, which have come to count on federal research money for basic operating expenses, have been hard hit.[8] A recent report prepared by the New York Academy of Science entitled <u>The Crisis Facing American Science</u> declared that any gains in the form of better discipline and closer planning of current and future spending were overwhelmingly offset by the loss of opportunity and continuity in scientific research. It called for immediate corrective action and the "establishment of a long-range federal science policy that obviates future crises."[9]

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7. <u>Basic Research and National Goals</u>, Report to the House Committee on Science and Astronautics, by the National Academy of Sciences (Wash., D. C.: USGPO, 1965), p. 13. A number of legislators thought it was arrogant for any group to assume it should automatically be given a 15% boost in funding every year. Hornig disavowed the figure, saying, "We accept as the goal that America must be second to none in most of the significant fields of science. . . What is <u>not</u> accepted is the notion that every part of science should grow at some automatic and predetermined rate, 15% per year or any other number, as a consequence." Address to the American Physical Society, Wash., D. C. April 26, 1967. Cited by D.S. Greenberg, <u>The Politics of Pure Science</u> (N.Y.; New American Library, 1967), p. 167.

8. Massachusetts Institute of Technology receives some 84% of its total budget from the federal government; Princeton, 47%; Columbia, 42%; Brown, 35%; Chicago, 28%. <u>Impact of Federal Research and Development Programs</u>, Study No. 6, House Select Committee on Government Research, Report. (Wash., D.C.: USGPO, 1964), pp. 33-34. Cited by Greenberg, <u>op. cit.</u>, pp. 36-37.

9. House Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, <u>Hearings</u>, 91st Congress, 1st Sess., Vol. 1, <u>1970 National Science Foundation Authorization</u> (Wash., D. C.: USGPO, 1969), pp. 692-7. Hereinafter cited as <u>1970 NSF Authorization Hearings</u>.

The National Science Board of the National Science Foundation underlined the seriousness of the situation in the first public report it ever issued, Toward a Public Policy for Graduate Education in the Sciences. As Philip Handler, President of the National Academy of Sciences and former Chairman of the NSF Board, declared, the message underlying the report was the need for "a frank admission that financial support of graduate education is very largely a federal responsibility."[10] He stated:

> If the Federal Government will accept this proposition frankly we can then get on with the job through any number of mechanisms. . .
> The Board recommends that we continue to rely on the research project grant and contract system as the backbone of the research support system. But it also recommends that true institutional costs be funded by annual grants to the universities which would cover indirect costs, all payments for professorial salaries, etc. A program of departmental grants would provide for commonly used equipment, supporting services such as the shop or animal quarters, graduate student stipends, etc. Other programs would make possible facilities construction, university development and fellowships respectively.

The Board's report not only pointed up the degree to which cut-backs in science funding had deleterious consequences upon graduate science education, but it also revealed the degree to which principal scientific spokesmen were being forced to rethink old attitudes. The institutional grant, which gives university administrators relatively more power over individual scientists on the faculty, has never been popular with the scientific community. The project grant tends to provide for a more direct relationship between researcher and government agency. In calling for 20 percent of all federal expenditures to be made up of institutional grants by 1970, the Board is suggesting a figure "just 5 percent less than the ratio rejected by the politicians of science in 1950,"[11] when the National Science Foundation was created. The shift reflects, to some extent, a greater awareness by scientists that traditional methods of funding academic research may well have contributed to hurting the institutional fabric of universities. Universities, for their part, are thinking harder about what kinds of research are appropriate or not appropriate for them--particularly in the case of military-sponsored research.

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10. "An interview with Philip Handler," National Academy of Sciences News Report, March, 1969, p. 8.

11. John Lear, "New Deal for Graduate Education," Saturday Review, May 17, 1969, p. 79.

As the tightening of funds is being accompanied by a re-assessment of government-university relationships, so also government-industry arrangements are getting a close look. Behind daily jeremiads about the military-industrial complex are specific complaints about contract over-runs, deliberate cost-underestimation, poor administration, patent giveaways,[12] and a government-industry partnership so complex that it is not clear which partner is public, which private, or which is making the decisions. NASA meanwhile frets that the industrial capability it helped create in the process of getting to the moon will atrophy in the absence of speedy decisions involving substantial manned-space programs. Critics of the agency, however, would like nothing better than to see that capability--and NASA with it--wither away.

Thus, the budgetary statistics are but one indication of a much deeper malaise affecting government and science. There are many who have given up on science and technology. Handler has pointed out:

> Young people are not entering scientific careers with the enthusiasm they had only yesterday. Graduate enrollments in the sciences have doubled every ten years since the Civil War. We saw no demographic reason why this should change at this time. Yet, it is now changing. This is partly due to the operation of the draft, of course. But more important is the concern that science isn't quite as relevant to human affairs as we thought in the fifties.
>
> This has had an impact on the thinking of some mature scientists who are no longer quite as sure of their place in society or of their value to society as they were yesterday.[13]

The matter of relevance stems from a growing concern for a whole host of societal dilemmas--usually subsumed under such headings as the human condition, the quality of life, the urban crisis--to which science and technology seems at best unconnected, at worst, partly to blame. A day of reckoning for science and technology was bound to come, sooner or later. In 1958, speaking of basic research in universities, a high-ranking Bureau of the Budget official, William Carey, said as much:

> We must realize that when science and education become instruments of public policy, pledging their fortunes to it, an unstable equilibrium is established. Public policy is, almost by definition, the most transient of phenomena, subject from beginning to end to the vagaries of political

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12. See the author's "Government, Industry, and the Research Partnership: The Case of Patent Policy," <u>Public Administration Review</u>, May/June 1968

13. "NAS President Discusses U.S. Science," <u>Chemical and Engineering News</u>, June 30, 1969, p. 24.

> dynamism. The budget of a government, under the democratic process, is an expression of the objectives, aspirations and social values of a people in a given web of circumstances. To claim stability for such a product is to claim too much. In such a setting, science and education become soldiers of fortune. Today their fortunes happily are in the ascendant.[14]

In 1969 the government-science relationship is troubled. Government is attempting to find a better formula to help it support and use science and technology in the nation's interest. Scientists and engineers--and the institutions in which they work--are searching for a way by which their interests may be brought into closer harmony with the nation's. The foundation on which the government-science marriage has rested since the war is eroding and a new one must be built. A number of problems must be faced. Three of particular salience at this time are: 1) the place of basic research in a government of mission-oriented agencies; 2) the lack of a truly national perspective on science policy; and 3) the necessity to better relate science and technology to the improvement of the human condition.

