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THE WHITE HOUSE
WASHINGTON

08 dec 80

Stu Eizenstat
Frank Moore
Jim McIntyre

The attached was returned in the President's outbox today and is forwarded to you for appropriate handling.

Rick Hutcheson

Jim -
Stu -
Proceed as indicated in OMB memo
J

THE WHITE HOUSE

WASHINGTON

December 4, 1980

MEMORANDUM FOR THE PRESIDENT

FROM: STU EIZENSTAT Stu

SUBJECT: Hawaiian Deep Water Electrical Cable Demonstration Program

You requested my views on whether the Department of Energy should fund the Hawaiian Electric Company's unsolicited proposal for the Hawaii Deep Water Transmission Cable Demonstration Program. Senator Inouye asked for your support in obtaining $2,124,900 for this program in FY 81 and a total of $12 million over a four year period. I believe that this project can be justified because of its potential to back-out oil use and its importance to Hawaii's energy development, and I think that you should direct DOE to fund it.

The Hawaiian Electric Company has developed a plan to interconnect the islands with deep submarine cables to form an integrated utility network. This would allow them to generate geothermal electricity on Hawaii and wind electricity on Molokai and to transmit it by cable to the major population centers on Oahu. The submarine cables must be laid at depths of up to 8000 feet. Since the deepest submarine cables currently in existence are only at 1800 feet, this program obviously involves a degree of risk. The Hawaiian utility has proposed that DOE undertake a demonstration program to determine whether cables can be laid at that depth. The utility would then undertake the cable laying program itself.

DOE had initially requested $2.5 million in FY 82 for the submarine cable demonstration program but eliminated that request during its negotiations with OMB. Senator Inouye is anxious to proceed with the program in FY 81, and DOE could reprogram $100-200,000 in FY 81 in order to get started. But DOE now takes the position that it cannot fund the project at all within the current budget target.

I believe that DOE should begin funding the submarine cable project in FY 81. This is a significant project to enhance Hawaii's renewable resource capabilities, and the submarine cable technology developed here will be useful in the Great Lakes and in other areas. Senator Inouye's request is both small and reasonable and you should agree to it.

DECISION OPTIONS: Hawaiian Deep Water Electrical Cable Demonstration Program

_____ I. Do not fund the program at all (DOE's present position)

_____ II. Fund the program, but do not begin until FY 82 (DOE's position before FY 82 budget cuts)

_____ III. Fund the program beginning in FY 81 (DPS, CL)

Attachments

THE SECRETARY OF ENERGY
WASHINGTON, D.C. 20585

December 2, 1980

MEMORANDUM FOR: THE PRESIDENT

FROM : Charles W. Duncan, Jr.

SUBJECT : Hawaii Deep Water Electrical Transmission Cable Demonstration Program

My staff has reviewed the proposal made by the Hawaii Electric Company. The objective of the proposal, to assist Hawaii become energy independent, is strongly supported by the Department. However, the bulk of the Department's research and development work in the area of underwater cables involves riser cables (ocean floor vertically to the OTEC platform) as opposed to bottom cables (transmission of power along the ocean floor). There are no funds available in FY 1981 to start the effort and only $700,000 was requested in FY 1982 for the area of underwater cable power transmission. OMB has denied that request, leaving DOE without any funding in this area. Even if the funding for FY 1982 is restored and the $2,124,900 requested by Hawaii Electric Company is provided, the outyear mortgage of $10,290,075 would likely force reduction in other ongoing DOE programs. While bottom cable work is of interest to the Department, we do not think it is of such importance as to warrant giving it priority over other activities being performed by the Department.

In conclusion, although I support the objectives of underwater cable research, I cannot support funding for this proposal given the budget target established for the Department.

THE WHITE HOUSE

WASHINGTON

December 3, 1980

MEMORANDUM FOR THE PRESIDENT

FROM: Frank Moore FM/DT
Dan Tate Dan

SUBJECT: Hawaiian Deep-Water Electrical Transmission Cable

If the following sounds familiar, it's because I deeply believe it.

We have had few friends in the Senate; the ones we have had have run hot and cold. One who has been a consistently solid, steady supporter from the transition period four years ago until now is Danny Inouye. You have not had to deal with him much because he has always told Dan Tate and me that "if 'my leader' wants it, I will vote for it."

It is also true that he enjoys a solid political base and was reelected, with no opposition, for six more years. He used that political base for us early in the primary season when Patsy Mink was trying to deliver the state for Kennedy. In 72 hours, Danny flew to Hawaii, at our request, called in all his chips, and said he wanted the Governor and the rest of the delegation to support you. They were with us through the general.

When you vetoed a couple of his bills the first year he didn't say a word about it either publicly or privately. He merely asked us next session what he needed to do to fix them to conform with your wishes. He fixed them and they were later passed.

The work he does is neither flashy nor headline-making. Through the help of Jim Wright and Clem Zablocki, we usually squeezed out of the House a less than adequate foreign aid appropriations bill, IMF bill, IDCA bill, MDB's, and World Bank legislation. Danny always fixed it against formidable odds (Jake Garn) and with no domestic constituency to help him.

In return he has asked for little. He has asked for help on his judge. He is now asking you for this cable and gently reminding us of what he has done. The list of items -- major, often unpopular items -- on which he has been helpful to us is much longer than I have mentioned. I recommend you do it. I will let Stu Eizenstat make a substantive argument and Jim McIntyre make the budget argument. My argument is that you should do this for Danny.

INOUYE LETTER

THE WHITE HOUSE
WASHINGTON

11/18/80

STU EIZENSTAT
JIM MCINTYRE .
SECRETARY DUNCAN

The attached was returned in the President's outbox today and is forwarded to you for appropriate handling.

Rick Hutcheson

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

DEC 4 1980

MEMORANDUM FOR THE PRESIDENT

FROM: JIM McINTYRE

SUBJECT: SUBMARINE CABLES IN HAWAII

You asked for our assessment of Senator Inouye's proposal for a "sea trial" for deep submarine cables to provide a more effective electricity grid for the Hawaiian Islands. A total of $12 million in DOE funding would be required over a five year period.

In brief, our conclusion on the substance of the proposal is that the project is not of highest national priority, but would be very useful in helping Hawaii reach energy self sufficiency. While there are technical risks associated with this venture, they are not insurmountable if the Hawaiian Electric Company (the project sponsor) chose to undertake the project without federal assistance. The technology to be demonstrated in this case does not have wide applicability to other parts of the country although other applications of a limited nature are possible if the project is modified slightly. Ideally, we would prefer to have a greater degree of cost sharing with the Hawaiian utility, although they will fund part of the demonstration program and all of the costs of implementing the system should it prove feasible.

Notwithstanding these comments, however, I would not rule out funding this proposal if we have room at the end of the budget process. It could be done by directing DOE to reprogram $200,000 in FY 1981 to get the project started, and adding $2.5 million in FY 1982. Hawaii does have particularly sensitive energy needs given the long distances alternative fuels must be transported. We have in the past agreed to provide regional petroleum storage for the Islands, although only planning funds, not construction monies, are provided in the FY 1982 budget. If the submarine cable project were to succeed in reducing Hawaiian oil consumption, we could avoid the much higher cost regional storage program in budget years beyond FY 1982. It is also worth noting that the program will provide oil-back out benefits at a cost to the U.S. government substantially lower than our utility oil back-out initiative.

Let's do this

I recognize how important this project is to Inouye. You should also be aware that the tourism bill, another Inouye priority is still pending in Congress. If it is passed in its present form, I intend to recommend veto. Approval of the submarine cable proposal would help take the sting out of that veto, though I recommend that you hold off on a final decision until we go through our final budget ranking.

cc C Duncan
Sec E.
MS Bolger
advise
expeditiously
J

HAWAII DEEP WATER ELECTRICAL TRANSMISSION CABLE DEMONSTRATION PROGRAM

This Program, if successful, would result in the laying of a deep water cable between the Hawaiian Islands which would transmit electricity. The main obstacle to constructing such a cable has been the considerable depth of the channels between the Hawaiian Islands; in some places reaching approximately 7,000 feet. Construction of the cable system between the Islands would bring on line the vast potential of the geothermal energy resources of the Island of Hawaii and would result in a large proportion of Hawaii's electricity being generated by geothermal energy.

The unsolicited proposal for the Hawaii Deep Water Transmission Cable Demonstration Program was presented by the Hawaiian Electric Company to the Department of Energy on June 2, 1980. Supposedly, the DOE views this proposal favorably and anticipates releasing $3 million for the program in June, 1981. The total cost of $12,414,975 of the three and one-half to four-year program is divided into four phases with the first phase costing $2,124,900.

The proposed June 1981 funding date represents a nine-month delay that creates major problems for the State of Hawaii since the cable development work is interlinked with other ongoing alternative energy development work.

Attached are two copies of letters to President Carter requesting his assistance in securing earlier funding for the first phase of this program. Early start-up of this program is of major significance to Senator Inouye and the State of Hawaii.

DANIEL K. INOUYE
HAWAII

PRINCE KUHIO FEDERAL BUILDING
ROOM 6104, 300 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96850
(808) 546-7550

United States Senate

ROOM 105, RUSSELL SENATE BUILDING
WASHINGTON, D.C. 20510
(202) 224-3934

October 24, 1980

Honorable Jimmy Carter
President of the United States
of America
The White House
Washington, D.C. 20500

Dear Mr. President:

Last month I wrote to you requesting your special consideration and assistance for an extremely important energy project in the State of Hawaii.

In that letter I requested your support in obtaining funds as early as possible for the initial phase of the Hawaii Deep Water Electrical Cable Demonstration program. This project will develop an underwater power cable to be placed in, operated, and retrieved from water three times deeper than that encountered by electrical power cables anywhere else in the world.

The State of Hawaii is almost totally dependent on oil imported from foreign sources for all forms of energy. However, the neighbor islands of Hawaii have particularly strong potential to place alternative energy sources on line in the very near future. For example, the Big Island of Hawaii is about to generate energy for use by the community from geothermal energy. Not only does the Big Island have the hottest geothermal wells in the world, but it is also predicted that with full development of this resource, half of the State of Hawaii's electrical energy needs could be met in the very near future. Unfortunately, this energy would have to be transmitted 150 miles to the Island of Oahu, where 85% of the State's electricity is consumed. Other alternative energy sources, such as ocean thermal energy conversion and wind energy, are also being developed on the Big Island of Hawaii and would add to the Big Island's potential excess energy supply.

