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OVERSIGHT OF FEDERALLY SPONSORED  
RESEARCH AND DEVELOPMENT

At the Nineteenth Institute on Federal Funding, in April 1979, I discussed the subject "Federal Research Grants: Maintaining Public Accountability Without Inhibiting Creative Research." I welcome the opportunity today to present a sequel to that address. Last year I spoke to the question of how the Government can assure accountability over its funds while giving university researchers the freedom needed to work creatively. This year, I would like to turn from accountability in the management of individual research programs to the broader question of how the Government can best support the long-term development of a sound research and development base in this country.

I will begin by explaining the concept and meaning of oversight and then focus on how this applies to federally sponsored research and development, including the process and tools involved at the highest levels of the Federal Government. Although I will emphasize the congressional perspective, the same principles apply throughout the Government at all levels of management. Grantees

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and contractors need to understand and appreciate the importance of oversight which is receiving greatly increased attention in the Congress.

#### CONCEPT AND MEANING OF OVERSIGHT

In public affairs, oversight includes accountability and stewardship of resources, compliance with the law, management effectiveness, and program results review. It involves appraisal of achievements consistent with goals and plans to fulfill statutory or contractual requirements and commitments.

Congressional oversight is the "process by which the Congress learns about the implementation, results, effectiveness and adequacy of its past legislative work, including the policies implicit in laws and the programs and activities carried out under law." This entails a thorough, systematic and ongoing review of programs-- both permanent and temporary--to evaluate their effectiveness in accomplishing intended objectives. Thus, we see that oversight is a broad activity that can take many forms and whose primary focus involves the monitoring of Federal agencies, programs, policies, and activities.

Although oversight dates from the earliest days of the Republic, when it was principally accomplished through the appropriations process and by special investigations, oversight functions were not formalized until enactment of the Legislative Reorganization Act of 1946. That Act required House and Senate committees to exercise "continuous watchfulness" over programs and agencies within their jurisdictions. The Federal Government is big business,

and the congressional role is analogous to that of the Board of Directors of a large corporation in the private sector.

Over the years, the Congress has developed powerful tools for overseeing the effectiveness of Federal programs. These procedures include the annual appropriations process, periodic reviews of program authorizations, special purpose hearings, staff investigations, reviews by GAO and other congressional support agencies, and other less formal investigations. Thus, the congressional oversight process consists of a complex system of interlocking methods for checking program effectiveness.

Oversight in the executive branch involves the management activities of the Executive Office of the President and the heads of Federal agencies, as well as all levels of management and administration of Federal activities. The White House staff includes the Office of Management and Budget, the Council of Economic Advisors, the Domestic Policy Staff, the National Security Council, the Office of Science and Technology Policy, and the Council of Environmental Quality.

#### Critical Elements of the Oversight Process

The essence of oversight is evaluation. To be meaningful, evaluation must involve two major elements: comparison of performance against clearly delineated criteria and the necessary information on which to base the evaluation.

In some cases, performance can be measured against established standards. In other cases, it involves comparison with goals and plans, such as mission goals or program objectives and

plans which may be more specifically reflected in contract commitments or grant agreements. At all levels, it involves the appraisal of management effectiveness and stewardship of resources compared with Government policies, guidelines, and procedures. Frequently it involves comparison of various performers engaged in similar or related endeavors. At the program level, it involves comparison of progress and results against agreed to program plans and performance criteria. On a Government-wide basis, it involves assessing the impact of Federal policies and programs both domestically and internationally in relation to national goals. At the highest levels of Government, it involves comparison with statutory requirements and Executive orders of the President.

Essential information--both qualitative and quantitative--must be available on a timely basis and in an appropriate level of detail and format for each level and management component involved in oversight. For example, congressional committees need timely information appropriately packaged to serve their needs for authorization, appropriation, legislation, and oversight functions. This varies from one committee to another and depends to a large extent on the degree of congressional interest and concern in selected areas. Committees such as the House Committee on Science and Technology, which has special broad oversight over science and technology, have additional need for information on status, trends, and issues relating to the entire science and technology enterprise.

CONGRESSIONAL AND EXECUTIVE BRANCH ROLES  
IN OVERSIGHT OF FEDERALLY SPONSORED R&D

A common misconception is that total Federal investments in R&D are centrally planned in a total analytic framework which relates scientific and technological opportunities to national objectives. In reality, this is not so. What emerges as "the R&D budget" is pieced together from the numerous independent entities in the executive branch. R&D expenditures become a means to achieve larger ends and, as such, compete with other strategies for the departmental dollar.

This diversity of R&D sponsors and performers is a direct outgrowth of our national philosophy of pluralism. In this context, pluralism means that each agency, rather than one central authority, supports R&D for its own purposes. Each agency considers the ideas and proposals of individual scientists and institutions. The result is that a highly decentralized review system judges the merits of R&D proposals.

Although there is no centrally planned "Federal R&D budget" per se, the Office of Management and Budget annually publishes a "Special Analysis of R&D" as part of the total budget package. This supplement presents an overview and summaries of proposed Federal research and development expenditures.