BASIC SCIENCE AND MISSION-ORIENTED AGENCIES

No component of the R & D budget is more vulnerable to shifting currents in administrative decisions than is basic research. This is the dimension of science and technology that is most difficult to justify in terms of practical agency needs. Yet, as indicated, it is the one with which the scientists and their universities are most concerned. If there is a single interest that unites the loosely organized qroup of men and women known as the scientific community it lies in their desire to do pure or basic research. Pure research is that which, from an agency's perspective, is least directed. What direction it has comes from the scientist and the method and logic of his discipline. In applied research the agency exercises more control, and the scientist less, of the direction the research takes since the agency is presumably paying the scientist to apply his skills to a specific agency problem. It frequently is said that an agency <u>supports</u> basic research, <u>purchases</u> applied research.

Though it represents but a small portion of the total federal outlay for R & D, the basic research fraction provides two=thirds of all research funds spent by academic scientists throughout the country. Many regard it as the bellwether of government-science relations. The attempt to secure consistent support for pure scientists through administrative reorganization is at the heart of recent proposals for a Department of Science.

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14. William Carey, "The Support of Scientific Research," Scientific Manpower - 1957: Papers of the Sixth Conference of Scientific Manpower, Wash., D. C.: NSF, 1958, pp. 23-26. Cited in J.L. Penick, Jr., et. al., <u>The Politics of Science 1939 to the Present</u>. Chicago: Rand McNally, 1965, p. 189.

The Department of Science, a ghost long thought vanished, gained renewed importance as a proposal because of the man who raised the issue. Obviously a trial balloon, it came from Donald Hornig in a well-publicized speech before the American Association for the Advancement of Science on December 29, 1968. The talk constituted Hornig's farewell as Presidential Science Advisor.

After making it clear he was not urging that all basic research be placed in one department, he stated that there were many activities of various agencies which were not central to their main jobs and that would "flourish if transferred to a Department of Science." The criteria for location in such a department, said Hornig, should be an activity's relationship to basic research and higher education. He figured the department's budget should be at least $2 billion. He did not go into specifics, but underlined the role of NSF as the core of the department. His position was that science was now so important in the nation's affairs that it deserved a place at the Cabinet table--a status he expected would strengthen the general position of science in government.[15] Handler later gave emphasis to the Department of Science idea in an interview. While not officially endorsing it in his role as National Academy of Sciences President, he made it clear that eventually science in government would have to be reorganized and, like Hornig, stressed: "Whatever the new package may be, what we have known as NSF will be its nucleus."[16] Representative Emilio Q. Daddario (Dem. Conn.), Chairman of the House Science and Astronautics Committee's Subcommittee on Science, Research, and Development, who comes closer than anyone else to representing the interests of basic science in Congress, has begun discussing the need for greater "centralization" of science activities. In spring, 1969 he said it was "too early to act on the proposition of a cabinet-level department because all the information isn't at hand." However, he argued that preliminary steps should be taken now, so that action could be taken in the near future--a point that "should not exceed two years."[17]

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15. D.F. Hornig, "United States Science Policy: Its Health and Future Direction," Science, February 7, 1969, pp. 527-28.

16. "NAS President Discusses U.S. Science," op. cit., pp. 26-27.

17. "Science Structure Criticized," Industrial Research, May, 1969, p. 42. At Daddario's direction, the Library of Congress Science Policy Research Division prepared a report entitled Centralization of Federal Science Activities. Published by House Committee on Science and Astronautics, 91st Cong., 1st Sess. (Wash., D.C.: USGPO, 1969. Hereinafter cited as Centralization Report, it contained a "model" for a central science agency.

As indicated, this is not the first time the Department of Science banner has been waved. The idea has waxed and waned in American history, moving in tune to scientists' satisfaction (or lack thereof) with the existing state of affairs in government support. It goes back at least as far as the 1880's when the organization of science activities was being considered by Congress following a period of growth in the federal research establishment. In 1884 a Joint Commission was established in Congress. The National Academy of Sciences, chartered by Congress during the Civil War to provide it with scientific advice, was asked for its views on federal organization for scientific activities. An Academy committee looked into the matter and suggested that the best form would be a Department of Science. It felt the time was near when the country would demand such a body. Just in case it was wrong about the country's views, however, the Academy listed a lesser reorganization that would place various scientific bureaus into one of the existing departments supervised by a scientist-dominated commission drawn from public and private life. The congressional group disagreed with the Academy and went along with government opinion which held generally that it was best if science was left in the hands of those agencies that needed the research done.[18]

The Department of Science idea rose again in 1946 when Representative Clare Booth Luce introduced legislation "to foster, promote, and develop the study and spread of scientific knowledge and its practical application to the enforcement of peace and the attainment of high living standards throughout the United States and the world. The bill stated further that the creation of an executive department was necessary "to correlate on the highest governmental level the programs of national defense, national health, and proper conservation and use of the production and natural resources of the Nation...."[19]

The bill died in committee, having been given little attention by scientists. The lack of attention was not due to disinterest in government support. During the war pure scientists had learned the virtues of public money. The reason lay in the fact that a far more attractive bill was being considered. At issue was legislation that would set up a central agency for basic science in the executive branch. The very fact that a department, as such, was not requested was perhaps significant in suggesting the desire on the part of the bill's scientific supporters for non-involvement in the political affairs of government. A Cabinet Secretary loyal to the President was not what was wanted. The primary loyalty of the head of the agency was to be to science.

The agency in question would be called the National Research Foundation. It was to be governed by a part-time Presidentially appointed board of non-Government scientists and a director selected by and responsible to the board. One observer

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18. Centralization Report, p. 32.

