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HEARINGS

BEFORE THE

SUBCOMMITTEE ON

DOMESTIC AND INTERNATIONAL

SCIENTIFIC PLANNING AND ANALYSIS

OF THE

COMMITTEE ON

SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS

SECOND SESSION

JULY 20, 21, 23, 1976

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INTERAGENCY COORDINATION OF FEDERAL SCIENTIFIC RESEARCH AND DEVELOPMENT

Special Oversight Hearings

TUESDAY, JULY 20, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL
SCIENTIFIC PLANNING AND ANALYSIS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Ray Thornton, chairman of the subcommittee, presiding.

Mr. THORNTON. The hearing will come to order.

I am very pleased to open our hearings on the Coordination of Federal Research and Development and to welcome our distinguished witnesses this morning.

The vast program of R. & D. which is being carried out throughout the many departments and agencies of the Federal Government is chiefly directed toward the missions of the individual agencies. But the very size of this effort frequently means that the possibility of either duplication or gaps in the total effort exists.

Before the formation of the Federal Council for Science and Technology, Members of Congress often criticized the executive branch for not coordinating this massive program. The formation of the Federal Council in 1959 was a major effort to introduce a mechanism to meet this need. The subjects which it was expected that the Federal Council would coordinate include scientific and technical manpower and R. & D. in such fields as materials, ocean science and engineering, air and water pollution, and many others.

While the Council has had conspicuous successes in some areas, such as the development of the interdisciplinary materials research laboratories, which came into existence as the result of an FCST initiative, the history of the Council also suggests that it has been less successful in bringing about the kind of governmentwide policy planning and coordination which was expected of it.

There are clearly a number of ways in which coordination can be brought about. A major alternative to formal coordination which has been tried over the last 25 years in several areas of new technology is the creation of a new agency. The Atomic Energy Commission, NASA, and, most recently, ERDA have brought together in one strong organization the many activities which logically belong together. In the case of the AEC, its responsibilities were comprehensive in that it covered all aspects of atomic energy development, from

agriculture to weapons, and from biology to waste management. While this permitted good internal coordination, many external factors and concerns, such as safety and economics, were not as well coordinated. As a result we are finding today that major emphasis must be given to the coordination of these aspects.

Another approach to the coordination problem has been to bring together in one agency all the functions related to a particular societal mission. The Department of Agriculture is an example of such an agency in which research and development is only one of the many functions related to agricultural production. Here the agency function is focused, not on a particular technological mission by itself, but on all aspects of a particular function of society. And, as our recent hearings showed, R. & D. has tended to become strongly commodity oriented and, as a result, coordination across the lines of the scientific disciplines has not been entirely satisfactory.

The technological orientation and the societal orientation represent different approaches to the need for coordination of complex programs by the creation of strong organizations. And it is clear that if we organize large organizations along one of these dimensions we will inevitably require coordination along the other dimension.

But it is neither sensible or feasible to create new organizations every time a problem or even a national crisis arises. And whether we do so or not, there is a continuing need for an effective mechanism to coordinate Federal R. & D. activities. The Federal Council for Science and Technology was recently given a legislative mandate under a slightly different title to perform that function.

It is constructive to review the intent and expectations which senior officials had for the Federal Council when it was first set up. President Eisenhower, when he signed the Executive order establishing the Council, said that "The FCST can aid the objective of improving the ways in which the Federal Government uses and supports science." Dr. Killian at the same time suggested that the Council should be able to call on both the President's Science Advisory Committee and the National Academy of Sciences for assistance in its work. The Executive order itself also established that the Council Chairman should from time to time submit the recommendations of the Council directly to the President. This indicates clearly that the Council was intended as a high-level, policymaking body.

One of the problems, however, which are perhaps inherent in the operation of a coordination council is that the Council itself does not have the authority to carry out its recommendations, and only when the Chairman of such a council has Executive powers can the recommendations be directly implemented. For example, the National Security Council, which is chaired by the President himself, has been effective largely for this reason. In the case of the Federal Council the final responsibility for the implementation of the policies and recommendations has rested with groups and individuals outside the Council such as the OMB or individual Government agencies.