The major problem is these alternative energy projects will not move ahead nor receive the necessary full financial commitment from the private business community if a market for this energy is not readily available.

DANIEL K. INOUYE
HAWAII

PRINCE KUHIO FEDERAL BUILDING
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(808) 546-7550

United States Senate

ROOM 105, RUSSELL SENATE BUILDING
WASHINGTON, D.C. 20510
(202) 224-3934

September 25, 1980

The Honorable James E. Carter
President of the United States
The White House
Washington, D.C.

Dear Mr. President:

The purpose of this letter is to request your support in obtaining $2,124,900 in FY'81 for a Hawaiian Deep Water Electrical Cable Demonstration program. The funds requested are for the first phase of a four phase four year program to demonstrate that it is technically feasible to interconnect the principal Islands of Hawaii with an under water electric power transmission cable. This project will develop an under water power cable to be placed in, operated, and retrieved from water three times deeper than that encountered by electrical power cables elsewhere in the world. This program has been proposed to the Department of Energy in an unsolicited proposal by the Hawaiian Electric Company.

Imported oil which is the source of more than 90% of the electric energy consumed in Hawaii has experienced a 15 fold price increase since 1970, consequently there are many programs in the State to develop alternate energy sources. A near term development is geothermal energy on the Island of Hawaii. Full development of this resource, which would supply as much as one-half of the State's electrical energy needs, will require that the energy be transmitted to the Island of Oahu, a distance of 150 miles where 85% of the State's electricity is consumed. While the ability to transmit power between the Islands is the major goal of the cable demonstration program, the technology developed during the demonstration program has direct application to many other continental United States electrical energy transmission projects. These projects include the transmission of hydroelectric generated power from Canada to the Northeast United States, the transmission of power from the Bahamas to the continental Southeast United States and the transmission of electric power from Central Canada to the Midwest United States. These project represent 3,800 megawatts of electrical energy and will result in the significant reduction in the importation of foreign oil for power generation purposes. The cable technology developed will be directly applicable to the research and development effort currently being carried by DOE on OTEC.

Aloha,

DANIEL K. INOUYE
United States Senator

Therefore, the Hawaii Deep Water Electrical Cable Demonstration program is an integral part of Hawaii's drive towards energy self-sufficiency.

I understand that there are funds for this project in the DOE's FY 1982 budget. However, this would mean that the project could not begin until some time late next year. This delay in Department of Energy funding of the initial phase of this project would halt the progress of other alternative energy projects in Hawaii.

Unfortunately, this proposal was brought to my attention at a very late date; otherwise, I would have attempted to obtain funding assistance through the Senate Appropriations Committee. Because of the project's importance to my State, I have requested your special assistance.

In writing you last month, it was my hope that a strong and clear indication from you to the Department of Energy for early funding of the initial phase of this project would result in funds being provided within the existing DOE budget to get this project off the ground. However, I understand my letter has been received by the Department of Energy and that prospects for approval appear to be very slim.

Your further consideration and assistance in obtaining some form of short-term funding of the Hawaii Deep Water Electrical Cable Demonstration program would be greatly appreciated. Thank you for the effort you devote to this matter.

Aloha,

DANIEL K. INOUYE
United States Senator

DKI:vqbf

Susan
file
J

THE WHITE HOUSE

WASHINGTON

December 4, 1980

MEMORANDUM TO THE PRESIDENT

FROM: Frank Press FP

You asked me to send you the enclosed manuscript "Science and Technology in The White House, 1977-1980." It will be published in Science in early January and will be seen by most of the Nation's scientists and engineers.

The article summarizes my activities as your Science and Technology Adviser and as Director of the Office of Science and Technology Policy.

Enclosure

SCIENCE AND TECHNOLOGY

IN THE WHITE HOUSE

1977 - 1980

PART I

Manuscript for Submission to SCIENCE
October 24, 1980

Dr. Frank Press
Office of Science and Technology Policy
Executive Office of the President
Washington, D.C. 20500

ABSTRACT

This is the first of a two-part article on science and technology policy in the Carter White House. Written from the perspective of the President's Office of Science and Technology Policy (OSTP), the article describes specific activities and accomplishments in the context of the overall policy framework and institutional structure within which the Office operates. This part of the article addresses policy issues related to strengthening the U.S. science and technology enterprise, fostering industrial innovation, enhancing relationships among government, industry, and universities, and improving the regulatory process. The concluding segment will focus on OSTP activities related to national security and foreign policy, space, energy and the environment, health, and agriculture, and discuss OSTP advisory mechanisms and planning efforts.

Most of the issues with which a modern President must deal have been greatly affected and complicated by rapid advances in scientific and technological knowledge and achievement. Indeed, for many issues, science and technology are critical elements of the policy alternatives the President faces. These issues include foreign policy, national defense, nonproliferation of nuclear weapons, economic revitalization, energy, space, health, agriculture, environmental protection, and many others. To deal wisely with issues such as these, it is helpful for a President to have broad technological literacy, but essential that he have strong staff support.

President Carter, at the outset of his Administration, recognized the pervasiveness of scientific and technological concerns and the need for direct support in these areas. For this reason, he followed the tradition of several of his predecessors, choosing to have a Science and Technology Advisor as part of his senior White House staff. When the President selected me for this position, he also nominated me to become the Director of the statutory Office of Science and Technology Policy. OSTP had recently been recreated by Congress, after a hiatus of several years, under the National Science and Technology Policy, Organization, and Priorities Act of 1976 (P.L. 94-282) and placed in operation during the last year of the Ford Administration by President Ford's Science Advisor, Dr. H. Guyford Stever.[1]

I had never met Jimmy Carter, nor was I active politically prior to joining the Administration. Only after the President offered me the position did his Chief of Staff inquire about my political affiliation in order to inform the Congressional leadership. Although there is something to be said for a prior political and personal relationship between a President and his Science Adviser, I have found it advantageous to be viewed primarily as a professional rather than political appointee, particularly in my dealings with the Congress, industry, universities, and professional societies. There are political differences even within the White House staff and the Cabinet, and the credibility of my advice was enhanced by the apolitical and impartial image of OSTP. In my first interview with the President, he indicated that he chose me from a list of nominees submitted by leaders of American science and technology because my background served his priorities in energy, environment, resources, arms control, and relations with the USSR and other countries.

President Carter retained OSTP as an integral part of the Executive Office of the President. At the same time, as part of his effort to streamline the expansive structure of the White House and its associated offices, OSTP was slimmed down and the President's reorganization authority invoked to transfer to other agencies, certain staff-intensive responsibilities,

such as writing prescribed reports for the Congress. On the other hand, other responsibilities in the national security areas ~~such as telecommunications~~ and space policy were transferred into OSTP.[2]

We organized the Office around three Associate Directors in order to enhance our ability to deal with the tremendous range of substantive issues we anticipated, and recruited a small staff of accomplished scientists, engineers, and other professionals with relevant policy analytical experience. On specific issues we have consulted intensively with experts from around the country. Individual consultants and ad hoc panels focused on well defined, high priority issues have proven an effective and flexible means of augmenting staff capabilities and obtaining the most knowledgeable advice.

The OSTP enabling legislation was important in providing the overall mission and the framework within which we sought to establish the Office. However, the elimination of a White House science and technology office by President Nixon led to a distribution of its responsibilities to other offices in the Executive offices of the President and other Executive Branch agencies. The new office -- OSTP -- would be faced with a natural bureaucratic resistance to reestablishing the influential roles its predecessor offices played under Presidents Eisenhower, Kennedy, and Johnson. For this reason, it was our early assessment that, in order to be effective and to have significant influence on major policy and program decisions, we had to prove ourselves to be a valued source of advice and our mode of operation had to be consistent with, and complementary to, the policies and operating styles of the President and other members of his immediate staff with whom we were to work on a day-to-day basis.

Thus, we began by establishing personal and operating ties with the Vice President, the senior Presidential advisors and staff of the various White House offices -- the National Security Council, the Domestic Policy Staff, the Office of Management and Budget, the Council of Economic Advisors, the Council on Wage and Price Stability, the Council on Environmental Quality and others responsible for Presidential personnel, appointments, and other functions. Although the White House is a center of political activity, OSTP came to be viewed primarily as a source of non-political, expert advice.

The leaders of the Departments and agencies were also appointed during this time. My role in advising on those appointments particularly relevant to research and development helped establish early relationships with these key officials.

My dual roles of personal advisor to the President and Director of a staff office in the Executive Office of the President have allowed me to participate in policy deliberations and decisions across the full span of Presidential responsibility and to have the staff capabilities necessary to conduct the timely, high quality policy analyses needed to support that participation. My attendance at Cabinet meetings and Senior staff meetings, along with participation of the OSTP Associate Directors and staff in a substantial portion of internal White House activities, has made possible continuous interaction in the formulation of Presidential policy.

Above all, it has been the personal interest of the President that has given scientific and technological considerations weight and significance in Executive Branch policy formulation over the last four years. The President has been highly accessible to me, seeking my advice and counsel on a wide range of issues and personally directing that I take the lead in specific instances. In this way, the scientific and technological perspective has become an integral part of the body of analysis which aids the President in making what are ultimately political judgments. The evidence of that personal interest of the President has also made more effective the extensive interactions with the departments and agencies in carrying out Presidential policy, in developing coherent policy across the government, and in mobilizing the departments and agencies to respond to special needs or issues.

The principal themes of the Administration emerged during the first year. My discussions in early 1977 with the President and Vice President led to a broad outline of Administration science and technology policies emphasizing growth in the support of basic research, an increased role for science and technology in regulatory decision-making, incentives for technological innovation, and an enhanced role for science and technology in international relations. Extensive conversations with representatives from the academic and industrial sectors helped to indicate the scope and magnitude of the problems faced by these sectors, and to clarify and refine the specific issues within the broader policy areas. The high priority issues emerging from this process formed a working agenda for both the near-term and longer-range policy initiatives that would be undertaken by OSTP. This policy framework, the personal and organizational relationships

formed with colleagues in the agencies, the Executive Office of the President, and the Congress, and a wide-ranging network of formal and informal consultants from many disciplines and institutions, have permitted this small policy office to have considerable influence on a wide range of scientific and technological issues of national importance.[3]

In this two-part article, I will discuss some of our activities and accomplishments, focusing on the overall policy framework and government structure within which OSTP operates in the formulation of science and technology policy. This first article will describe activities aimed at strengthening U.S. science and technology, new government relationships with industry and universities, and regulatory reform efforts. The subsequent article will describe foreign policy and defense-related activities, energy, health, and agriculture efforts.

