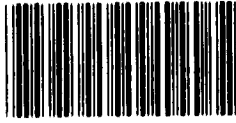


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United States General Accounting Office  
Washington, D.C. 20548



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FOR RELEASE ON DELIVERY  
Expected at 9:30 a.m., EDT  
Thursday, July 31, 1980

STATEMENT OF  
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BEFORE THE  
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY  
OF THE  
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY  
ON  
"LONG-TERM PLANNING FOR NATIONAL SCIENCE POLICY"

Mr. Chairman and Members of the Subcommittee:

Since World War II, the Federal Government has become increasingly aware of the national importance of science and technology. Dr. Vannevar Bush's 1945 report to President Truman entitled Science--The Endless Frontier greatly influenced the post-war development of science policy and the establishment of the Atomic Energy Commission, the National Institutes of Health, research offices in each of the armed services, and the National Science Foundation (NSF). It called attention to the importance of Federal support for basic research and scientific education and urged adoption of principles to preserve freedom of inquiry by researchers and stability of Federal funding over a period of years. NSF's charter stated in part that the Foundation

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would be responsible for developing and encouraging "the pursuit of a national policy for the promotion of basic research and education in the sciences."

Over the years, the executive branch has tried a variety of formal and ad hoc arrangements for planning, coordinating, and advising Federal agencies and the President on science policy. These arrangements, which included the President's Science Advisory Committee and the Federal Council for Science and Technology, succeeded in varying degrees. In 1962, Reorganization Plan Number 2 created the Office of Science and Technology (OST) and transferred responsibilities for science policies and planning that transcend the lines of executive agencies from NSF to OST. Today, planning national science policy is vested primarily in the Office of Science and Technology Policy (OSTP), created in 1976 by Public Law 94-282. Two important elements of planning as stated in the Act are: "anticipating future concerns to which science and technology can contribute and devising strategies for the conduct of science and technology for such purposes, \* \* \* [and] reviewing systematically Federal science policy and programs and recommending legislative amendment thereof when needed."

While various institutional mechanisms were being tried, tools for planning science and technology policy were also being designed. These include NSF's statistical reports on research and development (R&D) and the biennial Science Indicators of the National Science Board (NSB). Public Law 94-282 mandated the preparation of a Science and Technology Annual Report and a

Five-Year Outlook for science and technology. The first of each of these reports has been published.

OSTP has been operating now for 4 years. It, therefore, seems timely that in these hearings you examine the adequacy of the present tools for planning, the role of OSTP, and how well the process of science policy development is fulfilling national needs.

In my statement I will address three questions. What elements of strategic planning for science and technology transcend individual agency or specific mission strategies? How can the science and technology reports, individually and in combination, be better designed to serve the needs of policymakers? What could usefully supplement OSTP's strategic planning efforts?

#### THE CONCEPT OF STRATEGIC PLANNING

Before addressing these three questions, I want to discuss the concept of comprehensive strategic planning. Many views differ about what it could be and its place in our democratic and pluralistic form of government. In its broadest dimensions at the national level, comprehensive strategic planning would begin with examination and refinement of national social, political, and economic goals in the whole context of anticipated domestic and international developments. Government planners would identify long-term issues that require timely decisions, and they would evaluate the status of national resources and trends in policies and programs. They would diagnose problems and analyze interdependent strategies. They would rank goals and possible

actions and consider trade-offs. They would "scan the horizon" to identify emerging issues, assess risks, and develop contingency plans for emergencies.

Such comprehensive strategic planning is extremely difficult in a complex government like ours with decentralized agency missions; mixed Federal, State, and local authorities; and blurred distinctions between public and private sectors. Difficulty is compounded by uncertainties and conflicts that require compromises in one or another of equally desirable national goals--as might happen if energy supply or energy conservation conflicted with environmental protection, if government regulation that constrained business also retarded the innovation and productivity that stimulate economic growth, or if national security closed off international trade.

Many people believe that comprehensive strategic planning is unrealistic in our Government. Others oppose "central planning," fearing that it would lead to a centrally controlled economy and infringement of life styles. Such fears and opposition may explain why no one office or agency has been specifically chartered to perform comprehensive strategic planning in the United States.