The Federal Council, which began as an advisory group for the President, has over the years evolved as an arm of the Office of Science and Technology. At the same time, the assignments of tasks, which in the early years came from the President, have in more recent

years tended to come from within the Council itself. This has probably tended to lessen the Council's ability to implement its policies.

The Federal Council has developed a number of policy statements in several different areas and, although the Council does not have the power to implement them directly, they can become accepted as binding in a number of ways. As our historical study of the FCST shows, policy statements by the Council have become accepted through voluntary consensus, through acceptance of the FCST minutes, through promulgation by the OMB, or as a result of a directive of the President. The means used have varied from the press release and the memorandum of the Council Chairman to an announcement in the Federal Register and the Presidential statement. However, it appears that the Council has been less active in recent years in the development of policies for R. & D., and that even for those policy statements developed in the past there is no review mechanism and only a very cursory tracking system.

In reviewing the coordination question in the field of R. & D., it is well to keep in mind that the present philosophy of our Government places the dominant operating responsibilities on the individual departments and agencies. As a result, coordination has normally had to be done through mediation and consensus rather than by Executive action. All chairmen of the Federal Council have realized this and, as Dr. Wiesner noted "neither the Office of Science and Technology or the FCST are interleaved between the President and his department and agency heads." Both the Executive order and the recent law have confirmed this.

It is probably true, however, that the Federal Council can work effectively only when there is no basic disagreement between the policies and priorities of the agencies and the policies and priorities of the Council as a whole. When the mission of several agencies are overlapping and especially when they are competing in the area of overlap, coordination becomes difficult because "territorial competition" predominates. The result is that the Federal Council and especially its Chairman must put the major effort into the time consuming process of persuasion and the development of consensus if success is to be achieved.

Another approach to the question of coordination to which the Federal Council has contributed is the so-called lead agency concept. Under this concept, the particular agency with major responsibility in one field of R. & D. takes on the task of coordinating the other agencies which are active in the field. Although it is known that some agencies are formally designated as lead agencies, for example, NOAA in oceanography and NSF in scientific information field, we do not have a clear picture of how extensive this practice is or how successful it has been.

A further solution to the problem of R. & D. coordination has been to make the head of the agency assigned as the lead agency in a particular field serve the chairman of the corresponding Council committee. But it is not clear that it is wise to have the protagonist of a particular program also serve as its chief, governmentwide coordinator.

An additional function often referred to in discussion of Federal Council has been the exchange of information. Some have suggested

that the Federal Council serves as a tent under which many participants can meet to discuss the common problems. We hope to explore the usefulness of this function and its relationship to the other objectives of the Federal Council.

One problem which appears to have been a source of repeated concern is the problem of staffing and budget. The Council has never had its own budget and has always operated with an absolute minimum of staff. Some have felt that no interdepartmental committee can be effective in the development of policies and plans and in the achievement of coordination without having these resources available. On the other hand, we also understand that the Council has in the past had some difficulties in recruiting well-qualified staff for its limited number of staff positions. Furthermore, in some cases the person holding the Executive Secretary position has had other responsibilities elsewhere and, even though well-qualified, has therefore not been able to devote full time to his Council duties.

I believe that the Federal Council has an important task to perform. Perhaps in a general sense one of the most important things it can do is to lessen the limited perspectives of the individual agencies in regard to R. & D. as a contributor to the Nation's welfare. In this and in its other tasks, the Federal Council has the strong support of this committee and of the Congress.

As you know, the House concluded at the beginning of the current Congress that a coordinating function in the field of R. & D. was needed within the Congress itself, and these hearings are being conducted under the new Special Oversight responsibility for all Federal R. & D. which was assigned to our committee last year. This Special Oversight function is very much similar to the coordinating function being performed in the executive branch, and we hope that not only the new Federal Coordinating Council for Science, Engineering and Technology, but also we ourselves in this committee will benefit and learn as a result of these hearings.

In preparation for our hearings we asked the Library of Congress to perform a study of the past history of the Federal Council on Science and Technology, a study which is very close to publication. And I want to publicly recognize the work of Mrs. Dorothy Bates of the Congressional Research Service and her substantial contribution to the committee work.