19. Ibid., pp. 34-35.

has called the administrative plan "a design for support without control, for bestowing upon science a unique and privileged place in the public process--in sum, for science governed by scientists, and paid for by the public."[20]

The Foundation was the brainchild of Vannevar Bush, Director of the wartime science agency, the Office of Scientific Research and Development. In his 1945 report to President Truman on postwar organization for research, Science, the Endless Frontier, Bush explained why it was essential that science be given an agency of its own. There was a "perverse law" that governed research, he stated. "Under the pressure for immediate results, and unless deliberate policies are set up to guard against this, applied research invariably drives out pure." Thus, he declared, "The moral is clear: It is pure research which deserves and requires special protection and specially assured support."[21]

The obvious corollary to Bush's "perverse law" was that the pressure for applied, in contrast to basic research, invariably came from those who didn't comprehend the importance of pure research--namely politicians. The only answer was to insulate science from politics as much as possible. The insulation was too much for President Truman, however, who vetoed the bill embodying Bush's ideas when it reached his desk. It was not until 1950 that legislation finally passed setting up an agency specifically for science--NSF.[22] By this time conditions were so different that scientists felt they could get along perfectly well without a Department or central organization for science--which NSF certainly was not. For while NSF waited in the wings other agencies staked out claims to basic research territory--and various factions of the scientific fraternity applauded from the sidelines.

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20. Greenberg, op. cit., p. 107.

21. Penick, op. cit., p. 145.

22. As it turned out, the Director would be appointed by the President although the Board was retained. The reasons for the lengthy debate on NSF were many and complex. There was competing legislation and there were numerous issues--from the place of social science research to patent policy--that kept holding the bill up.

When Science and Pluralism Were Friends

In 1945, the war was ending and Bush's OSRD was looking forward to terminating so that most of its leaders could go back to their civilian pursuits. In the process of winding up its affairs it transferred 44 contracts to the National Institutes of Health in the Public Health Service in order to support the continuation of university-based medical research that it had undertaken.[23] NIH took it from there, building in ensuing years a massive program of support for basic research in the various chemical, biological, and medical sciences. Scientists in these fields were delighted for they had never been very happy about being lumped with physicists and others in an all-embracing central science agency. They wanted a home of their own and NIH could not have been more inviting.

In 1946 came the Atomic Energy Act. Atomic energy was a field Bush had not broached in his report since at the time he wrote it, atomic energy was locked in secrecy. The dominant view about atomic energy after the war was that it was unique and therefore required an agency separate from the more general science agency being discussed. With the life sciences and atomic energy fields locked up in other agencies, the military began making their move on the basic research front, led by the Office of Naval Research. After the war ONR became the darling of the physical scientists, supplying them with virtual blank checks, and, in the process, establishing a beachhead for the Defense Department on campuses throughout the country.

In 1951 NSF finally got started. It possessed the broadest kin of mandate "to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences." NSF was authorized to coordinate federal policies for the promotion of basic research and education in the sciences. It also was supposed to evaluate the scientific research programs undertaken by other agencies of the federal government. But no one took this language seriously--not even NSF. The agency's director had neither the temperament nor the congressional backing to engage the other, more established organizations in administrative combat. It was all he could do to keep NSF alive in its early years. Immediately after coming into existence, the Foundation was hit by an economy drive and then the diversion of resources to pay for the Korean War.

Postwar science organization was thus established on the principle of headless pluralism. There was no Department or central agency for science; NSF could not and would not dictate a national science policy; the President was not concerned with science policy. Basic research funding was dominated by a variety of mission-oriented agencies, each going its own way. Since

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23. Greenberg, op. cit., p. 134.

these agencies presumably supported research aiding their missions, it was somewhat ironic that they should be spending so much for basic research. After all, basic research implies a quest for understanding without thought to possible uses. The mission agencies argued, however, that they were fulfilling a need to sustain a national scientific capability which could be tapped for applied purposes in times of future emergency.[24]

However reasonable or unreasonable the rationale, the fact remained that few questioned the developing pattern of relations between government and science. Far from fulfilling its paper responsibility as the leader of basic research, NSF took the only role left for it--that of a "gap filler." It supported basic science areas the mission agencies ignored or found unpalatable. In science education NSF had more maneuverability. But even here NSF steered clear of controversy, taking pains to avoid giving any impression of trying to set policy for anyone.

In 1958, the next move came to concentrate scientific effort in one agency--in this case a Department. The push originated with Senator Hubert Humphrey (Dem., Minn.) and his Senate Government Operations Subcommittee on Reorganization. Humphrey's motives were largely managerial. He wanted to give some organization and direction to a field that, with the coming of the National Aeronautics and Space Administration in 1958, was increasingly more fragmented. The scientists rose up in opposition:

> The 1958 session of the Parliament of Science, sponsored by the American Association for the Advancement of Science, roundly denounced the idea of such a Department, thereby bringing the organized voice of the broad scientific community into opposition. Numerous scientists personally testified against the creation of a Department in congressional hearings, and finally the executive branch, reflecting the opinion of the scientists through the President's Special Assistant for Science and Technology and the National Science Foundation, voiced emphatic disapproval and helped to stall the legislative proposal in committee.[25]

The wisdom of the scientists' position, at this point in history, seemed clear. Most legislators were quite unaware of the growth of agency spending for basic research. Those who were aware

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24. House Committee on Science and Astronautics, Report, The National Science Foundation: A General Review of Its First 15 Years. Wash., D.C.: USGPO, 1966, p. 3.

25. J. Stefan Dupre and Sanford Lakoff, Science and the Nation, (Englewood Cliffs, N.J.: Prentice Hall, 1962), p. 70.

tended to be sympathetic to scientific claims. They held to their faith in basic science and worked with "their" agencies and "their" scientific communities to keep the Humprey proposal from getting off the ground. Science policy, or what passed for it, emerged from discrete centers of power that cut across segments of the executive, Congress, and the scientific community.

Thus, during the 1950's and most of the 1960's NIH was able to ignore the wishes of its own department (Health, Education, and Welfare), the Bureau of the Budget, and even the President. Every year, after receiving from the President the budgetary figure to which it was supposed to adhere, NIH would march up to Congress and would always come back with a larger appropriation than that for which it had asked. Behind the scenes, NIH worked closely with two legislative guardians, Senator Lister Hill (Dem., Ala.) and Representative John Fogarty (Dem., Rhode Island), chairmen of the agency's respective appropriations subcommittees. NIH worked as well with allies in universities and the society at large. For example, The American Cancer Society and American Heart Association were convinced that if NIH were simply given enough money, cures for cancer and heart disease would surely be found. They did not hesitate to speak up before Congress. NIH invariably received what it "really" needed--not what a supposedly niggardly President felt it should have.