At present, strategic planning in the Federal Government is dispersed among mission and regulatory agencies and other offices of limited jurisdiction within the executive branch. As a result, strategic planning tends to focus on relatively narrow issues or collections of several related issues, usually within the purview of a single department or agency. It tends to be

selective and fragmented. Centrally coordinating and reconciling individual mission strategies is the responsibility of the Office of Management and Budget (OMB) and other units within the Executive Office of the President. Customarily, individual mission strategies are implemented by guidance and review, especially through the Federal budget process.

ELEMENTS OF STRATEGIC PLANNING  
FOR SCIENCE AND TECHNOLOGY  
THAT TRANSCEND INDIVIDUAL STRATEGIES

Most strategic planning for science and technology that is done by mission agencies and OSTP addresses particular topical or mission-oriented issues. Relatively little holistic examination is made of comprehensive interactions among the selected issues and strategies. There are several reasons for this. One is the absence of clearly defined overall national goals. Another is the frequently expressed view that science and technology are not ends in themselves but only components essential to achieving specific mission goals. Another reason is that each task and study is constrained by resources and time. Finally, OSTP has expressed the view that long-range comprehensive studies would overload the Executive Office of the President and hinder, rather than stimulate, positive action.

We believe that strategic planning for science and technology should adopt a long-range perspective on today's incremental decisions, correlating them appropriately with the annual Federal budget cycle. For this to be successful, it requires that the highest levels of Government provide guidance and context for science and

technology. It will be interesting to see how well the President's Commission for a National Agenda for the 80's and the proposed Task Force on Global Resources and the Environment fulfill this need.

Strategic planning for R&D in support of agency missions and programs is important, but so is national policy that transcends individual agencies. There are two types of issues that cut across agency lines: those which are related integrally to R&D in the Federal budget, and other issues that are at most only related to the budget peripherally or may impact on the budget in the future.

In previous testimony before the House Committee on Science and Technology and its Subcommittees, I have cited examples of crosscutting issues related directly to the R&D budget process that should be addressed in national strategic planning and in congressional oversight. One is the need to develop a policy committed to adequate and stable support for basic research and graduate education in science and engineering. Federal funding for basic and applied generic research to build and maintain a strong science and technology base frequently may encompass related programs in two or more agencies. Such interrelated programs should be examined to insure that they are complementary without undesirable duplication. Examples of such areas are generic laser technology, life sciences, materials research, computer sciences, energy conservation, and weather modification--to name a few. Another transcending budget-related issue is

adherence of the Federal Government to the stated policy that Federal investment in R&D should focus "where the Government seeks to augment, but not supplant, the R&D efforts of the private sector because of an overriding national interest and the need to accelerate or increase the range of technological options available to the Nation." This policy was stated in Special Analysis L on R&D in the Federal Budget for Fiscal Year 1980.

Issues that are either unrelated or related only indirectly to the Federal R&D budget include:

- o Establishing criteria and strategies for the Federal role in fostering commercial R&D and technological innovation. Particular attention should be given to establishing a coherent and consistent national policy for relations between Government and industry to balance incentives and constraints that affect the climate for investment in long-range, high-risk R&D and capital formation by private enterprise. This involves consideration of tax policy, regulatory reform, intellectual property rights, and antitrust constraints.
- o Resolving tensions and improving the partnership between the Federal Government and universities. The concepts and methods of accountability in federally funded basic research should be considered, as well as how to resolve other issues raised by the National Commission on Research.

- o Determining how the Federal Government can foster more cooperative research arrangements between industry and universities.
- o Determining what constitutes an acceptable degree of uncertainty in research data and risks in health and environmental regulations.
- o Developing consistent policy and strategy for reconciling trade-offs between protectionism and technological assistance in international sharing of research results and technological developments.
- o Determining policy and strategy for Federal involvement in the social, economic, and employment impacts of the rapidly advancing communications and information processing technologies.

These are only a few of many issues that must be addressed if our Nation is to achieve a coherent policy framework and a set of compatible strategies for our science and technology effort.