STRENGTHENING U.S. SCIENCE AND TECHNOLOGY

Science and technology have become major factors in almost every facet of our lives. We increasingly look to scientific and technological advances to help solve the complex problems facing the Nation and the world. We expect science and technology to improve our health, feed the world's growing population, find new energy sources, provide for our national security, and contribute to the health of our economy by generating growth, jobs, and productivity through innovation. Indeed, it is implicit in our Nation's approach to the future that technologies will aid in the solution of many of the problems we face. The development and application of new technologies are viewed as a national imperative.

Fulfilling our ambitious expectations for technology will require a national commitment to research and development among the several sectors -- government, industry, academia, and the public -- which play complementary roles in the support and conduct of basic and applied research and of technological innovation, development, and application. Thus, early in the Administration, it became clear that critical tasks would be: delineation of the role of the Federal government in the support and conduct of research and development, clarification of the relationship of the government role to the roles of the academic and industrial sectors, and improved and increased cooperation among these three sectors in meeting the scientific and technological challenges of the future.

Over the last four years, my staff and I have devoted a major portion of our energies to defining and strengthening the Federal research and development commitment, to working with our government colleagues in developing appropriate policies and programs, and to working with our academic and industrial colleagues to enhance government-university-industry relationships.

Federal Support for Research and Development

The Federal government's support and conduct of research and development is critical to the overall advance of science and technology. The largest fraction of the Federal investment serves those areas for which the government has either total or major responsibility, such as defense, space, and health. Because of the technical challenges involved in meeting these national needs, there is a relatively large and broad Federal investment across the entire spectrum of research, development, demonstration, and application.

Similarly, the Federal government undertakes research and development where there is a national need to accelerate the rate of development of new technologies in the private sector. This is especially true when the risk is great, the costs inordinately high, or time particularly pressing such as with many aspects of alternative energy technologies. In such cases, the government may provide incentives such as direct grants and contracts, guaranteed loans, purchase contracts at guaranteed prices, joint ventures or, as a last resort, construction of government-owned facilities. The recently created Synthetic Fuels Corporation, which has these authorities, is an example of government involvement in an area of national need.

We look to the private sector, however, to finance research and development activities having near-term commercial payoff and to bear the major financial responsibility for required capital investment in such cases as synthetic fuels commercialization. Industry is more knowledgeable about the marketplace and sensitive to opportunities for commercialization of new technologies. This view is consistent with that of industrial leaders who ask the government for a climate that fosters innovation rather than for direct financial support of research and development with commercial potential.

Underlying the achievement of both public and private sector objectives is the need for basic research. The costs, long time required for payoff, and widespread but unpredictable results of basic research make necessary and desirable the expenditure of public resources to support basic research as an investment in the Nation's future. This principle has been accepted in the United States over many years and the Nation has committed substantial resources to create and support the world's most productive scientific enterprise.

There are no established criteria and procedures for determining the adequacy of the existing science and technology base or for identifying an adequate level of support for research, especially basic research. Relevant factors include: the levels of activity in various scientific fields and the anticipated benefits or costs of incremental changes in level of support; the potential opportunity-costs of not funding given areas of research; the effects of past contraction of support on research capabilities, institutions, and facilities; opportunities available to bright young scientists; the views of employers on the quantity and quality of new scientists and engineers; and policies of other countries. The National Science Foundation's Science Indicators, as well as reviews and reports of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, the American Association for the Advancement of Science, and other professional societies, provide data useful in making these kinds of judgments.

Ultimately, however, policy makers must decide on appropriate levels of research on the basis of imperfect indicators, information from many disparate sources, and many uncertainties. The Administration has used all available sources of advice and information, relying particularly on the views of many experienced individuals in the academic and business communities. Early in the Administration, we concluded that government support for basic research had declined seriously in the preceding decade and required sustained real growth above inflation. Perhaps even more important from the policy viewpoint was the President's personal decision to view basic research as an investment rather than an expense.[4] This decision became the basis for the strong support for research and

development in the President's budgets and the major science and technology initiative in the economic revitalization program announced by the President on August 28, 1980.[5] The latter included the provision of $600 M in new funds for Fiscal Years 1981 and 1982 to achieve 3% real growth above inflation in basic research for those 2 years and to support several other steps designed to stimulate research and innovation. Taken together with earlier commitments, this recent initiative, if adopted by President-elect Reagan, will bring real growth in basic research over the FY 79-82 budget periods to 10-11%. Thus, as a result of the last two Ford budgets and the Carter budgets, the previous decade of decline in the support of basic research will have been reversed and a new all-time peak (in deflated dollars) achieved.

The Budget Process. The budget process is the most influential and comprehensive policy tool in the government. Our efforts to assess the adequacy of government research and development programs and to initiate appropriate actions have been effective largely because of our excellent working relationship with the Office of Management and Budget (OMB). I have found the senior officials in OMB to have a keen interest in science and technology and a thorough understanding of its national importance. In addition, we have been perceived by these officials and by others in the Executive Office to be a highly professional office supportive of the President's needs rather than a non-objective representative of science and technology constituencies.

The OMB budget process begins in the spring with a review of major issues and continues with agency budget submissions in September, agency-OMB negotiations later in the fall, and Presidential decisions in late

December. The President submits the budget to Congress in January with subsequent congressional action expected that spring. OSTP participates in every step of the process, advising OMB and the President and helping to defend the budget before Congress. In addition to advising on the appropriateness of proposed levels of support for agency research and development programs, we identify and analyze specific budget and policy issues. These include: special opportunities presented by recent scientific discoveries or by new techniques, processes, or instruments; the potential for addressing a national need more effectively by reprogramming or expanding funds within or among Federal agencies; or problems with agency proposals that are technically flawed, misplaced in priority, or more properly a role of the private sector. During budget sessions with the President, we have sided with OMB or the agencies, or have taken an independent position, depending on the merits of the issue. Examples of issues that have received special attention because of new opportunities, previous underfunding, or national need are: microelectronics, computer sciences, the engineering sciences, the physical sciences and mathematics, defense research and development, alternative energy supply technologies, the space shuttle, climate research, food and agricultural research, basic biomedical research, environmental research and control technologies, and toxic substances and hazardous wastes.

After individual agency budget decisions have been made, we have worked with OMB and the President to adjust the overall level of government research and development. In the last three budgets, funds were added to individual agency budgets through a process of cross-agency proposal ranking by OSTP and OMB in order to bring government-wide research

support up to the level of real growth above inflation set by the President. This process has proven to be an effective method for carrying out a systematic overview of research and development, particularly of basic research. Despite the difficulties inherent in assessing and comparing diverse programs, and in projecting inflation and other economic behaviors, I feel that this OMB-OSTP process is an important development. The close working relationship that has emerged between OMB and OSTP is one of the high points of my service in Washington.

Other Research Resource Issues. Non-fiscal resources must also be considered as major factors in the strength of the U.S. scientific and technological enterprise. These include equipment, facilities, and manpower. As Director of OSTP, I have been made increasingly aware of: (1) the steady decline in the quality of scientific instrumentation and facilities for research and teaching within our research universities and engineering colleges; and (2) the need for objective analyses of the need for trained scientific and engineering professionals.

Over the last three years we have worked with Federal agencies to identify ways to somewhat alleviate these problems consistent with current budget realities. For example, NIH and NSF have received some additional resources in the President's budgets for upgrading research equipment. In addition, they have explored ways to encourage time-and cost-sharing of valuable scientific resources. Although the President's economic revitalization program of 1980 will undoubtedly be replaced by President-elect Reagan's own program, we hope that the proposed long-term emphasis on upgrading university science and engineering instrumentation and facilities will receive bipartisan support.

Another critical resources is, of course, scientific and engineering personnel. Because of the rapidly changing needs for various scientific disciplines and engineering specialties and of the lag-times inherent in the education process, predicting demand and influencing supply of trained professional personnel have proven particularly difficult. For this reason, the President commissioned a study by the Department of Education and the NSF to assess the current and projected supply and demand of science and engineering personnel and to assess the quality and appropriateness of science and engineering education. The study, including major recommendations, has just been delivered to the White House.

Insert from p.12A.

We have also worked with OMB, the agencies, and Congress to bring more stability to the research community through longer-term research planning, and through negotiation of a dependable base of research support. Continuity and stability of support will facilitate the training of needed scientists and engineers, maintenance of high quality research teams, and the conduct of significant, long-term scientific investigations. For example, the Administration has established support for a steady number of biomedical research projects and provided for stable, predictable growth of funding for high energy physics based on the priorities of that community.

In addition, the Administration and Congress explored ~~are exploring~~ the possibilities of establishing multi-year research budget authorizations. The annual budgetary, authorization, and appropriations process has become so complex and unwieldly that it can have serious negative effects on the conduct of research. Specific legislation has been proposed by Representative Don Fuqua, Chairman of the House Committe on Science and Technology and enacted by the House of Representatives; however, action on this bill likely will not be completed during the 97th Congress.

We are particularly proud of having initiated a program with potentially large impact for minority representation in the Nation's scientific and engineering professions. As the result of a cooperative effort among OSTP, OMB, and all agencies with significant scientific and technical programs, 1300 summer placements were created for minority high school students to provide them with hands-on research experience under the tutelage of an experienced investigator in a university or government laboratory. We are planning for the Minority Research Apprenticeship Program to grow to 2000 students next summer.

We have also worked outside the budget process to strengthen government research and development programs. It will be recalled that basic research in the mission agencies had declined sharply over several years, especially in the years following enactment of the so-called Mansfield Amendment.[6] One of our first steps in analyzing the adequacy of Federal support for research and development was to assess the basic research programs of several mission agencies. Early in the Administration, OSTP initiated reviews for the Department of Defense and the Department of Energy at the request of their Cabinet officers. High level study panels were established comprising individuals with a range of perspectives and backgrounds, and with experience in industry, academic science, and administration. In their final reports, both panels recommended that mission goals would be more readily achievable if the Departments reversed earlier declines and gave greater emphasis and more coherent management attention to research and development, particularly basic research.[7,8] The Cabinet officers agreed and have taken steps to implement the panel recommendations. Both agencies have included members of the original panels in continuing efforts to monitor basic research and both followed panel recommendations to strengthen ties with the university communities. Subsequently, OSTP initiated similar reviews of priorities and management in the Department of Agriculture, Transportation,[9] Health and Human Services, and the Environmental Protection Agency.