Consequently the basic research budget of NIH soared. In 1955, NIH obtained $81 million; in 1957, the sum was $213 million; in 1959, the appropriation rose to $324 million. At the turn of the decade NIH was getting approximately three-quarters of a billion dollars. Presidential aides threw up their hands in exasperation. George Kistiakowsky, Eisenhower's second Science Advisor, lamented there was little the White House could do about NIH. It was too powerful, he declared. "Shannon /The NIH Director/ had a perfect understanding with Lister Hill and John Fogarty."[26]

The coming of NASA substantially enlarged the basic research pie--particularly after Kennedy's 1961 moon decision. The agency determined that in the interests of space a great deal of pure research would have to be funded. In addition to the usual project support NASA added a program helpful to universities as institutions. This was NASA's Sustaining University Program, an effort as innovative as it was quickly conceived.[27] Planned in

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26. Greenberg, op. cit., pp. 282-83.

27. See the author's Launching NASA's Sustaining University Program and Laurin Henry's The NASA Memorandum of Understanding, to be published in the forthcoming Inter-University Case Program-Prentice-Hall volume, Federal Science Administration: Politics and Policy, edited by Edwin Bock.

1961 and launched in 1962, it was not really announced to Congress (via a line item in NASA's budget) until 1963. SUP was aimed at helping higher education through fellowships, institutional research grants, and facility grants. The scientific community was jubilant that NASA had come into the federal science support picture, with academic administrators particularly pleased with SUP. NASA's congressional space committees formally endorsed the program once they understood what the agency was doing. The President, who had trouble getting money for science education through the "appropriate" agencies--NSF and Office of Education--acquiesced. Some of this aides, however, grumbled at the way NASA had bulldozed ahead. From the perspective of academic science, however, subsystem politics was good politics.

NIH, meanwhile, was spending $930 million for research in 1963 and in 1965 the agency pushed over the $1 billion dollar mark for the first time. The Joint Committee on Atomic Energy, Atomic Energy Commission, and high energy physicists saw eye-to-eye on the need for a succession of atom-smashers, each larger and more expensive than the preceding one. The military and academic scientists continued their cozy relationship, thanks to a willingness on the part of DOD's congressional committee to pay for anything the department wanted. All was placid in the world of government and science--until the long period of budgetary growth came to a sudden, abrupt halt.

<u>The Other Face of Pluralism</u>

The year 1966 marked the beginning of the end of the growth cycle in federal R & D. The good days had to conclude sooner or later. Many in Congress who were not wedded to science by committee self-interest were getting restive as early as 1963, the year they became fully cognizant of just how ample the R & D Hydra had become. With Viet Nam, the riots in the cities, and a host of other costly items on the federal agenda, the case against further substantial increases for science and technology was clinched. Hard questions began being asked both in Congress and the Executive. What became evident was that basic research, from the point of view of the mission-oriented agencies, was an expendable item, a luxury they could ill-afford in a time of belt-tightening.

NIH, for which the support of basic science had become virtually a mission unto itself, has been forced of late to recall its public health mission and divert funds to applied research in better ways to deliver health care. In mid-July 1966, President Johnson, rumored to have privately expressed concern to NIH about "too much research being done for the sake of research," publicly stated: "A great deal of basic research has been done. . . . I think the time has now come to zero in on targets by trying to get our knowledge fully applied."[28] The recent death of Fogarty

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28. Greenberg, <u>op. cit.</u>, p. 287.

and retirements of Hill and Shannon have removed much of NIH's political protection and have contributed to opening up the agency to new ideas not necessarily favored by the scientific community. NIH has cut back on basic research in a number of areas such as fundamental biology and chemistry.

The Defense Department also has been making a close review of its R & D policies. To the applause of many but the chagrin of those who had benefitted under the old rules, the Defense Department is reducing its support for high energy and nuclear physics. It has gone so far as to announce its intention as a policy matter to withdraw completely from these areas and from support of astronomy except in its own laboratories. Basic engineering is also hurting from new Defense Department practices.[29] NASA's basic research effort has suffered and its Sustaining University Program, in particular, has been hard hit as declining budgets forced NASA to make priority decisions. From a high of $45 million in 1966 SUP has fallen in 1969 to just $9 million. NSF is being pressured to pick up where other agencies have withdrawn. But with an estimated 1970 budget of $348 million NSF's hands are tied. At no time has NSF's budget been such that it provided more than about one-eighth of the total federal support for basic research or about one-sixth of federal funds for academic science.[30] To the extent it does assume grants formerly maintained by the mission-oriented agencies, NSF further limits its own flexibility.

The scientific community is now seeing the other face of pluralism and realizing that mission-oriented agencies are, almost by definition, fair-weather friends of basic research. Thus, we see the new willingness to reconsider the Department of Science idea, or at least various ways of making NSF more closely resemble in size and influence the kind of central science organization Bush had originally planned in 1945.

One apparent difference in approach today is the greater political realism on the part of scientists. Far from avoiding politics, the Department of Science proposal as set forth by Hornig represents a coming to terms with American politics. The scientific community has discovered that its interests in basic research and higher education do not compete very well with more applied interests in the mission-oriented agencies. In NSF, however, the scientific point of view is dominant--to the point where NSF traditionally is quite reluctant to get involved in research with an applied flavor. The scientists' strategy calls today for building upon the power of the one agency in government in which they have privileged access. To the extent the scientists succeed, they will build a policy subsystem more capable of influencing the general system. As

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29. <u>1970 NSF Authorization Hearings</u>, pp. 53-54.

30. <u>Ibid</u>., p. 53.

Hornig has stated:

> With a strong cabinet officer for science in the Executive Branch, there would automatically be a strong congressional counterpart committee having a broad interest in the problems of science and technology, not a minor or incidental interest. . . . [31]

The head of the Department of Science "would have line responsibility and public accountability and, most importantly, the interest and confidence of the President, the attention of the Bureau of the Budget, and the ear of Congress."