Our first witness will be Elmer B. Staats, the Comptroller General of the United States.

Mr. Staats, it is a great pleasure to have you with us and I would like to now ask you to proceed.

[A biographical sketch of Mr. Staats follows:]

ELMER B. STAATS

Elmer B. Staats became Comptroller General of the United States March 8, 1966, after 26 years' service in the Federal Government. Before his appointment as Comptroller General, Mr. Staats had served as Deputy Director of the Bureau of the Budget under Presidents Johnson, Kennedy, Eisenhower and Truman.

Mr. Staats joined the Bureau of the Budget in 1939 serving in various capacities prior to his appointment by President Truman as Deputy Director in 1950.

In 1953 Mr. Staats left Government service to accept a position as Research Director for Marshall Field & Company in Chicago. A year later he was appointed by President Eisenhower as Executive Officer of the newly established Operations

Coordinating Board of the National Security Council. He held this post until he rejoined the Bureau of the Budget in September 1958. He was reappointed Deputy Director by President Kennedy in 1961 and continued in this position by President Johnson until his appointment as Comptroller General in 1966.

Mr. Staats is a native of Kansas and a graduate of McPherson College, McPherson, Kansas. He has an M.A. degree from the University of Kansas and Ph. D. degree from the University of Minnesota.

He was a fellow of the Brookings Institution from 1938 to 1939, is a member of Phi Beta Kappa, an honorary member of Alpha Kappa Psi, and received the Rockefeller Public Service Award in 1961.

Mr. Staats received distinguished service awards from the University of Kansas (1966) and the University of Minnesota (1964) and honorary degrees from McPherson College (1966). The George Washington University (1971). The University of South Dakota (1973) and Duke University (1975). He is currently serving on the Board of Trustees of American University in Washington and McPherson College in Kansas.

Mr. Staats was National President of the American Society for Public Administration in 1961-62. He is a member of several boards and committees interested in the public service.

Mr. Staats' interest in science policy and organization dates back to World War II. He participated in the development of the legislation which established the Atomic Energy Commission and the National Science Foundation, and later while Deputy Director of the Bureau of the Budget, helped draft and testified in support of the legislation which established the Office of Science and Technology in 1962.

He has given congressional testimony many times on issues involving science and technology, and most recently, in June 1975, he testified before the House Committee on Science and Technology on Federal policy, plans and organization for science and technology (H.R. 4461, The National Science Policy and Organization Act of 1975).

Mr. Staats also is a statutory member of the Technology Assessment Advisory Council to the Office of Technology Assessment.

STATEMENT OF ELMER B. STAATS, COMPTROLLER GENERAL OF THE UNITED STATES, GENERAL ACCOUNTING OFFICE, WASHINGTON, D.C., ACCOMPANIED BY MESSRS. MORTON A. MYERS, ASSISTANT DIRECTOR FOR SCIENCE AND TECHNOLOGY, AND OSMUND T. FUNDINGSLAND, SCIENCE ADVISORY STAFF

Mr. STAATS. Thank you very much. We are delighted to be here and we are pleased that you are holding these hearings at a particularly appropriate time, it seems to me, in view of the reestablishment of the Office of the Science Adviser in the Executive Office of the President.

My concern for the subject of today's hearing goes back to World War II. Since then, as both an observer and a participant in the work of the Federal Council, I have been involved in nearly all the steps in the evolution of various Federal mechanisms for coordination and central oversight of science and technology in the executive branch. I have been interested in the role of the Federal Council for Science and Technology since its inception in 1959 and I testified in support of the establishment of the Office of Science and Technology in 1962 which also formalized a staff support base for the Federal Council and the President's Science Advisory Committee.

Since you have commissioned the Congressional Research Service of the Library of Congress to perform a historical review of the Council, I will not discuss this background in detail. But it may be helpful if I offer some perspective for examining the role of the

Council as one element of the structure involved in central focus and coordination of our efforts in science and technology.

My statement will cover five topics:

One: The nature of our traditional pluralistic system for Government support of R. & D. and the need to supplement this with central coordination and oversight.