INDUSTRIAL INNOVATION

Within the first few months of my tenure as Science and Technology Advisor and Director of OSTP, I began meeting with small groups of industry executives. A dominant theme of these meetings was the impact of government policies on industrial innovation. It clearly was a question of national importance. United States imports of manufactured goods each year are on the same order as our oil imports. As the world's most technologically advanced nation, our balance of trade in research and development-intensive manufactured products is positive, but we suffer a trade balance deficit in non-research and development-intensive products. The rate of productivity increases by the United States is among the lowest of the industrialized democracies. Together with high inflation, aging capital plant in many industries, and other indicators of relative change between the United States and foreign countries, the need for improving competitiveness through increased productivity was clear. My conversations led me to recommend to the President that he initiate an examination of government actions to encourage innovation. While there had been previous studies of innovation, these had not directly engaged Cabinet Officers and the President.

I worked with the Domestic Policy Advisor, Stuart Eizenstat, the then Commerce Secretary Juanita Kreps, and the Assistant Secretary of Commerce, Jordan Baruch (who was asked to manage the study), in organizing the review. We recommended a new policy review format used in the Administration, the Domestic Policy Review (DPR) system, somewhat analogous to a long-established procedure used by the National Security Council.

The system offered an improved method to bring diverse points of view to bear on complex issues at the Presidential level. The DPR on Industrial Innovation involved some twenty government agencies, as well as hundreds of outside groups and individuals. The Departments of Justice and Treasury were heavily involved as well as the OMB.

Those involved recognized that there is much that the Government needs to do both through positive actions as well as through removal of disincentives to innovation. Accordingly, the President took a number of steps to effect changes in policies that stimulate, or remove or reduce, barriers to innovation. The President's decisions were announced in a message to Congress, delivered in October 1979.[10] These first initiatives included:

-- Expansion of government efforts through the National Technical Information Service (NTIS), to transfer to industry -- particularly to small firms and businesses -- technological know-how generated in universities, government laboratories, and industrial laboratories from work under government grant or contract.

-- Increase of government research and development for technologies of special value to industry, including generic technologies which underlie many industrial sectors like welding and joining, corrosion prevention and control, and robotics, as well as "compliance technologies" designed to help small industries meet their obligations to comply with environmental, health and safety regulations.

-- Increase of the National Science Foundation (NSF) program to foster industry-university cooperative projects. This program also would pay for university participation and up to 90 percent of small business participation.

-- Strengthening of the patent system by establishing a uniform government-wide policy which gives title to university and small businesses and exclusive licensing rights to large companies which develop patents with government funds.

-- Clarification of anti-trust policy concerning prospective cooperation in research, including cooperation among companies in a given industrial sector. 1

-- Expansion of the NSF Small Business Innovation Research Program which provides funding to small companies for development of new products and demonstration of technical feasibility.

-- Establishment of several state and regional Corporations for Industrial Development which would assist in the start-up of firms that wish to develop and bring to market a promising but high risk innovation; provide guidance and advice to potential applicants for the NSF program; provide early management assistance to firms funded by NSF; and when qualified, act as the recipient of economic development assistance funds for the state or region.

These and other programs to stimulate industrial innovation are not costly. For the most part, the government's role in innovation is not through direct budgetary outlays, except for the benefits flowing from government supported research and development, but through nonbudgetary policy. Perhaps the most significant result of the innovation review was to sensitize policy makers at all levels of government to the

1 An anti-trust guide for use by technical and legal experts in industry, universities, and government has been issued.

effect of their actions on industry's ability to innovate. However, we realized that from industry's point of view the most important area affecting industrial innovation is economic policy, particularly Federal tax policy. The 1979 innovation initiatives were viewed as first steps to be followed by tax incentives for innovation and productivity, as part of future tax proposals.

The economic revitalization program announced by the President on August 28, 1980, proposed the next steps in government efforts to stimulate industrial innovation and productivity. In addition to the commitment of the additional research funds mentioned above to assure real growth of 3% in Federal support for basic research over the next two years, the program includes:

- o an accelerated and simplified depreciation schedule in business taxes to encourage rehabilitation of existing facilities and investment in new plants and equipment;
- o a partially refundable tax credit to benefit those businesses -- distressed firms in industries such as autos and steel as well as small businesses just starting up -- which have no earnings, yet have substantial investment needs;
- o a variety of measures to increase exports;
- o initiatives proposed by the White House Conference on Small Business to help in the start-up and operation of small business.

(Accelerated depreciation was the highest priority recommendation of the industrial advisers to the DPR.)

At the final decision meeting on the economic program, I appealed to the President to include a research and development tax credit. The Secretary of the Treasury, however, argued successfully that direct expenditures represented better tax policy than tax credits. As a result, the research enhancement package was included instead, at an augmented level.

GOVERNMENT-INDUSTRY-UNIVERSITY COOPERATION

There is growing realization that the Nation requires much closer cooperation between government and industry if it is to meet the competition offered by other countries. Because of their research and development capabilities, universities must also be a partner in that cooperation. With this realization in mind, OSTP stimulated the development of two research initiatives that can provide a precedent and a model for cooperation between government and industry, foster greater cooperation within industrial sectors, and exploit more effectively the scientific capabilities of this Nation's research universities. In each case, the objective has been to plan new activities that have substantial prospect for long-term payoff but which would not likely take place without collective cooperation within an industrial sector and between government and industry.

The first of these is the Cooperative Automobile Research Program (CARP). In May, 1979, the President met with the Chief Executive Officers of the automobile industry and set forth guiding principles for a new jointly funded program of basic research related to automobile technology. CARP is intended to increase the level of basic scientific research underpinning automotive technology, and thus, to contribute to the design of automobiles in the 1990's and beyond for more economic manufacture and operation, greater fuel efficiency and safety, and reduced pollution.

CARP-supported research will be carried out at universities, at private and government research laboratories, and in the industry's own research centers in such areas as combustion, structural mechanics,

electrochemistry, and aerodynamics, materials science and processing, tribology, and catalysis. The large scale involvement of universities represents a new opportunity for that research community to make a significant contribution to a major industry.

Both the government and the industry recognize that the national effort in basic automotive research should be increased and have agreed on a planning target of $100 million annually to be reached by the mid 1980s. The industry amount will be divided among companies on the basis of their respective percentages of domestic automobile sale. While the commitment is for five years, it would presumably be renewed if the program is successful. Government agencies and individual companies will select and manage research projects independently to ensure freedom of decision in pursuing new ideas. However, a coordinating mechanism will be used and the research results will be widely distributed, subject to appropriate patent provisions. All five major automobile manufacturers in this country have agreed to participate in this program and Congress has approved funding for the first year, FY 1981.

A second program for government-industry cooperation is a joint venture with the oil industry, the Ocean Margin Drilling (OMD) program. The program will involve frontier research and technological development. It will enable us to characterize by deep sea drilling the last remaining unexplored province of the sea floor -- the passive and active continental margins. The history of early continental breakup and of the subsequent evolution of the shelves and margins is contained in the thick sedementary deposits of the margins. The project is, therefore, of great research interest to university and industry scientists and also makes possible assessment of hydrocarbon resources in these regions. Ten major oil companies have joined the program and Congress has approved the first year of Federal funding.

In my dual role as member of the President's staff and Director of OSTP with a statutory mandate to coordinate interagency programs, I was able to organize the participation of several government agencies and to clear the programs through the White House. There are many other opportunities for similar sectoral collaboration that will stimulate research and development in a manner consistent with established Federal policies. Thus, the CARP and the OMD programs may serve as models for exploring joint ventures in other sectors, which have similar attributes -- a high degree of shared private and government interest, the need to organize cooperation of the major firms of an industry in ways that do not impede competition, and a long-term but high rate of return to joint investment.[12]

Administration efforts to enhance basic research and stimulate industrial innovation have also focused attention on the importance of formal university-industry cooperative relationships in science and engineering. OSTP has encouraged widespread discussion among the government, ~~convened a high level panel of representatives of the~~ academic and industrial sectors ~~to examine~~ of the status of, and potential for, university-industry research consortia and research partnerships and the current and prospective roles of the Federal government in stimulating such relationships.[13] Based on this analysis, we have supported budgetary and programmatic initiatives designed to stimulate a diversity of university-industry linkages.

REGULATORY REFORM

Discussions of industrial technology and innovation invariably turn, at some point, to the regulatory system. Indeed, one of the most striking changes that has taken place in our governmental system over

the past two decades has been the rapid growth of regulation to achieve socially desired objectives. In many cases, regulation involves important technological decisions. Air and water pollution control, energy conservation, hazardous waste disposal, occupational health and safety, aircraft safety, and nuclear power safety are prominent examples. It was clear to us early, therefore, that regulatory matters would be of major concern to OSTP.

In the past four years, a number of steps have been taken to improve the regulatory process and to reduce unnecessary regulation. These include: promulgation of Executive Order 12044[14] requiring that regulatory agencies publish regulatory analyses to ensure that regulators and the public are well informed about the costs and benefits of individual regulations; creation of a Regulatory Council, which is intended to help bring coordination and consistency into regulatory programs across sectors; and publication of the Regulatory Calendar to provide a complete picture of the government's major regulatory activities. In addition, the White House established a Regulatory Analysis Review Group (RARG), chaired by the Chairman of the Council of Economic Advisers (CEA), to improve the quality of regulatory analysis by ensuring that the most important regulations get a thorough economic, technical, and policy review. OSTP was a participant in the discussions that led to these steps and is a member of RARG.