If the Hornig view is at all representative of the new strategy of science, it would suggest a remarkable turnabout in the government-science relationship, administratively and politically. Having grown to manhood on the periphery of administrative politics--a pampered stepchild of the mission agencies--science now seeks to join the executive branch competition as a full-fledged member of the family. It asks only that as it enters the lists it be given a stronger mount than NSF has heretofore been.

Given the constellation of forces affecting science and technology in 1969 and the foreseeable future, a Department of Science may make sense from the scientists' point of view.[32] From another perspective, it may not. Reorganizations have a way of creating new problems as they solve old ones. More administrative clout for science <u>might</u> help avert the operation of Bush's "perverse law." It could at the same time worsen a number of dilemmas that flow from the bottom-heavy pluralism that characterizes federal science organization. The ultimate solution to what ails science and technology lies at the national, not the subsystem or subnational level of government.

NATIONAL AND SUBNATIONAL SCIENCE POLICY

The Organization for Economic Cooperation and Development for some time has been giving attention to an examination of the science policies of various member states. In the mid-1960's the

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31. Hornig, <u>op. cit</u>., p. 528.

32. Michael Reagan, a political scientist who has given the matter of federal organization for science considerable thought, proposes a Department of Research and Higher Education amalgamating NSF, the National Foundation for the Arts and the Humanities, and the Office of Education's Higher Education functions. See his <u>Science and the Federal Patron</u> (N.Y.: Oxford, 1969), pp. 263-69.

U.S. came under purview. A team of observers came over to learn whatever lessons might be garnered from the American experience in science and technology. One of the members of the OECD team, Theo Lefevre, a former Prime Minister of Belgium, wrote in their report, published in 1968,[33] that the group had come to this country "looking. . .for something that was not there: a science policy, distinct from general policy, with its own aims and its special administration and programs." Instead, he went on, what the visitors found was "a plurality of policies and responsibilities split between varied, but none the less converging agencies." Such arrangements might work in the United States, he remarked, but "not, in our view, because of their intrinsic qualities, but in spite of defects which are no doubt tolerable and even profitable in a society of plenty, but which would be unacceptable in a European society with limited resources."

The United States is now finding that perhaps not even it can continue without something more closely approximating a national science policy. It, too, must begin to make hard choices about what to do in areas involving science and technology when there isn't enough money to do everything. As indicated by the preceding discussion of basic research, these choices tend to be made today in a haphazard manner that has as its locus of decision-making the agencies and departments. There has been precious little of what another OECD observer, C.H. Waddington of Edinburgh University, called "anticipatory programming"--a decision-making that poses the question "Where do we want to go?" and then asks "How do we get there?" Most decisions in the United States, he noted, involved "projective programming" i.e., an assessment of the present situation as a basis for the question "Where do we go from here?"[34]

Foreign visitors may be overly conscious of the fragmentation of American government, but there is little question that they have hit on some fundamental weaknesses in our science policy. Examples are the lack of central initiatives, long-range perspectives, or rational priority setting. That this is a serious problem in any period much less one of budgetary stringency is obvious. Pulling the financial rug out from under basic research in so sudden a manner is good neither for government nor science. However, moving ahead in certain areas of science and technology without fully considering the implications is equally senseless. Many of today's social ills stem from yesterday's failures to anticipate consequences of scientific and technological advances. Clearly, a broader, more searching approach to science decisions must be found.

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33. Organization for Economic Cooperation and Development, Reviews of National Science Policy: United States. (Paris: OECD, 1968), p. 360.

34. *Ibid.*, p. 384.

As Carey has noted, at present:

> . . . we in the United States have devolved great respons-ibility upon the mission agencies of the government for recognizing scientific opportunities, for sustaining the nation's research capabilities, for creating new scientific initiative, for determining where the public interest lies in matters of science and technology, for stewardship in seeing to the quality of publicly sup-ported research, and for anticipating emerging national problems and rates of social and technological change which call for long-range research strategies.[35]

Unfortunately, it is almost inherently impossible for such agencies to evaluate objectively technologies for which they are responsible. It is a cardinal rule of public administration that "every bureaucracy seeks first of all to survive; since survival is assured by expansion, every bureaucracy seeks to expand."[36] Agen-cies accommodate themselves to a variety of environmental influ-ences of which the President represents but one, and frequently not the strongest.

In the case of atomic energy, for example, there is rel-atively little power the President exerts upon AEC. This agency is responsive primarily to the Joint Committee on Atomic Energy. Pres-ident and Congress invariably go along with decisions made at the AEC-JCAE level of government. The problem, however, is that the prestige and status--and thus the survival--of both agency and committee depend upon the ability to promote atomic energy as a technology. Harold Green, who has studied atomic energy policy for years, has indicated that what is good for AEC-JCAE is not neces-sarily good for the country:

> . . . Under the national atomic energy program admin-istered by the Atomic Energy Commission, private enter-prise is encouraged, with AEC financial and moral sup-port, to use and create huge quantities of radiation. This radiation is capable of producing immense harm to the health and safety of the public unless properly con-trolled or contained. A stringent regulatory program has been established to protect the public from these hazards, but even under this program people will be exposed to

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35. Carey, "Science Policy Making in the United States," op. cit., p. 143.