Two: Results of recent GAO case studies and reviews concerned with Federal coordination of R. & D. and governmentwide issues involving science and technology.

Three: Aspects and essential ingredients of central coordination.

Four: A retrospective look at the limitations of the Federal Council.

Five: Recent efforts to strengthen central coordination and oversight of science and technology.

NATURE AND LIMITATIONS OF THE PLURALISTIC SYSTEM

Traditionally there has been a strong consensus favoring our decentralized or pluralistic system for Federal support of R. & D. The essence of the pluralistic system is to encourage each Federal agency to support the R. & D. essential to meet its specific mission requirements, with the National Science Foundation primarily responsible for sponsoring basic research. The Foundation also is authorized to support selected applied research in the areas and disciplines not otherwise adequately covered by mission agencies. The pluralistic system depends heavily upon consideration, frequently by more than one agency, of ideas and proposals initiated by individual scientists and research institutions, rather than a directed approach from one central authority. It is generally believed that this system has enabled the United States to maintain a strong scientific leadership.

Science and technology are important components in the accomplishment of program objectives in such fields as transportation, medical care, national defense, and food production. Program objectives and goals are the principal considerations in establishing budgetary plans, rather than the amount of money contemplated for the science and technology component per se.

As head of the Executive branch, the President is responsible for the effective execution of programs approved by the Congress. The President holds the heads of departments and agencies accountable to him and the Congress for establishing organizations, selecting staff, mobilizing resources to carry out assigned responsibilities, and achieving results.

Each Federal agency should develop a strategy and priorities for the support and use of R. & D. to fulfill its mission objectives. However, our pluralistic system has some inherent imperfections. Although the diversity of opportunities is generally regarded as a strong characteristic, the associated permissiveness can result in unwarranted duplication in some areas and insufficient coverage in others. This duplication arises in part from conflicting missions of various agencies. The number and importance of crosscutting and overlapping areas of interest of individual agencies make a central focus not only desirable but essential to insure mutually compatible and coherent R. & D. programs.

In connection with hearings before the House Committee on Science and Technology in 1975, I cited instances of these program interrelationships and the need for central and interagency coordination. I should like to repeat these instances because they are quite relevant to today's hearings. For example, energy source development and conservation objectives are constrained by environmental protection requirements. Public transportation, crime prevention, law enforcement, and housing and urban development are all mutually interactive and constrained by energy and material shortages as well as by environmental concerns. Also, the pressures of inflation and budgetary constraints tend to squeeze the allocations for basic and longer range applied research for which each agency's return on investment is uncertain in both results and time.

There are other issues involving science and technology that transcend individual Government agencies. Among them are the impact of science and technology on the economy and the environment, the Federal role in assisting State and local governments, Government-industry relations to foster technology innovation, and Federal support of basic science and assistance to graduate education.

Also, the science and technology component of international relations is emerging with growing importance. For example, in coping with the energy crisis, and dealing with the shortages of critical materials, and world food supply, it is clear that central coordination and oversight need to be established. Such policy issues are also involved in striking an appropriate balance among protecting technological advantages for military preparedness, fostering international sharing of technological resources to help developing nations, and strengthening negotiations for world peace.

GAO CASE STUDIES AND REVIEWS

During the past 10 years, my observations have been derived to a large extent from the work of the General Accounting Office. Accordingly, this phase of my testimony will be based on recent reviews performed by GAO and directed, at least in part, toward examining the effectiveness of and need for improvement of Federal R. & D. coordination and central focus involving science and technology that transcend individual agency lines. Although we have not specifically directed attention toward evaluating the role and effectiveness of the Federal Council per se, we have noted what appeared to be some inherent limitations.

MATERIALS R. & D.

Our report to the Congress entitled "Federal Materials Research and Development: Modernizing Institutions and Management" (OSP-76-9, December 2, 1975) includes observations on the lack of overall Federal materials R. & D. coordination, as well as a discussion of the limitations of a previous Federal Council coordinating committee.

In this report, there are several observations on materials R. & D. coordination:

We lack clear national materials policy goals against which the effectiveness of related R. & D. activities can be measured.