OSTP has focused on improving the quality of scientific and technological data and upgrading the methods of risk assessment used in the regulatory process. This focus is particularly important in regulatory decision-making since the fundamental political, and indeed, adversarial nature of the process does not provide an ideal environment in which the technical

data from diverse sources may be pooled and objectively examined. In many cases, the time pressures set by statute, court decisions or other events do not allow the orderly resolution of technical conflicts. As a result, regulatory decisions are an excellent example of those issues in which scientific and technological knowledge and judgment must be effectively joined with economic and other perspectives in reaching policy conclusions.[15]

For example, an issue of major significance is regulatory treatment of potential carcinogens. As our instrumentation and diagnostic capabilities have improved, we have increasingly discovered that many man-made substances introduced into our environment may be carcinogenic. However, government policies for dealing with this situation have often been inconsistent. OSTP, therefore, undertook a study analyzing the scientific principles underlying carcinogen risk assessment and laying out a framework for identifying and characterizing chemicals which might pose a carcinogenic risk. The resulting report was a factor in establishing a uniform government policy for controlling chemical carcinogens.[16]

Another example arises from one of the most dramatic developments in all of science -- the application of recombinant DNA techniques to many problems of basic biology and to production of needed hormones, vaccines, chemicals, and other pharmaceutical and agricultural products. Four years ago, the public had been greatly alarmed by controversy within the molecular biology community over the safety of such research. A determined effort led by Dr. Donald Fredrickson, Director of NIH, and joined by an effective Interagency Committee, including OSTP, brought public health insights, risk assessment experiments, new data, and a

more objective attitude to policy discussions. Congressional hearings also helped air all sides of this complex issue and promote a reasoned assessment of the putative risks involved. The prudent course undertaken has allowed very rapid progress in this work, permitted university and industrial efforts to grow and flourish, and assured workers and environmentalists that great care is, indeed, being exercised through the NIH guidelines and through educational efforts on industrial applications.

The evolution of sound technical policies for areas of prospective future regulation has also been a focus of attention by OSTP. For example, OSTP has worked extensively on government policy regarding the introduction of diesel engines into the passenger car fleet. The prospective rapid movement toward increased use of diesels raised serious policy issues in 1977-78 when it appeared that particulates emitted by diesel-powered vehicles might be carcinogenic. While technology-based emissions standards on particulate emission were required under the Clean Air Act, it appeared to some that other more severe regulatory restrictions might be necessary to deal with the possible carcinogenicity problem. The EPA quickly mounted a substantial multi-year research program aimed at providing some policy resolution before manufacturers made large investments in diesel engine production capacity. During 1978, various White House staff members realized that the spector of carcinogenicity would influence a major technology decision in the automotive sector -- one with substantial national energy and economic implications. After a series of meetings with the major automobile

manufacturers, the concerned government agencies, and a range of other experts, two actions were initiated. First, OSTP encouraged DOE to accelerate and expand its planned diesel health efforts program as a complement to EPA's program, and worked with OMB to obtain the necessary funds. Second, OSTP, with the strong support from other White House offices, suggested that DOE, DOT, and EPA fund jointly a major study by the National Academy of Sciences to analyze a range of federal policy alternatives and to ensure the soundness of the research programs of both the public and private sectors. The study is scheduled for completion in December of this year.

In March 1980, after a detailed White House review led by staff from OSTP and the Council of Economic Advisors, EPA released its diesel particulate standards. These standards, based on the technology for controlling total particulate emissions, effectively regulate the installation of devices to trap and oxidize the particulates from large diesel passenger cars beginning in 1985. Whether other measures will be necessary to deal with the possible carcinogenicity of the diesel exhaust will be determined next year after the NAS report is completed and the research programs are further along. I believe that external reviews such as this should play an increasingly important role in the years ahead to improve the technical basis and credibility of government regulatory decisions.

Conclusion

During the last four ~~In the last three and a half~~ years, science and technology have played a key role as the Administration addressed the national agenda. In this article, I have described something of the operating environment of OSTP and some of its major initiatives: strengthening the national science and technology base; enhancing research efforts in the mission agencies;

initiating government actions to stimulate industrial innovation; improved technical basis for regulatory policy; and fashioning new institutional relationships among government, industry, and universities. Other aspects of the Administration's science and technology policy dealing with energy, agriculture, health, space, national security, and international relations will be discussed in the concluding article.

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SCIENCE AND TECHNOLOGY

IN THE WHITE HOUSE

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PART II

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ABSTRACT

This is the second half of a two-part article on Administration science and technology policy during the period 1977-1980. The first part of the article (reference) discussed the role of the Office of Science and Technology Policy (OSTP) within the context of the overall Federal policy-making framework and institutional structure and described specific activities aimed at strengthening U.S. science and technology, fostering industrial innovation, enhancing relationships among government, universities, and industry, and improving the regulatory process. This part of the article focuses on OSTP activities related to national security and foreign policy, space, energy and the environment, health, and agriculture, and discusses OSTP advisory mechanisms and planning efforts.

NATIONAL SECURITY AND FOREIGN POLICY

Science and technology have long been important components of our national security and foreign policies. They are particularly so in the current era of sophisticated defense systems and of increasing reliance among developed and developing countries on advanced technologies for food and energy production, resource development, and industrial vitality. In the past three and one-half years, scientific and technological considerations have necessarily been integral parts of White House policy deliberations on such defense and foreign policy issues as strategic weapons modernization, arms control, technology transfer, the growing bilateral relationship with China, and North-South relations.

International Cooperation

The development and maintenance of cooperative relationships between the United States and other developed and developing nations increasingly involve scientific and technological considerations. The specific nature of the involvement of science and technology in relations between this Nation and another country depends on a variety of factors which, combined, constitute the overall foreign policy context within which the two countries interact.

Scientific and technological relationships with countries such as China and the Soviet Union, with which we have intricate political contacts, pose special challenges. For example, the President substantially curtailed our relationships with the Soviet Union because of its invasion of Afghanistan. In addition, Soviet persecution of dissident scientists led many American scientists to boycott cooperative activities. Yet, we recognize the long-term importance of scientific contacts with scientists of the U.S.S.R. and have acted in such a way as to reduce activity but preserve the framework of the bilateral scientific agreements between the two countries.

Other nations, particularly developing countries, often viewing our scientific and technological expertise as the direct basis of our economic and social well-being, wish to share in the benefits of that expertise. Complementing this desire is a growing consensus in this country that our government can and should do more in applying U.S. scientific and technological capabilities to major global problems and in helping developing countries build their own scientific and technological strength so as to more effectively address their own problems.

Science, by its very nature, has tended to bring nations closer together. Traditionally, the international scientific community has sought contacts across national boundaries as a means of sharing and nourishing intellectual pursuits. In fields where global observation of phenomena is important, for example my own field of geophysics, international mechanisms often have been established to support collaboration. Increasingly, multinational cooperation is important to support high cost, "big" science projects in areas of major concern to many countries -- for example, particle accelerators, space exploration, fusion research, and coal liquefaction process development. The government is deeply involved in funding and, in some cases, negotiating and operating such international efforts.

The importance of the role of science and technology in foreign policy was recognized early by my colleagues and me in OSTP, and the President was receptive to our recommendations. The President's Message to the Congress on Science and Technology[3] spelled out four themes that have shaped U.S. policy in international scientific and technological cooperation: pursuit of new international initiatives to advance our own

research and development objectives; development and strengthening of scientific exchanges to bridge political, ideological, and cultural divisions between this country and other countries; formulation of programs and institutional relationships to help developing countries use science and technology beneficially; and cooperation with other nations to manage technologies with global impact.

With the President's encouragement, OSTP has actively pursued international programs in science and technology in support of these themes. Although we have been involved in many aspects of international program policymaking and implementation, we have given special attention to: scientific and technological relations with China; new forms of scientific and technological cooperation with Japan; cooperation with Mexico, other Latin American and Caribbean countries, and several states in Black Africa; and the proposed Institute for Scientific and Technological Cooperation.[17] President Carter was directly involved in the formulation of each of these international initiatives. Typically, Presidential approval of a proposed approach was followed by intensive preparations within the U.S. government and by extensive consultations with the other country or countries involved.

The development of the U.S.-China Agreement on Scientific and Technological Cooperation is particularly illustrative of the process of program innovation.[18] Early in the Administration it was clear that one of its major challenges would be improvement of relations with the People's Republic of China. At that time, China's renewed modernization drive was just getting under way. This is an undertaking of enormous magnitude and ambition aimed at bringing Chinese agriculture, industry,

science and technology, and military strength up to world-class status by the end of the century. China had indicated that, to accomplish its modernization goals, it would seek technology, training, and capital from the Western industrialized nations.

Trade and scientific, technological, and academic contacts with China had been under way through private channels since the Nixon-Kissinger initiatives of the early 1970's. The Committee on Scholarly Communication with the People's Republic of China played an important role in building scientific relations during this period. Beijing had refused to deal directly with the U.S. government in such areas, ostensibly because of the absence of diplomatic relations. It was our view in 1977 that, in light of China's new interest in technology acquisition from the West, formal government-to-government relationships might be possible. Without such relationships, our ability to aid China would be seriously constrained.

It was our conviction that U.S. interests would be served by China's stable growth and by its ability to remain self-sufficient in, and perhaps become a net exporter of, energy and nonfuel mineral resources. We also saw major benefits for the U.S. in the long-term individual and institutional relationships that would evolve through contacts; in the expansion of trade; and in the insight we would gain into the extraordinary process of China's modernization and its impact on the Pacific region and the world.

Accordingly, the President asked me to develop proposals for cooperation with China in such areas as space, energy, academic exchanges, agriculture, and health. An interagency group convened by OSTP devised

proposals for non-military, government-to-government, scientific and technological relationships consistent with stated Chinese modernization plans. These proposals were in areas for which the government, rather than the private sector, had a leading role.

Within two months of completing our work, the President's National Security Adviser, Zbigniew Brzezinski, was in China discussing a wide range of consultative arrangements, including the concept of governmental cooperation in science and technology. An Associate Director of OSTP accompanied him and held preparatory discussions with the Chinese on such cooperation.

Two months later I led to Beijing what was very likely the most senior delegation of U.S. Government scientific officials ever taken abroad, comprising the Presidentially appointed heads of the major research and development agencies except the Department of Defense. The aim of this delegation was to establish a framework in which a broad range of governmental and private relationships could flourish. During this visit it became clear that -- even in the absence of diplomatic relations -- China desired scientific and technological cooperation with the United States. The Chinese openly discussed their scientific and technological deficiencies, the difficulties of offering the U.S. benefits in kind, and their willingness to pay for U.S. assistance where this assistance would not be matched by scientific or technological gain by the United States. During discussions with members of the U.S. delegation about possible areas for cooperation, the Chinese expressed special interest in purchasing a U.S. telecommunications satellite, in reimbursable U.S. technical assistance for energy resources development, and in exchanging students and scholars.