36. Anthony Downs, Inside Bureaucracy (Boston: Little, Brown and Co., 1967), as cited by Alvin Weinberg, "Scientific Choice and the Scientific Muckrakers: Review Article," Minerva, Autumn-Winter, 1968-69, p. 53.

quantities of radiation which are only assumed, and not known, to be tolerable. [37]

Atomic energy is one of many technological fields in which policy is made at the [illegible] level of the U.S. government. This fact is not neutral in determining what kind of values are given or are not given attention. Thus, Green makes the further point:

> . . . when government makes a decision to develop a technology on a more or less predetermined time scale, there is a natural tendency for those who have a vested interest in the program--in government (both in the executive and legislative branches) and in industry--to become obsessed with their programmatic objectives and to minimize the social hazards or problems which may be inherent in practice of the technology after it has been developed.[38]

A number of critics of present science policy decision-making processes have proposed reforms. Nicholas Golovin, for example, has suggested a fourth branch of government that would employ "physicists and social scientists . . . /"in_7 making optimal technological choices in public policy" and thus "ensure sound planning decisions for society in a time when grave consequences would follow from the wrong decision or even from indecision." The fourth branch would be "an evaluative branch designed to function independently of the original three branches--legislative, executive, and judicial." It would "a) collect all the data necessary to continually track the state of the nation; b) define potential problems suggested by the information, c) develop alternate plans to cope with the problems, and d) evaluate ongoing projects in terms of real time and advise the people accordingly. . . . staffing would depend more on the social sciences than on the other sciences but would call upon all scientific disciplines; its environment would be politically neutral, its economic status and career stability comparable to that of the judiciary. The 'fourth branch's' power to counter-balance the older three branches would reside in public access to its information as well as to its conclusions." Establishing such a branch would require a constitutional amendment.[39]

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37. Harold Green, "Technology Assessment and the Law: Introduction and Perspective," <u>George Washington Law Review</u> (July 1968), p. 1039.

38. <u>Ibid</u>.

39. John Lear, "Public Policy and the Study of Man," <u>Saturday Review</u>, September 7, 1968, p. 60.

Less demanding of substantial governmental reform, but similar in reflecting fears that existing institutions are not capable of the "authoritative evalution" the society needs, is a proposal made by a panel of the National Academy of Sciences-National Research Council. The NAS-NRC panel advocates the addition of "a new center for advance research . . ., a forum for exploring . . .outside of regular channels . . . the theoretical and methodological problems of applying knowledge to social action . . . , an independent . . . setting . . . [beyond] the pressures of political preoccupations and constraints."[40]

"Such a center might be called the National Institute for Advanced Research and Public Policy," the panel suggested. Whatever the name, however, the organization should be established jointly by the President and Congress and should be independently endowed so as to be "free to examine not only the issues of the society but also the prevailing premises and perceptions of those issues. [Thus] . . . it could provide a kind of lightning rod for future changes as an alternative to the frustrating process of analyzing social and economic crises after they have occurred and taken their toll."[41]

Representative Daddario has called for a Technology Assessment Board responsible to Congress to aid that institution in dealing with issues of science and technology. "Technology assessment," Daddario points out, "is a form of policy research which provides a balanced appraisal to the policymaker. Ideally, it is a system to ask the right questions and obtain correct and timely answers. It identifies policy issues, assesses the impact of alternative courses of action and presents findings. It is a method of analysis that systematically appraises the nature, significance, status and merit of a technological program." The congressman stressed the need to insulate the Board from"special interest pressures, whether these be mission-oriented departments and agencies, members and committees of Congress, or the private sector."[42]

There has been a potpourri of other suggestions in the past few years. Most of them reflect a growing concern that existing institutions are not up to the new demands brought by science and technology. In addition they indicate a feeling that a more "trustworthy" source of evaluation is necessary than is currently being provided under existing arrangements.

Certainly there is a need for independent evaluation of science and technology programs. But there is no guarantee that an

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40. Ibid.

41. Ibid.

42. Emilio Q. Daddario, "Technology Assessment--A Legislative View," George Washington Law Review (July 1968), pp. 1054, 1058.

outside group can examine a technology and agree on its assessment any better than can more "political" institutions. Moreover, experts have often been wrong in the past. For example, a panel of the National Academy of Sciences on Weather and Climate Modification in 1964 called rainmaking by cloud-seeding "astrology." In 1966, literally forced to review information supplied by commercial seeders (i.e., nonscientists) the same Panel had to admit there was something to rainmaking after all. It took 20 years from the invention of cloud-seeding in 1946 for a consensus to be reached among scientists that "it works!" In the interim, most of the advances that took place in the field occurred in spite of expert opinion.

This is not an attempt to undervalue the need for as much study as can be brought to bear upon public policy in science and technology. Rather it is to emphasize that any organization or institution made by and composed of human beings will have weaknesses. "Philosopher kings" will inevitably bring to government their own professional perspectives and biases. Experts may supply more rational imputs to the decision-making process. They cannot remove politics from that process, at least as long as policy decisions deal with values about what ought to be. Democracy has its own logic, however imperfect, for getting at the truth.

Presidential Perspectives

In making and implementing science policy the President's role is central. In his essay "Managing the Federal Government," Stephen Bailey put it succinctly: "The Presidency is the only institution in the American polity where overarching and long-range public imperatives can be coherently analyzed and melded. This is true both because of the ubiquity of the presidential constituency, and because the President is mandated to recommend to the Congress a coherent program for allocating resources to and within the executive branch."[43]

To do his job the President needs the best thinking he can get on all facets of federal science policy. He has his Science Advisor and numerous other units in the Executive Office to aid him in getting information. The most important of these are the Office of Science and Technology and the President's Science Advisory Committee. The Science Advisor is in charge of both. OST is a 20-man Office to which was transferred the national science policy role formerly held, but never exercised, by NSF. PSAC is a group which meets for two days of each month and which is composed of 17 eminent men drawn from private life. Another important governmental body is the Federal Council for Science and Technology, a subcabinet entity chaired by the Science Advisor.

There are numerous other organizations or individuals throughout the country from whom the President can seek advice. He can appoint any number of task forces. There is no substitute, however,

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43. Stephen K. Bailey, "Managing the Federal Government," Agenda for the Nation, K. Gordon, ed. (Wash., D.C.: Brookings, 1968), p. 312.

for an established working staff, one that is close enough to him to see the world as he sees it and involved enough in day-to-day decisions to feel the political heat as he feels it. As elaborate as the machinery is for aiding the President in science policy, it may yet fall short of being what he needs to cope with increasing policy complexities. Hornig alluded to this in his "farewell" speech. He recommended adding more staff to OST and making the Science Advisor head of a three-to five-man Council of Science and Technical Advisors. As an alternate plan, he suggested supplementing the present director and deputy director of OST with three assistants. With more staff, he pointed out, it would be possible to prepare for Congress and the President an annual report on the state of U.S. science and technology roughly analogous to the annual Economic Report.