There is no overall Federal materials R. & D. program. Rather, there exists a large number of specific mission oriented R. & D. activities. In fiscal year 1974, there were 23 Federal agencies with 90 subdivisions sponsoring materials R. & D. It would be incorrect to conclude that the sum of these activities constitutes a viable national program.

The National Commission on Materials Policy study in 1973 recommended several Federal actions to complement materials R. & D. These included tax incentives to spur industrial use of recycled materials and acceleration of technology transfer on resource recovery.

Little data regarding private materials R & D. activity is included in the Federal information system. Thus, we can only appraise that part of national materials R. & D. activity associated with the Federal Government.

Concerning the Federal Council's Coordinating Committee for Materials R. & D., our report states:

* * * The Coordinating Committee was limited in approach. First, it had a strong basic science orientation with little or no engineering or other input. Second, it was composed of representatives of only selected agencies, * * *. Third, the representatives were at the chief-scientist level; consequently, they were not active in policy determination. Finally, the Coordinating Committee operated entirely with borrowed staff.

However, the report continues that, in its relatively brief history (1963-70), the Coordinating Committee for Materials R. & D. did identify significant program and problem areas needing more attention.

MARINE SCIENCE AND OCEANIC R. & D.

A second GAO report on "The Need for a National Ocean Program and Plan" (GGD-76-97, October 10, 1975) noted that the United States has no comprehensive national ocean program.

Federal marine science and other oceanic activities are conducted by 21 organizations in 6 departments and 5 agencies. Many of the activities of these organizations are closely related and must be effectively coordinated to insure efficient use of Federal resources. Several methods have been used in attempts to achieve coordination.

The Interagency Committee on Marine Science and Engineering was established by the Federal Council in April 1971 in recognition of the need for a continuing interagency mechanism to consider policy-level issues in the field of marine affairs. The committee, composed of officials from 11 Federal departments and agencies, is chaired by the Administrator of the National Oceanic and Atmospheric Administration. We found that, for the most part, the committee studies did not result in specific recommendations to the agencies. When recommendations were made they were of a general nature calling for either continuous monitoring by the committee or for consideration by the Federal Council or the Office of Management and Budget. However, within this framework, the committee has provided a forum for member departments and agencies to exchange information.

The Congress established the National Advisory Committee on Oceans and Atmosphere by Public Law 92-125, dated August 16, 1971. Responsibilities of the Advisory Committee include undertaking a continuous review of the progress of U.S. marine and atmos-

pheric science and service programs and reporting annually to the Congress and the President on the results of its reviews. The Advisory Committee, however, plays no role in coordinating agency programs or establishing priorities.

We concluded that, because of the vital role the oceans play in the Nation's economy and national security, a concentrated effort should be undertaken to establish a national ocean plan and program. Such a program should (1) identify marine-related needs and establish specific national objectives; (2) establish priorities to accomplish these objectives; (3) evaluate program results, including relevance to national needs; (4) periodically update needs, objectives, and priorities; and (5) provide for adequate funds to effectively carry out the plan and program.

AIR POLLUTION R. & D.

In a report to the chairman of the Subcommittee on the Environment, Senate Committee on Commerce, entitled "Federal Programs for Research on the Effects of Air Pollutants" (FED-76-46, December 11, 1975), we concluded that there was need for improved coordination of Federal departments which were conducting and/or supporting research on the effects of air pollutants on health and the environment.

The Clean Air Act directs EPA to promote research coordination, but the agency had taken little positive action and had no written policies, procedures, or regulations for coordination. Some coordination occurred on a scientist-to-scientist basis and through meetings of various committees. We noted several instances in which EPA scientists were unaware of research similar to their own which was being funded by other Federal agencies. We also noted that no control point existed for disseminating air pollution research information, and as a result, there was no assurance that a potential user would become aware of all completed and ongoing research in his area of interest.

We recommended, among, other actions, that the Administrator of EPA, establish criteria or guidance for setting air pollution research priorities and develop written policies and regulations that will enable EPA to fulfill its responsibility to coordinate research under the Clean Air Act.