Subsequent high level discussions led to the conclusion, on January 31, 1979, of a U.S.-China Agreement on Cooperation in Science and Technology. The agreement was signed by President Carter and Vice Premier Deng Xiaoping. Since that time, our two countries have negotiated and signed thirteen protocols for cooperation in a broad range of scientific and technological areas. More than 2000 Chinese students are now studying in this country and a large number of U.S. scholars are in China. We view this cooperation as being of great importance to the building of an economically strong and stable China, a development clearly in the long-term interest of the United States. The developing scientific and technological relationships with China also proved to play a significant positive role in the broader successful effort to normalize relations between our two countries.

Japan presented a different kind of challenge. With the second largest GNP in the world and a modern, well-developed, aggressive science and technology establishment, that nation already had contributed a great deal to scientific and technological advancement, with the potential to contribute much more. In May 1978, then Prime Minister Fukuda made a major proposal that the U.S. and Japan cooperate in energy research and development. The President asked OSTP to lead a task force to respond with specific projects. After detailed negotiations, U.S. and Japanese representatives signed a bilateral agreement for cooperation in large-scale energy research and development projects such as coal liquefaction, nuclear fusion, and geothermal and solar energy. The next year, President Carter proposed to Prime Minister Ohira a complementary program of joint

research and development in various nonenergy areas of global importance, such as space, environmental protection, health, agriculture and resource conservation. Again, OSTP led the development of U.S. government policies and programs.

The scale of these programs represents a new concept in international science and technology cooperation in which expensive, risky, globally important science and technology projects are undertaken across the entire range of technological possibilities and in both the energy and nonenergy fields. These projects are designed not only to benefit the two countries, but also to advance the state-of-the-art in various fields, thus benefiting all nations. Manpower, physical resources and financing of these large-scale projects will be shared. An increased Japanese investment in basic research could also result from these activities. In recognition of the importance of this new approach, President Carter and Prime Minister Ohira signed the Science and Technology Agreement in a White House ceremony on May 1, 1980.

In another part of the world, we have made impressive progress in our science and technology relations with Mexico. During President Carter's meeting with President Lopez Portillo in Feburary 1979, an Associate Director of OSTP signed a memorandum of understanding inaugurating or expanding bilateral cooperation in a number of areas including arid lands agriculture, railroad safety, and energy research and development. In October 1979, I led, at the President's request, a high-level government delegation to a number of countries in South America and the Caribbean to strengthen cooperation in this hemisphere. Intensive consultations

with leading science officials in Venezuela, Brazil, Peru, the Andean Pact nations, and the Caribbean region led to joint science and technology activities in many fields.

At the President's direction, I took a similar high level delegation to Nigeria, Zimbabwe, Kenya, and Senegal this September. With each of these important countries, months of planning led to the identification of projects and funds to start or strengthen programs for scientific or technical assistance. With each, I signed a science and technology agreement which provides a useful framework for cooperation. We also signed specific agreements for carrying out major projects with the host countries in areas which they identified as high priority, typically agriculture and fisheries, energy, health, remote sensing, management, and manpower training. These visits took on added significance in that I met with the head of state of each country to deliver a personal message from the President in support of the mission. The President used the results of the visits in follow-on interchanges with these leaders.

Our cooperation with all these countries reflects the importance that each of them has placed on the relationship between economic growth and scientific and technological capability. It also reflects their view that the great strength of the U.S. in science and technology makes close relation with the U.S. technical community a particularly productive means of enhancing this capability. I am convinced that scientific and technical assistance is a key linkage between the U.S. and the developing countries, one that has been underutilized in the past.

In a March 1978 speech in Venezuela, President Carter announced his intention to create what came to be called the Institute for Scientific

and Technological Cooperation (ISTC). The new Institute was conceived as an agency that would have as its primary mission the strengthening of the capacity of developing nations to undertake sustained research efforts on critical development problems. It was also intended to play an important role within the U.S. government in stimulating more extensive scientific and technical cooperation with developing countries as well as "middle-income" countries no longer eligible for foreign aid.

Ambassador Henry Owen, a Presidential adviser on international economic issues, and I have worked intensively for more than three years to establish the ISTC. A broadly based Advisory Committee on Science and Technology for International Development, with membership drawn from industry, labor, universities, and the foundations, was assembled to guide design of the new Institute. With the President's announcement and his continued interest and commitment, the concept of such an Institute has gained wide support here and abroad. Yet, the ISTC has not become a reality. Although authorized by Congress, opposition during the appropriations process has prevented the Institute from becoming operational thus far. However, in response to this initiative, Congress did appropriate funds for a new science office in the Agency for International Development (AID) with the charge of undertaking innovative scientific research pertinent to development. The effort has led also to increased interest within AID in the role of scientific and technical assistance in our foreign aid programs. Indeed, there are those who believe that, in time, U.S. bilateral aid programs will increasingly emphasize scientific and technical assistance, leaving financial resource transfers to the international development banks to which industrialized countries contribute.

National Security

Our national security depends in large measure on our ability to meet present and future technological challenges. As other nations are becoming more proficient in science and technology, we must make certain that our research capabilities remain at the frontier of knowledge, and our technological capabilities remain productive and innovative. OSTP has worked with the President, the Office of Management and Budget, and the Department of Defense to restore the declining support for research and technology in defense budgets during the first half of the 1970's. We also have worked to revitalize the relationships between the Defense Department and the university and industrial research communities, relationships which had deteriorated in the aftermath of the Vietnam war.[19]

As mentioned in Part I, an OSTP review of Department of Defense research programs led the Secretary of Defense to propose significant increases in basic research and to strengthen basic research management in the Department. Since then, with the strong support of the President, funding for basic research in Defense has been increased sharply, showing a cumulative growth of over 50 percent from fiscal years 1978 to 1981, including an increase in basic research of nearly 65 percent. Defense support of university research will have increased more than 40 percent during this time period.

As Director of OSTP, I am involved in the development of policy related to a broad array of national security issues. My staff and I participate in policy deliberations on these issues through a variety of

processes and mechanisms. We chair or sit on various Cabinet and sub-Cabinet level committees and working groups of the National Security Council and participate in the review processes established by the Office of Management and Budget for analyzing the defense, intelligence, and foreign assistance budgets. For example, I have chaired Cabinet-level NSC policy review committees formulating our scientific and technological cooperation with China, developing space policy and programs, and considering our telecommunications protection policy. The efforts of these groups have formed the basis for a number of Presidential decisions. In addition, the OSTP Associate Director responsible for national security issues serves jointly as a senior member of the National Security Council staff, providing the NSC with a channel for obtaining valuable analytical support and contributing to early and full consideration of scientific and technological components of major defense and foreign policy issues.

Frequently, the President asks me to assemble committees of prestigious scientists and engineers from outside the government to provide independent advice on key national security issues. The President has used their advice in making final decisions on a variety of issues and, when appropriate, committee reports have been given to government agencies to use in shaping policies and programs. For example, OSTP convened a high-level panel to compare and assess U.S. and U.S.S.R. technologies, such as computers, nuclear warheads, space, battlefield weapons, and high energy lasers. The President's initial review of the U.S. defense posture incorporated this panel's findings. At a later stage, the President asked for a review of the vulnerability of U.S. strategic weapons systems to an expanding Soviet missile threat. That panel's findings were considered by the President in decisions on U.S. strategic

modernization efforts such as the Trident, cruise missile, and M-X ICBM programs. Regarding the complex M-X issue, the panel advised the President on several alternatives to our current Minuteman system and on the underlying environmental, military, and arms control implications.

OSTP participates in a wide range of NSC arms control reviews, many of which involve difficult technical questions. For example, a senior member of the OSTP staff chairs the NSC interagency working group on the Comprehensive Nuclear Test Ban (CTB) and also has chaired NSC working groups on the U.S. nuclear test program and other arms control issues. OSTP frequently convenes outside panels to support these activities. For example, a panel was convened to review the relative impact of a halt in testing on both U.S. and Soviet capabilities and to consider special verification procedures and other provisions to support the CTB negotiations.

At the request of the President, OSTP has conducted reviews of special problems such as the sonic booms heard on the East Coast last year and the September 22, 1979 light flash recorded by a VELA satellite over the South Atlantic. In exploring the origin of the mysterious booms, OSTP organized an intensive review involving both government agencies and outside consultants. This review concluded that the booms were caused by supersonic aircraft rather than unusual geophysical sources. The OSTP evaluation of the September 22 event concluded that the light flash probably was not caused by a nuclear explosion. This conclusion was based on the absence of persuasive corroborative data; the existence of signals from natural phenomena similar to signals from known nuclear explosions; and characteristics of the September 22 signal unlike those observed in light signals from previous nuclear explosions.

Space Policy

Since its inception almost a quarter century ago, the United States space program has been a highly visible and dramatic testimony to this Nation's technological achievements. Space-age benefits are an integral part of our lives -- for communication, weather forecasting, navigation, resource evaluation, environmental monitoring, as well as for national security and arms control efforts. Now, our national space program is entering a new stage of maturity, one in which we will receive increased dividends through scientific exploration and technological applications.

Early in his Administration, President Carter called for a review of national space policy, which culminated in a Presidential directive outlining a comprehensive policy based on reaffirmation of those principles which have guided our space efforts since their beginning and on support for new programs of technology sharing between military and civilian programs. This space policy is consistent with the view that space is an extension of our environment, and that our space program is a major vehicle for achieving our goals for scientific advancement, social and economic benefits, national security, and international well-being.

The President also created, and asked me to chair, a Policy Review Committee (Space) to make recommendations on space policy issues. The committee's review of the Nation's civil space policy led to a Presidential decision that civil programs should be balanced among space science and exploration, space technology applications, and new technology development. Completion of the Shuttle will receive our highest priority. This flexible system will make possible routine manned operations in space, including launching spacecraft of larger size and capacity than ever

before. It will allow spacecraft retrieval and repair, assembly of large structures in orbit, and experimentation with materials processing in space. It is likely that no other nation will have this capacity for the remainder of this century. The Shuttle will be central to our national efforts in space science, commercial space utilization, defense, and technological leadership. In addition, its completion could release significant funds for new space science and applications projects, thus eliminating a concern which I share with members of the space science community who fear that cost overruns will lead to a decline in planetary exploration and space research.