#### THE DESIGN OF SCIENCE POLICY REPORTS

The key to Federal science policy planning is to develop an institutional process in which the Congress and the executive branch can work together to define questions and obtain answers. The science policy reports that are presently issued are potential tools for developing the institutional process and the information. We have found that the kind of information that is needed and that these reports provide can be divided into four somewhat flexible categories. The categories are: (1) an overall assessment of the



national science and technology effort, (2) the Administration's view of future Federal science and technology strategy in the context of the assessment, (3) the Administration's annual statement of posture and strategy, and (4) the Administration's justification for actual policy and program decisions.

1. An Overall Assessment of the National Science and Technology Effort

This assessment should include the present effort as well as the probable future uses and effects of science and technology in all sectors of the economy. It should include trends, potential impacts, problems, opportunities, and national issues pertaining to science and technology in the United States. Reports that presently provide this type of information are the Five-Year Outlook, the topical NSB reports, the NSB Science Indicators series, and NSF statistical reports.

Five-Year Outlook. NSF has produced a creditable first attempt at a five-year outlook that broadly fulfills the requirements of an overall assessment. Assessments in the Five-Year Outlook were supplied by Federal agencies, the National Academy of Sciences (published separately), and independent consultants. The next version will probably include a sorely needed industrial view as well as comments from professional societies. Assisted by many contributors, NSF is an appropriate source of a five-year outlook, but continuing assistance from OSTP is needed for suggesting issues and obtaining agency assessments. The first Five-Year

Outlook was not released in time to be useful to this year's congressional budget cycle. We agree with the NSF plan to release issues of the Five-Year Outlook every other fall beginning in 1981.

NSB Reports. These topical reports, such as the report on basic research in the mission agencies, offer a good biennial opportunity for the relatively independent National Science Board to offer its thinking on selected issues that are related primarily to basic research.

Science Indicators (as augmented by the range of annual NSF statistical reports). This is a major continuing effort by NSB and NSF jointly to understand and provide quantitative measures of trends in U.S. science and technology through the development of a broad range of indicators. Our major recommendations to NSF are that it strengthen its conceptual approach to design of the indicators it uses and that it develop indicators which deal with the processes of science and more appropriately distinguish science from technology.

These recommendations are contained in our report to the Congress entitled Science Indicators: Improvements Needed in Design, Construction, and Interpretation, PAD-80-35, September 25, 1979.

We do not see how the NSF staff could do the tremendous amount of work required in any time less than its current 2-year

cycle. Therefore, a publication of Science Indicators every other year, perhaps alternating with the Five-Year Outlook, is appropriate.

2. The Administration's View of Future Federal Science and Technology Strategy in the Context of the Assessment

How does the Administration regard the Nation's future capacity in science and technology to contribute to societal needs? What problems and opportunities are foreseen for the Federal science and technology effort as it relates to industrial and university science and technology activities? The President's Message on Science and Technology, the Five-Year Outlook, and frequent testimony by the Director of OSTP address this category.

President's Message on Science and Technology. In March 1979, the President provided a very good general framework for his view of the role of science and technology. Additionally his message highlighted key issues. Each Administration should be encouraged to do this for Congress and the Nation.

Five-Year Outlook. The first Five-Year Outlook contained a short opening overview of the issues by the Director of NSF. His personal view is important, but as Director of NSF he has limited purview of issues involving other Federal agencies.

Testimony by OSTP Director. Depending on the schedule of hearings and the questions asked of him, the OSTP Director has provided the Administration's view

of many issues. We believe that additional overview by the Director of OSTP related to the Five-Year Outlook and published along with the Five-Year Outlook, would be viewed as an authoritative statement from the broader perspective of the President's office.

3. The Administration's Annual Statement of Posture and Strategy

This should coincide with the presentation of the budget. It should discuss the Administration's strategy in the present year to attain some of its stated goals. It could be presented in testimony by the Director of OSTP and in the Annual Report.

Testimony by OSTP Director. The testimony by the Director of OSTP gives the Congress and excellent opportunity to question the Administration on its annual posture and strategies for science and technology. We believe that the present Director has performed this function rather well in his statements to the appropriations and authorization committees. If the requirement for an annual report were discontinued, the Director should make his statement available before the hearings. This would facilitate analysis, comments, and questioning; additionally, the hearings and questions addressed to the Director of OSTP might be published under separate cover in place of an annual report.

Annual Report. Many criticized the first and only Annual Report published so far because it did not give the Administration's view and posture on current issues.