LAND SATELLITE PROJECT

The need for a somewhat different type of coordination is discussed in our report on the Land Satellite project (PSAD-76-74, January 30, 1976).

We stated that none of the Federal agencies involved in the LANDSAT project have developed a long-range comprehensive plan which includes user requirements to assist in deciding if and when LANDSAT should become an operational system. We recommended that NASA take the initiative to lead the other participating agencies in developing a plan which includes requirements, milestones, and dates for evaluating progress being made toward the goal of deciding if and when there should be an operational earth resources satellite system. We recognized that such a plan must postulate a Federal Government policy role in satellite-based remote sensing technology. Accordingly, we said that the plan could address (1) the assignments of

roles and responsibilities to the involved agencies; (2) interrelationships among oceanographic, meteorological, and earth resources satellite systems; (3) alternative organizational arrangements for operational systems reflecting differing degrees of government, private sector, and international participation; and (4) estimated resource and funds requirements to be filled by the Federal Government.

In addition, because the potential users have expressed a need for training in the use of LANDSAT data, we recommended that NASA take the lead, in conjunction with potential users, in developing a plan to provide formal training.

OTHER GAO REPORTS

A list of some of our reports dealing with different aspects of Federal coordination of R. & D. or with issues involving science and technology is attached to my statement as an appendix. Mr. Chairman, you may recall that two of these were discussed in my testimony before this subcommittee on "Research and Development and the Economy" in May of this year.

Mr. THORTON. Yes, sir, and I must say that that testimony was outstanding and very helpful to our committee at that time.

Mr. STAATS. Thank you.

In our report "Manufacturing Technology—A Changing Challenge to Improve Productivity" (LCD-75-436, June 3, 1976), we concluded that there is a need to create a national focal point to assist U.S. industry in acquiring and diffusing the most advanced manufacturing technology. We recommended that the National Center for Productivity and Quality of Working Life, in close cooperation with the Department of Commerce, take the lead in carrying out this objective. This Center would perform a leadership, coordinating, and catalytic role—not an operating or funding role.

Finally, our report entitled "The Government's Role in East-West Trade—Problems and Issues": (ID-76-13A, February 4, 1976) pointed out the need for centralized coordination, policy delineation, and monitoring the export of technology and international technology exchange agreements.

EFFECTIVE COORDINATION ASPECTS AND INGREDIENTS

One may distinguish four aspects of central coordination as follows:

Participation in R. & D. budget planning and analysis to examine resource allocations in relation to national goals and priorities, including early recognition of opportunities and anticipation of future needs.

Interagency comparison of potentially related Federal programs to identify incompatibilities, unnecessary duplication, and insufficient coverage.

Analysis of functional crosscutting issues, policy questions, and R. & D. administration matters not intrinsically related to any single program but generally pervasive of all efforts involving science and technology. Examples are patent policy, procurement policy, Federal regulations, Federal incentives for technology innovation by the private sector, administration and utilization of Federal laboratories, education and use of human resources, and international issues involving the sharing of scientific and technological resources.

Analysis of needs and involvement of users in the R. & D. planning process to assure coupling between R. & D. performers and ultimate users, and to facilitate technology delivery and utilization. The needs of users in both the Government and the private sector should be considered as appropriate and different mechanisms may be needed in each case.

Effectiveness of a central coordination mechanism depends on some essential ingredients:

It requires highly qualified staff with differing disciplines and experience.

It must have adequate resources available to cope with the issues involved in a timely manner.

Its charter and authority should be clearly defined.

Its reports should present the issues and recommendations involving science and technology in the context and terms of socioeconomic and political decision alternatives.

Finally, it must have a clearly identified customer with implementing authority to whom it may address its recommendations.

Notwithstanding the need for central focus and leadership, coordination cannot be fully effective unless it is also achieved at the working levels—staff to staff and unit to unit. This is a very important point, Mr. Chairman. This involves participation by individuals in conferences, workshops, professional society meetings, and other associations through which they develop mutual understanding and personal rapport, leading to frequent telephone communication and exchange of correspondence, including reports and other documents. This is the kind of day-to-day coordination which is so essential to effective coordination.