Despite budgetary constraints, our space science and exploration programs continue to be challenging. We have exciting missions now under way. The Voyager craft, having explored Jupiter, is continuing on to Saturn and Uranus. Under development are the Galileo mission to explore Jupiter, the Solar Polar mission, several Explorer missions, the Space Telescope, and Spacelab. The Gamma Ray Observatory has been approved as a new start in 1981 and the Venus Orbiting Imaging Radar will be a new start in the FY 1982 budget. ~~In addition, we are considering two new programs,~~ ~~and a Halley Comet mission.~~

A key element of our civil space policy is its emphasis on space technology applications which provide information valuable to all nations about the earth's resources, climate, weather, agriculture, and pollution. Under a new initiative, NASA will reenter research and development efforts on the next generation of satellite communications systems. In addition, our LANDSAT remote sensing satellites, which have proved so useful since first launched in 1972, will move from experimental to operational use under the management of the National Oceanic and Atmospheric

Administration. Finally, two new multi-agency projects are beginning. The first is AGRISTARS,[19] a remote sensing experiment which will improve agricultural and resource assessment capabilities from space. The other is the National Ocean Satellite System which will analyze sea and ice conditions, marine weather, and marine pollution, and provide scientific oceanographic observations.[20]

Energy and the Environment

The development and implementation of a rational energy policy based on creditable assessments of worldwide supply and demand and on recognition of economic, political, and social realities is an important goal. Ultimately, energy research and development will produce the scientific knowledge and technological capabilities necessary to address the complex questions we face: What alternative energy resources and technologies do we choose to pursue? How do we develop them over time? What are their safety, reliability, and environmental impacts? What bearing might they have on economic policy, national security, and international relations?

The Administration's energy policy emphasizes reliance on a range of energy strategies. These include: conservation; deregulation of domestic natural gas and oil prices; replacement of oil with coal where possible; efforts to reduce vulnerability to short-term oil supply disruptions through a strategic petroleum reserve and standby gasoline rationing; synthetic fuels development utilizing coal, oil shale, and biomass; nuclear energy with measures to improve safety, to control

nuclear weapons proliferation, and to manage radioactive waste; expansion of geothermal and solar energy; and long-range energy resource development in areas such as breeder reactors and fusion.

Within the broad array of policy issues corresponding to this range of energy resources, OSTP has focused on specific energy technology issues, the overall budget for energy research and development, and government organization to meet energy research and development needs.[21]

Early in the Administration, the President decided that, in order to make possible a coordinated, balanced energy program, it would be necessary to establish a single Department of Energy (DOE), comprising the existing Federal energy organizations. Because it was essential that this highly technical mission agency have a strong research and development focus with a long-term research agenda, an Office of Energy Research was created. Now, the annual budget for this office alone is the largest of any physical science research agency in the world. Of particular importance in the DOE budget process is our role in providing the President with independent evaluations of costly energy demonstration projects and with recommendations on priorities for support of energy supply technologies.

The safety of existing and proposed energy technologies is a major consideration in the formulation of energy policy. For example, nuclear energy safety has received a great deal of Presidential attention. The accident at Three Mile Island (TMI) revealed substantial shortcomings on the part of the government and the utilities in assuring the safety of nuclear power. The Commission established by the President to investigate the accident -- the Kemeny Commission -- made some forty-four recommendations

for change. These recommendations included modification of the structure and procedures of the Nuclear Regulatory Commission (NRC), improved training of operating personnel, and greatly strengthened emergency planning and response. The President has adopted virtually all these recommendations, although in some cases he has taken a somewhat different approach than the Commission recommended. The reorganization plan submitted to the Congress should serve to assist in the development of a unified and more reliable nuclear safety regulatory program. The President's nominee to become the next Chairman of the NRC awaits Senate confirmation.

OSTP worked on the Three Mile Island accident from the outset. I flew to the TMI site with the President and helped establish the Kemeny Commission and select its members. Finally, John Deutch, then Under Secretary of the Department of Energy, and I chaired the Executive Branch group that developed a response on behalf of the Administration.

The issue of nuclear waste management has been neglected to the point that it is a major impediment to the development of nuclear energy. Accordingly, the President directed that an Interagency Review Group on Nuclear Waste Management (IRG) be created to recommend a comprehensive government-wide approach to nuclear waste management. OSTP chaired the technical working group that examined alternative technical strategies for the disposal of high-level radioactive wastes and spent fuel, and coordinated much of the preparation of the IRG report, the recommendations to the President, and the subsequent announcements. In the course of this work, OSTP augmented its staff with several consultants and with experts in geology and engineering from other agencies, and convened an advisory panel of representatives from industrial, State government, and public environmental groups.

On February 12, 1980, the President sent to Congress the first comprehensive plan for a national radioactive waste management program. The program outlines the technical strategy that will be followed in working toward the construction of one or more mined, geologic waste repositories, the procedures that will be followed for State and local government and public participation, provisions for interim storage of spent fuel from nuclear reactors, plans for low-level waste disposal and for remedial clean-up action at waste disposal and uranium mill tailing sites, and regulatory actions necessary to implement the program. Although several elements of these comprehensive plans are included in legislation enacted or reported by the Senate and the House of Representatives, or their committees, the Congress has not yet acted on the recommendations.

Potentially one of the most serious long-range energy-environmental problems to confront our Nation is the buildup of carbon dioxide in the atmosphere from the burning of fossil fuels and from deforestation. This was the subject of one of the first memoranda I sent to the President and has already appeared on the agenda of discussions between the President and other heads of state. Plausible projections of future carbon dioxide concentrations suggest a doubling by the middle of the next century. Since carbon dioxide is a powerful absorber of thermal radiation in a region of the spectrum in which the atmosphere is otherwise quite transparent, small changes in the concentration of this trace constitutent could have major effects on the heat balance of the earth. The consequence might be substantial changes in climate and large impacts on society.

Informed policy decisions about this potentially significant environmental problem will require greater knowledge and sophistication than now exist. In response to this need, OSTP commissioned two studies by the

National Academy of Sciences. The first study examined the status of climate modelling in order to determine the climatic consequences of a doubling of carbon dioxide and the level of uncertainty in our knowledge. The study indicated that there was reasonable agreement among different approaches that a doubling of carbon dioxide would result in major climatic shifts. The second study addressed the way in which we might examine and deal with the potential social and economic impacts of increased carbon dioxide concentrations and the degree to which such impacts should influence current energy strategies and international political discussions. OSTP will continue to provide leadership in this important area. We are currently working ~~with the appropriate agencies~~ to plan and conduct further comprehensive reviews of the carbon dioxide issue as required by the recently enacted synfuels legislation.

Health Policy

Health policy initiatives of this Administration have emphasized wider availability of health care services; prevention of injury, disease, and disability; control of health care costs; and expansion of health insurance coverage. Such health service initiatives generally are not considered to be within the purview of science and technology policy. Yet, their successful development and implementation require decisions informed by the best available scientific information, programs supported by sound basic and applied research, and evaluation and impact assessments based on complete data. OSTP has concentrated on the scientific and technological issues in health care and identified specific key issues for consideration.[22]

One example is the controversy over the role of new health care technologies in escalating health care costs. Many observers equate the two, singling out specific technologies -- for example, computed tomography and coronary artery bypass surgery -- as causes of cost inflation. Cutting wasteful and excessive health care costs without inhibiting technological innovation requires objective analysis of incentives in the system, identification of those incentives which may reward inappropriate or excessive use of technologies, and wise assessment of the safety and efficacy of new technologies. Rational assessment and utilization of existing technologies could open marketplace opportunities and spur acceptance of innovative and cost-effective newer technologies in health.

OSTP is working with the appropriate Federal agencies to address these needs. The National Institutes of Health (NIH) is holding consensus development conferences on the safety, effectiveness, and appropriateness of medical practices and procedures. The new National Center for Health Care Technology (NCHCT) and its Advisory Council are assessing selected health care technologies and providing advice on government reimbursement for the use of these technologies. In addition, OSTP, the NCHCT, and the Health Care Financing Administration are collaborating on a model system for benefit/cost assessments of new technologies and for better reimbursement policies.

In light of considerable agency and Congressional interest as well as public concern, OSTP organized and led an interagency effort to define, and set priorities for, research opportunities in human nutrition, and to delineate agency roles.[23] The careful definition of clear areas for emphasis -- human nutrition research, food sciences, nutrition

education, and nutrition surveillance and methodologies -- enhanced individual agency nutrition programs and enabled working level managers and scientists from the different agencies to coordinate their efforts. The priority topics for research in each of the four areas have been emphasized and expanded in the agencies in the three years since the study. Continuing interagency coordination is facilitated by a highly effective interagency committee in human nutrition research under the aegis of OSTP.

There is also widespread concern about the proliferation of potentially dangerous toxic chemical dumps and considerable pressure on the government immediately to impose rigorous restraints on the chemical industry. However, decisions such as this, which have broad public health and welfare as well as economic implications, must be based on sound scientific information. Accordingly, OSTP convened a working group of government and nongovernmental experts to identify major problems of hazardous waste management and the scientific and technological advances needed to address these problems. Questions reviewed included sampling and analytical procedures, health effects data, fate and transport of wastes, site clean-up technologies, means of improved management of waste streams, as well as long-range research needs, public information, and personnel training. Based on the recommendations of this group, we are working with agencies to put together a long-range, hazardous waste research plan, to develop standard procedures for responding to specific waste hazards, and to improve coordination among various governmental hazardous waste research programs.