The report contained essentially an academic analysis of issues by NSF, prefaced by a broad strategic overview signed by the Director of OSTP. Perhaps the most informative part was the statistical overview of the Federal R&D effort. We do not believe this report fulfilled the need for the Administration's statement of posture and strategy. One alternative would be for the functional analysis of Federal R&D to be published as a separate statistical NSF report with the Administration's view presented independently by the OSTP Director, as we suggested above.

4. The Administration's Justification for Actual Policy and Program Decisions

This category pertains to interagency programs, new science and technology missions, and crosscutting issues. The category provides overviews as distinct from the detailed budget data given by the individual agencies in appropriations and authorization hearings. This category is related very closely to the Administration's annual statement of posture and strategy, except that it describes actual programs and decisions made to implement the strategy. Information for this category is given in testimony by the Director of OSTP, to a limited extent in OMB's Special Analysis of R&D, and in NSF statistical reports, which describe programs functionally but give no justification for them.

OMB's Special Analysis on R&D. This is an annual document prepared under very tight time constraints. It provides a useful overview of Federal R&D but has the

potential to supply much more information. For broad science and technology oversight, the Congress needs better program descriptions and more detailed explanation of the rationale for priorities, particularly for interagency programs. More comparison should be made of the agency shares of these programs, and agency science and technology base expenditures should be contrasted more. NSF supplies functional comparison of agency research in a separate report that would be far more useful if it were presented at the beginning of the congressional budget cycle as would be required by the Research and Development Authorization Estimates Act (H.R. 7689) recently passed by the House.

#### SUPPLEMENTING THE PRESENT SYSTEM

As I stated earlier, we think the Director of OSTP's presentation of the Administration's view of present and future strategy on science and technology is very important. In the present Administration, OSTP is too burdened to prepare a lengthy annual report, but with timely publication and distribution, the OSTP Director's statements and testimony before congressional committees could fulfill this information need.

In our recent study of OSTP for Senator Adlai Stevenson, we recognized that OSTP does not perform the most comprehensive strategic planning and, therefore, cannot provide the Congress this kind of analysis. Instead, OSTP participates within the Executive

Office of the President, particularly with OMB, in a narrower approach to strategic planning as defined by energy, space, and other quite specific missions. The major limitation of this approach is that it may not give adequate attention to emerging issues that transcend present missions. Although OSTP does some work that is related to these issues--such as sponsoring studies on the future environmental impact of increasing levels of carbon dioxide- the limitation still exists.

We believe that this inadequacy can be countered in 3 ways, pertaining to (1) OSTP, (2) the Five-Year Outlook, and (3) the establishment of a more formal congressional/executive process for discussing science and technology policy issues.

As a result of our work for Senator Stevenson, we believe that OSTP should establish a detached mechanism to assist it in identifying emerging issues for its work agenda. However strong their expertise, the staff of one small office such as OSTP is unlikely to have a breadth of views that can encompass the ever increasing span of science and technology. Some systematic mechanism should be used to scan potential issues, rank their importance, and submit work proposals for OSTP to consider.

We also suggest that the potential of the Five-Year Outlook for identifying emerging issues be turned to good use. This is not a new proposal, and it is clear that the overall synthesis of the many contributions to the Five-Year Outlook can be a rich source for an early alert to problems and opportunities in science and technology.

We suggest that a more formal process of congressional/executive communications be established. We have addressed this process in our comments and testimony on H.R. 7689. There are several attributes of this process that I want to mention today. Because it is not sufficient for the Administration to simply present its view of the issues and strategies, the Congress should press the Administration to justify its selection of issues and strategies. Questioning could draw from the work of the congressional support agencies and the analyses contained in independent reports (such as the excellent annual series on the Federal R&D budget by the American Association for the Advancement of Science). I do not wish to imply that this questioning should in any way be antagonistic. Perhaps this Subcommittee would find it helpful to go further than questioning the Administration after the fact. Perhaps a cycle could be established in which, each summer, appropriate congressional committees suggest issues they would like the Administration to address in the following season's testimony and statements. Sharing mutual concerns could enhance the congressional role in Federal science planning.

Mr. Chairman, I have completed my summary of our present views of the existing efforts in planning for science and technology. My colleagues and I will be pleased to answer your questions now.