In my view, a major function of the Federal budget is to serve as a policy document which discloses the Administration's plans and strategy for implementing priority decisions emerging from major policy considerations. The budget should present information on

specific mission- or program-related R&D and information on inter-related programs to facilitate the broad oversight of total Federal R&D expenditures in relation to transcendent issues, interagency-related programs, and similar technologies. For broad oversight, reports (such as the Special Analysis of R&D and the Science and Technology Annual Report) are needed to present the Administration's view of how the total amount and distribution of Federal R&D expenditures relate to transcendent issues and national goals, and to disclose the rationale for major changes in existing programs, new initiatives, and analysis of issues associated with multiagency programs. In reviewing the strategy for Federal support of R&D, we should pay particular attention to the respective roles of the Government and the private sector and how they interrelate.

The Congress has taken a number of steps to strengthen Government-wide oversight of science and technology in both the executive and legislative branches of the Federal Government. A major initiative was the creation of the Office of Science and Technology Policy (OSTP) in the Executive Office of the President by Public Law 94-282 enacted in 1976.

OSTP was established to serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. In fulfilling this responsibility, it was charged with coordinating Government-wide research and development, assessing the status of federally sponsored R&D, working closely with the Office of Management and Budget and other executive agencies in establishing

priorities for R&D budget allocations, and to identify and assess emerging and future areas in which science and technology can be used effectively in addressing national and international problems. The Act also required OSTP to prepare a Science and Technology Annual Report and a Five-Year Outlook for the President to transmit annually to the Congress, two important tools for congressional oversight and strategic policy decisions. In 1977, formal responsibility for these two reports was transferred to the Director of the National Science Foundation (NSF) by Executive order of the President.

I want to emphasize two facets of Federal oversight of R&D and discuss how this process can be improved. First is the importance of developing definitive comprehensive strategic plans for science and technology, and second is the need to improve the information tools that provide the basis for evaluation.

#### Strategic Planning for Science and Technology

The best way to establish criteria for oversight of ongoing R&D programs is to define specific goals and develop good strategic plans from the beginning of any new initiative.

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 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.

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.

#### Information for R&D Oversight

The key to comprehensive Federal science policy planning and oversight 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 National Science Board (NSB) reports and Science Indicators series, and the National Science Foundation statistical reports.

NSF has produced a creditable first attempt at a five-year outlook that broadly fulfills the requirements of an overall assessment. Quantitative measurement of the status and trends in science and technology, when properly presented, is another valuable resource for oversight. NSF annually publishes a variety of statistical reports on R&D trends. In addition, since 1973, NSB, assisted by NSF, has published the Science Indicator series for the purpose of measuring significant changes in the state of science and technology. Such measures are particularly important in view of the need for a long-range Federal strategy for R&D.

Devising science indicators is a very complex and difficult task, however, and the art is still in an early stage of evolution. The development of such indicators is difficult for many reasons, including: the complex nature of science and technology, the diverse and pervasive way both interact with society, and the primitive understanding of the processes and linkages involved. We encouraged the National Science Board to continue its efforts and recommended that it strengthen its conceptual approach to design of the indicators it uses and that, in addition to input and output indicators, 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-79-35, September 25, 1979).

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.

In his March 1979 Message on Science and Technology the President provided a very good general framework for his view of the role of science and technology. In testimony, depending on the schedule of hearings and the questions asked of him, the Director of OSTP 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 broad 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 the Director of OSTP gives the Congress an excellent opportunity to question the Administration on its annual posture and strategies for science and technology. 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. We do not believe this report fulfilled the need for the Administration's statement of posture and strategy.

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 the Office of Management and Budget's Special Analysis of R&D, and in NSF statistical reports, which describe programs functionally but give no justification for them.

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.

We recently completed a study of OSTP for Senator Adlai Stevenson. The results of this study are published in a GAO report entitled The Office of Science and Technology Policy: Adaptation to a President's Operating Style May Conflict With Congressionally Mandated Assignments (PAD-80-79, September 3, 1980). 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. 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 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.

WHAT GRANTEEES AND CONTRACTORS SHOULD  
UNDERSTAND ABOUT ACCOUNTABILITY AND OVERSIGHT

I have tried to explain the concept of oversight, how it relates closely to accountability, and the nature of the process at

all levels of management. From the broad policy perspective of the Congress and the Executive Office of the President, I have illustrated how oversight of our Nation-wide science and technology enterprise is conducted, with emphasis on research and development. With this overview as background, I now want to discuss briefly what each grantee and contractor needs to understand about accountability and oversight.

First, you should have sufficient knowledge of the sponsoring agency and the program manager involved to understand the perspective and context in which they will consider your proposal in relation to the agency mission and the specific program to which your proposal is addressed. This will enable you to prepare a statement of proposed work that is germane to the specific area of interest or program as well as to present a clear statement explaining the rationale or justification to demonstrate how your proposal is related and why it should be funded.

Second, you should understand the nature of the review processes used by the sponsoring agency both for an initial proposal and for follow-on extensions or renewals. For example, some agencies use external peer review, some have intramural colleagues, and others use different approaches.

Third, you must understand the nature of the agreement and know what kinds of information and data must be reported periodically or at the end of the contract term to satisfy both the program manager and the contract administrator or financial officer.



Finally, you must know what records must be kept to substantiate financial accountability and compliance with all legal requirements. Such information is of particular importance to auditors.

This concludes my remarks. I will be pleased to answer questions.