Hornig went so far as to recommend that OST evolve

> into an office of planning, evaluation, and analysis, looking broadly at national problems with some scientific or technological component but extending well beyond the purely technical areas. The OST has been moving in this direction in its work in environmental pollution, urban needs, and the world food problem.[44]

Planning has often been considered a dirty word in America. But at the Presidential level, and especially where science and technology is concerned, planning is an inescapable executive responsibility. The President must seek to represent the interests of the future. The realization that decisions of the present influence favorably or unfavorably the lives of later generations is implicit in Waddington's notion of "anticipatory programming."

It is noteworthy that the Science Council of Canada has recently proposed a National Science Policy that sets forth certain basic societal objectives--national prosperity, physical and mental health and high life expectancy, etc.--as a framework for policy-making in science and technology. The Canadian design attempts to ask "Where do we want to go?" It also attempts to decide which science programs are major and which are minor.[45]

This is the kind of thinking that must be adapted to the American scene and can best take place at the White House level. While it might have been possible to skirt the priorities issue at a time when R & D expenditures were on the upswing, it is difficult to avoid doing so now that the budget has levelled off. If the

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44. Hornig, op. cit., p.-527.

45. Science Council of Canada, Towards a National Science Policy for Canada, (Ottawa, Canada: Queen's Printer, 1968).

President does not develop a research strategy in terms of broad national interests, a strategy will be established by the individual agencies in terms of their interests.

Subnational Competition

If the President could formulate a national science policy he would have to implement it. There is no point in underestimating the difficulty of this responsibility. Since his own time is limited, the President must rely upon his Science Advisor, OST, and other mechanisms at his disposal to carry out policy in his name. The burdens of implementation are great. They reveal the less glamorous side of policymaking. They call for selling Presidential policy to subnational centers of power which are often content with the way things are and resent interference by the Chief Executive. An OST staff member has described what this often entails as: "finding a hall that will lead to getting what you want from an agency after going down earlier ones only to have doors slammed in your face."

The ability of agencies and departments to say "No" to the President is considerable. It varies in degree with their responsiveness to other forces in their political environments. Among these forces Congress looms large. The national legislature, working through its various committees, has power over what the agencies are permitted to do and how well they can do it. It relies upon such tools as authorizations, appropriations and the investigatory process. Congress thus exerts a continuing influence, but its committees represent interests more specific than those of the President. Often there is disagreement with the Presidential perspective on what an agency should do in a given area. Attempts at coordinating a national program in such a congressional environment become extraordinarily frustrating.

The weather modification program is an excellent illustration of some of the dilemmas of making sense out of fragmented agency efforts, and the role congressional committees can play in hampering coordination.[46] It is one of the smallest and most obscure science programs extant with only $11.8 million for the entire federal effort estimated for 1970. However, its potential implications for domestic and foreign policy are so great that the President, through his Science Advisor and Bureau of the Budget, has had to give attention to its organization and direction. To do so has not been a simple matter. There are at least seven agencies working and fighting over the various aspects of the field, from fog dispersal to hurricane suppression. Agencies as diverse as Agriculture and Navy have research projects in operation.

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46. The author is presently engaged in writing a case history of Federal Weather Modification Policy.

There is simply no national weather modification program and it is generally agreed that the field desperately needs more coherence for maximum progress. A number of administrative devices have been used or suggested for the purpose of more balanced and directed activity. Most utilized in practice has been the Federal Council on Science and Technology, whose watchword seems to be national policy through consensus. All agencies with interests in the field are represented on an atmospheric sciences subcommittee of the Federal Council. They meet, exchange information, and discuss any and all matters pertaining to weather modification. They usually can reach agreement on everything except the most important questions in designing a national program--priorities and agency jurisdictions.

Another device which has been forwarded by the Executive Office to assist in planning is that of the "lead" agency. In such an instance, one agency takes responsibility for designing and coordinating a multiagency research program. For example, in weather modification, the agency the Bureau of the Budget champions is the Environmental Science Services Administration. ESSA presumably has the most extensive scientific competence in the field. Its mission gives it an across-the-board interest in weather phenomena and it already has lead status in most weather services due to the fact that one of its subunits is the Weather Bureau.

Whatever the merit in theory has been of giving ESSA the lead, there is little chance of such a development succeeding in practice. ESSA has an estimated 1970 weather modification budget of $1.6 million. The Bureau of Reclamation has a comparable budget of $4.8 million. ESSA says it merely wishes to coordinate. BuRec says ESSA defines coordination as take-over.

What BuRec and its western-based congressional constituency fear is that ESSA would not be as favorably inclined as they are to rainmaking--and particularly a rainmaking program with a regional orientation. In the 1950's the Weather Bureau was, in BuRec's view, negative on the subject of rainmaking and BuRec fears ESSA might downgrade its effort. So this one dimension of weather modification gets "special" protection and treatment from BuRec and its congressional allies who want water for their arid states. ESSA, on the other hand, has a congressional constituency that is not particularly excited about weather modification and, in some cases, opposed to it.

The BuRec-ESSA split has exacerbated whatever inherent limitations interdepartmental councils and lead agency concepts may already have in working out overall programs. An alternative--asking a respected scientist-administrator in a neutral agency to design a program--was consequently tried in the weather modification case. Homer Newell, a high ranking NASA official, was asked to chart a national program and he accepted. But the program he designed, which gave something to everyone, and avoided giving too much to anyone, has probably served more to kindle NASA's interest in the field than to stimulate cooperation among the already interested parties.

As a final solution there is always the thought of putting all elements of weather modification into a single agency. All agencies are against this unless they serve as the base for the new agency.

It is obvious that weather modification has not really been run as a coordinated national effort, and there is little likelihood, short of strong Presidential intervention, that it will be. With more science policy staff for planning and direction the President might be in a better position to take hold of this program before it gets completely out of hand. But the difficulty of doing so cannot be underestimated. One may ask, If the President cannot coordinate a national program for scientific small-fry, how can he hope to move very far in implementing a more general national science policy? Obviously, he cannot move very far at all--unless he has congressional cooperation.