Another area which evokes strong public concern is that of environmental and occupational exposures to ionizing and nonionizing radiation. Yet, objective and reliable data on the biological and health effects of such

exposures have not been available. For example, we do not know with certainty the health effects of exposures to low levels of ionizing radiation such as those associated with atmospheric nuclear tests, nuclear shipbuilding, nuclear power plants, and medical diagnostic procedures, including x-rays. The President called for an interagency task force to lay out appropriate government radiation policies and research strategies. OSTP helped formulate the task force's agenda, monitored outside review of its work, and assumed responsibility for assuring that its recommendations were carried out. A similar review on the biological effects of nonionizing radiation, conducted by OSTP, has influenced a number of decisions on Federal research policies and budgets.[24]

Public policy decisions related to the regulation of environmental and occupational exposures such as toxic chemicals, hazardous wastes, and radiation, and to other personal medical and public health concerns, must be informed by the best possible science. Indeed, basic knowledge of the human organism in health and disease is fundamental in addressing successfully the major health challenges we face. Rational growth of this country's biomedical research enterprise and of its Federal guardian -- the National Institutes of Health (NIH) -- has been an important Administration goal. Consistent with his overall budget strategy, the President has proposed each year a substantial increase in the NIH budget over his request of the previous year. Consistently, Congress has increased the NIH budget above the President's request, resulting in rapid unplanned growth, with money frequently allocated according to criteria other than the needs and opportunities of the field. This approach is not in the long-term best interest of the NIH institutes or of the research universities

where instability is particularly damaging to basic research. Accordingly, OSTP has joined with Congress, NIH, the biomedical research community, and OMB to develop a consistent approach to NIH budget growth. The fiscal 1981 NIH budget proposes stabilizing the number of new and competing research grants at around 5,000 awards. This approach will provide continuity and predictability, especially for individual investigator-initiated research.

OSTP has taken parallel actions to strengthen the biomedical research establishment. Over the last three years we have emphasized basic research across the board. Secondly, we have stressed the importance of upgrading scientific resources fundamental to high quality scientific work. Lastly, we are working with NIH to reduce the administrative burden on researchers through shorter grant applications, simplified reporting, streamlined review procedures, and innovative approaches to grant funding and management.

Agricultural Research

Advanced agricultural research is vital to our future and that of other nations. Our agricultural productivity must grow to meet ever increasing domestic and worldwide needs. Yet, our cultivated land is producing near its biological limits and we are approaching the boundaries of our present knowledge and technology. We face other challenges as well. Prime agricultural land is being diverted to other uses or to nonfood crops such as energy, fiber, and chemical feedstocks. Our farmers are turning to other occupations. Many agricultural chemicals and practices are being restricted for valid health, safety, and environmental reasons. Lastly, critical agricultural resources such as energy, soil, water, chemicals, and capital are increasing in cost.

OSTP has worked closely with the Secretary of Agriculture in stabilizing and increasing agricultural research budgets and in strengthening the management of the Department of Agriculture's research programs. The Department's Director of Science and Education has been elevated to the level of Assistant Secretary and is a member of the Secretary's budget and policy review group. Program review and evaluation procedures are being improved to assure that scarce resources fund the highest quality, most relevant research.

OSTP and the Department of Agriculture (DOA) have given special attention to the role of the Federal government in agricultural research and to the relationships between the government and the other partners in the agricultural research enterprise -- the States, the private and State universities, producers, consumers and business. We are exploring new joint government-industry research programs in such areas as food processing, occupational health and safety, and animal fats. The new competitive research grants program, a new DOA approach to funding research, is now in its third year and has been especially successful. This small program supports high priority, basic research in plant science and human nutrition. It has attracted a number of investigators to the field, including new young scientists as well as more senior scientists from other research areas.

The demand in our own country as well as abroad for freshwater and marine plants and animals for food, fiber, and biomass has focused attention on the need to strengthen government aquaculture research and development activities. Although aquaculture -- both fresh and salt water -- constitutes a substantial business in the United States, providing revenues

for many farmers and small business enterprises, it supplies only 3% of our current demand for seafood. There has not been, at the Federal level, a coordinated approach to aquaculture research and development, with responsibility for these activities located in several Departments and agencies and under the aegis of a number of Congressional committees. At the direction of the President, OSTP worked with the relevant agencies and Congress to develop a National Aquaculture Plan, to study those factors which may constrain the American aquaculture industry, to institutionalize interagency coordination and joint programming, and to develop appropriate and effective aquaculture legislation. On September 26, 1980, the President signed "the National Aquaculture Act of 1980", culminating two years of intensive cooperation with Congressional committees. This legislation recognizes the progress made by the Administration in strengthening Federal aquaculture programs and lays the groundwork for government assistance in the future development of commercial aquaculture in this country.[25]

ADVISORY MECHANISMS AND LONG-RANGE PLANNING

In developing and analyzing national science and technology policy alternatives across the whole spectrum of issues addressed by this Office, we have drawn on expertise from the Federal government, state and local governments, industry, and universities throughout the country.

Two formal OSTP mechanisms facilitate communications between our Office and representatives from various levels of government. The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), the highest level coordinating mechanism for science and technology issues, operates as a sub-Cabinet group under my chairmanship with membership composed of chief officials for research and development in the various agencies. FCCSET and its various committees have proven to be effective in anticipating and defining science and technology issues confronting the government, mobilizing Federal agency reactions to these issues, and achieving long-term interagency coordination. The Intergovernmental Science Engineering, and Technology Advisory Panel (ISETAP), which I co-chair with Governor James Hunt of North Carolina, provides a mechanism for identifying and ranking State and local government research needs which might be fulfilled by better direction of appropriate research and development at the Federal level, and for disseminating to those governments, the results of Federally sponsored and conducted research projects. Established by Congress in the law which reestablished this Office, ISETAP was a new feature of the White House science policy process. It has been successful in bringing a needed new perspective on many research and development issues to the Executive Office and to the policy leadership of the departments and agencies.[26]

The policy analysis process OSTP applies to major issues depends to a considerable degree on external advisors drawn from the university and business communities and representing many scientific and technical disciplines and fields. Acting as individuals or as ad hoc panels focused on specific, high priority issues, these advisors have proved to be an effective and flexible means of obtaining objective, expert

advice. In addition, we have utilized the expertise of many professional scientific and engineering societies and, in some instances, arranged to have specific analyses undertaken by them.[27]

Some hold the view that these mechanisms are inadequate for securing outside advice on complex scientific and technical matters and advocate the reestablishment of the President's Science Advisory Committee (PSAC). PSAC consisted of nationally known, Presidentially appointed scientists and engineers who met two or three days a month under the chairmanship of the Science Adviser. PSAC, during its existence, was used to varying degrees by past Presidents. In its most effective period, PSAC was fully briefed on Presidential matters and provided advice to the President on major issues, particularly national security problems. It made use of subcommittees on special topics such as space technology, defense systems, and supersonic aircraft.

The concept has much to recommend it and future Presidents may choose to use it. It was not adopted by this Administration, however, for several reasons. The President preferred specially constituted panels on each issue (more akin to the PSAC subcommittees), seeing these as more effective instruments and closer to his operating style than longer-term, standing advisory committees. Furthermore, the Federal Advisory Committee Act and the Freedom of Information Act would prevent PSAC from operating in its earlier closed style since they require that meetings and documents they concern be open to the public unless classified topics are under consideration. It would be difficult to involve PSAC in current Presidential deliberations and the decision-making process under these circumstances.

Some observers of the science policy scene have also questioned the degree to which OSTP participates in long-range planning for science and technology. Long-range planning for science is both necessary and difficult. Certainly, in order to formulate goals, a President and Congress need informed advice as to what the future holds in the way of opportunities and risks. Accordingly, I have made it a point to keep the President aware of major issues worthy of his concern no matter how distant their impact and have raised long-range issues with Congress in personal conversations, frequent testimony, and special messages sent by the President. However, the degree to which a White House Office can engage in long-term planning unrelated to near-term policy decisions is limited. Moreover, just as is the case for much of our advice on near-term issues, the scientific and technical advice that OSTP provides on longer-term concerns must be brought together with the advice of other senior advisors to the President. Our planning efforts have, by necessity, emphasized those intermediate and long-range issues for which early action is needed. These have included such topics as destabilizing and weakening trends in the national scientific and technological endeavor, future science and engineering manpower needs, defense weapons choices, priorities among long-range energy technologies, climatic change, incentives for technological innovation and productivity improvements, and our relations with developing countries. In identifying and analyzing such issues, we have used our own staff and have relied on the larger planning staffs in the mission agencies and on advice from the National Academies, professional groups, industry, and our individual consultants.

The complexity of science and technology planning in our pluralistic system and the dangers of overplanning in a rapidly changing environment make it imperative that a balance be sought between a focus only on short-term problems and a preoccupation with long-range alternative futures. Either carried too far would preclude this Office from having significant impact on policy within the Executive Office of the President. OSTP simply would not survive in the White House structure were it not to emphasize issues on the President's agenda, nor would the Office serve either the President or the Congress well if it neglected entirely long-term issues, goals, and plans.

In this regard, we look to the potential of multi-year authorizations for research and development budgets, an improved 5-Year Outlook prepared by NSF with OSTP guidance, and the new OMB system of 5-year budget projections to improve the ability to take a longer range view of science and technology policy.

CONCLUSION

Scientific advancement and technological achievements pervade all areas of government responsibility. The scope and complexity of science and technology throughout the national agenda complicate the task of structuring the government efficiently for science and technology. The President needs scientific and technological advice and support thoroughly integrated with political, economic and other perspectives in the White House. In the last four years we have worked to reestablish the Office of Science and Technology Policy and the role of the President's Science

Adviser in the Executive Office. We also have outlined a national science and technology policy to guide government programs. Our efforts have been strengthened by the President's personal interest and his call for a scientific and technological perspective in policy formulation. It is my hope that in the years to come, our work will have provided a strong impetus to the national scientific and technological endeavor and that together with the earlier successful White House science offices, we will have justified the need for scientific and technological input in the formulation of Presidential policy.[28]

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18. Anne G. Keatley Conceptualized this initiative and with Benjamin Huberman undertook the planning and implementation.

19. Contributing OSTP staff: Benjamin Huberman, John M. Marcum, Wayne G. Kay.

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27. For Example: American Physical Society Study on Photovoltaic Energy Conversion, January 1979.

28. Many others have contributed substantively to the activities and accomplishments described in this article. These include: Richard H. Adamson, Louise H. Blair, David R. Calkins, Richard C. Curl, Robert L. Dixon, Essex E. Finney, Robert E. Goldman, Richard H. Hartke, Richard Nicholson, Richard A. Rhoden, Charles Thiel, Robert Wesson (short-term or part-time staff); and Clifford L. Berg, Jack P. Ruina, and Eugene B. Skolnikoff (senior consultants).