Congressional Cooperation

Under the Constitution, Congress has a great deal to say about the degree to which the President can implement science policy. Establishing anything resembling national goals or research strategies upsets arrangements worked out at the subsystem level. It is therefore incumbent upon the President to look for help in Congress as a whole against the congressional committees that so greatly limit his own effectiveness in managing the executive branch. There are no easy solutions, no magic levers the President can press. He must work with what sources of support he can find, through bringing together bits and pieces of influence.

Some of the bits and pieces are missing, however. If the President develops a national science policy, one of his chief problems lies in getting it heard and discussed in its entirety. The committees look at science in terms of specialized areas--space, health, defense, etc. The Daddario subcommittee in the House has a broad jurisdiction in science policy, but there is no counterpart in the Senate. Daddario's role in connection with NSF, the Department of Science idea, and basic research probably makes him seem to other committees as no more disinterested than they. The interest he pushes is simply science, as contrasted with a specific technology. The two Government Operations subcommittees that deal with science are too limited in their jurisdictions to provide the proper platform.

What is needed is something new, unifying, and more clearly "above the congressional battle." This might well be a Joint Committee on Science and Technology. Such a committee, composed of senior legislators from both Houses, could meet to study and debate a report on national science policy prepared by the President. It would have no power other than that of publicly discussing and illuminating an overview of federal science and technology policy. Hopefully, a base of information would thus be produced that would provide a backdrop for further discussion of the pieces of the science policy picture as they are treated in the regular committees.

the performance of committees could thus be contrasted with the priorities as seen from the broader executive-legislative perspective.

However, a common information base is not enough. More tangible influence is needed and could potentially be found in the Congressional party leaders. As Bailey notes, ". . . . there is a built-in propensity of party leaders to relate and homogenise conflicting interests and jurisdictions in the interest of a larger whole. Party leaders in Congress tend to be friendly to presidential perspectives, not because of any compulsive deference to presidential leadership but because, like him, they stand above the timber lines on their respective mountains."[47]

The fact that science policy is not yet a partisan issue would help the President gain the ear of all the party leaders, not just his own. At stake is the general against the specific, the long-range against the short. At present, the push and pulls of subsystem politics overwhelm all other influences, determining priority decisions almost by accident. It may be said that this is simply the way things are done in American public administration. Perhaps! But observers of the system must forward the question of whether business as usual methods are good enough in the designing of policy so crucial to the nation's future.

SCIENCE AND THE HUMAN CONDITION

If there is an area of public administration today in which the methods used to deal with problems are clearly unsatisfactory, it lies in those especially concerned with the human condition. Involved are a host of titanic social problems--from poverty to pollution, from urban blight to overpopulation. Science and technology has generally had little to say about such issues. Government and science has been even slower to shift priorities concerning them. The R & D budget continues to be colored by cold war orientations. Some entrenched scientists would apparently prefer to continue their traditional behavior under support from Defense Department, NASA, AEC or , even better, a Department of their own, than to meet new demands from different agencies for mission-oriented applications in the social realm.

Meanwhile, the social problems are not going away and are getting worse in many respects. Traditional sources of funds are starting to tighten at the same time as the nation, very slowly, begins shifting priorities. For example, as small as they are in comparision with the big science agencies, the R & D budgets of social problem agencies such as Housing and Urban Development are at least rising when many other agencies are having trouble preventing decreases.

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47. Bailey, op. cit., p. 328.

The research partnership, like any social entity, must adjust to new demands as the price of survival. In the 1970's, when the United States will hopefully experience a post Viet Nam economy and the Cold War psychology may have more completely worn off, it is very likely there will be a conscious attempt by government to produce what Alvin Weinberg has called "cheap technological fixes."[48] These innovations would attempt to provide short-cuts to the resolution of difficult, perhaps otherwise unbearable social problems. For example, the population explosion in underdeveloped countries cannot be solved quickly. It will take years for the ingrained customs that govern the number of children couples have to change or be changed. In the interim, human misery in those lands will be catastrophic and all attempts at development will be cancelled out. Better birth control devices and new sources of food could, however, help to buy time for the governments in question, permitting them to conduct the necessary educational tasks aimed at ending the upward spiral of population.

Similarly, science and technology can grapple with the physical aspects of urban problems. It can contribute to devising ways to produce better low-cost housing, mass transportation, city planning, community architecture, and quality of environment.[49] But there is no guarantee such efforts will mitigate the underlying social needs any more than birth control devices can lessen population growth if people choose not to use them.

Suffice it to say that science and technology is not the solution to the multitude of mankind's woes but simply a useful tool. Moreover, technological fixes can be mixed blessings. Proponents of peaceful uses of atomic energy are convinced, for example, that eventually their technology will solve virtually all the world's energy requirements. They may be right. In the meantime, however, radioactive wastes create problems of their own.

This is not to take the position that some critics of science and technology adopt. They see only the possible horrors and none of the potential benefits. It is merely to indicate that the relationship of science and technology to the human condition is extremely complex. In most cases, science and technology can help, but cannot solve problems that have roots in man and his institutions. To the degree it <u>can</u> help it should be used. Like any other resource in the public administrator's arsenal, it must be employed

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48. Alvin Weinberg, <u>Reflections on Big Science</u> (Cambridge, Mass.: MIT Press, 1967), p. 141.

49. "An Interview with Philip Handler," <u>op. cit.</u>, p. 7.

carefully with full attention to its second and third order consequences.[50] The difficulties are many and will have to be worked out "in process." The problems to which science and technology must be addressed cry out for action. The scientific community cannot afford to stand aloof. Society is not likely to permit it to do so and at the same time be supported in the manner to which it has become accustomed.

While keeping the best of the old enterprise intact, government and science will have to move to meet new challenges. This is bound to cause strains and require basic changes in the existing roles of many of the principal participants. Some of the implications for the university are already apparent. The research partnership is in transition. The passage will be turbulent.

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50. See Raymond A. Bauer (ed.), Social Indicators, (Cambridge, Mass.: MIT Press, 1966). Also James E. Webb, Space Age Management N.Y.: Columbia, 1969). The significance of science and technology for the education of public administrators is great. It may well be that the only relevant training for public administration today is that which cuts across the two cultures. Carroll (op. cit., pp. 907-908) suggests the management of science in the city will require the development of a social technology--"a method of organizing fiscal, legal, architectural, planning, managerial, and technological expertise."

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS—1963