Bearing in mind these aspects and essential ingredients of effective coordination, I shall now consider the Federal Council's role in central coordination of federally directed or supported science and technology.

THE FEDERAL COUNCIL

Opinions vary widely as to the effectiveness of the Council and the kinds of functions or tasks most suitable for Council involvement. Some observers believe that the Council has never fulfilled the expectations implied in its mandate.

There are several intrinsic limitations which impede its effectiveness, notably the following:

Each member of the Council represents an agency which has its own mission and a vested interest, and hence it has been restrained from reaching agreement on matters which might be construed as impinging adversely on the prerogatives of any of the agencies represented. Consequently, on controversial issues, the Council has only been able to agree on recommendations of a general nature.

The reports issued by the Council or under its sponsorship frequently have not had a recipient who would or could exercise authority to implement actions recommended.

Because of these two limitations, the members of the Council have tended to downgrade its importance as evidenced by frequent absenteeism and delegation of alternates to attend meetings.

Because it had no budget of its own and, therefore, depended on staff loaned from or studies funded by other agencies, the Council has not always been able to examine issues in sufficient scope and depth.

The Council's resources, to a large extent, have been members of the governmental scientific and engineering community who could deal effectively only with scientific and technological aspects of program coordination or deficiencies in Federal R. & D. support.

Because of these limitations, the Council has found it extremely difficult to deal forcefully with substantive interagency coordination of Federal R. & D. programs. In this area, its major contribution has been to survey and identify fragmented R. & D. efforts among different agencies and to surface the need for more formal centralized leadership.

On the positive side, the Council is credited with being relatively effective in dealing with administrative matters and policy questions of common interest to all of the agencies, and in identifying needs for increased R. & D. in selected areas. The Council has also provided a useful forum for discussion of matters of concern to the various agencies involved in R. & D. It has issued or commissioned a number of useful reports on Government-wide R. & D., some of which include policy and administrative recommendations.

According to knowledgeable observers, the Council has been effective in dealing with policy issues and administrative problems, especially when detailed studies were performed on specifically defined problems with subsequent review and debate by the full Council. Some of the most effective studies were those performed at the specific request of the President or the OMB. The Council was least effective when it initiated studies without a particular recipient in mind.

RECENT COORDINATION EFFORTS

One of the most effective means for establishing strong leadership and coordination is to pull together diversified and fragmented efforts that are or should be interrelated under the same umbrella and into a new organization with a new charter and mission.

The most recent major reorganization of this type was the creation of the Energy Research and Development Administration (ERDA) by the Energy Reorganization Act of 1974 to bring together and direct Federal activities relating to R. & D. in energy. It also established an Energy Resources Council to coordinate energy policy and management studies and to advise the President and the Congress on future reorganizations of energy and related functions in the Federal Government. Prior to the establishment of ERDA, energy R. & D. was highly fragmented and spread among a number of agencies. This act pulled together all the R. & D. elements of the Atomic Energy Commission and portions of the Department of Interior, the National Science Foundation, and the Environmental Protection Agency. The formation of ERDA was a step in the right direction but, in our view, it does not go far enough. We continue to favor establishment of a Department of Energy and Natural Resources.

Mr. THORNTON. Mr. Staats, if I may interrupt again, I might say that I share that recommendation.

Mr. STAATS: We are delighted that the subject is getting more and more attention in Congress. A number of hearings have been held on this and we are very pleased to note, for example, in the platform of the Democratic Party—and I hope it will be in the Republican platform as well—some attention to this need.

Another major initiative was the enactment, in May, of the National Science and Technology Policy, Organization, and Priorities Act of 1976. As you know, this act includes a formal statement of Federal policies for science and technology and establishes in the Executive Office of the President an Office of Science and Technology Policy. Since you are all familiar with the provisions of this act, I shall not dwell on it. I strongly supported this legislation and believe it could be a major step forward in strengthening our central coordination and oversight of science and technology as well as serving as a mechanism to advise the President, assist the OMB, and couple science and technology into executive planning throughout the highest levels of Government. For the first time, it establishes a congressional mandate for the entire central coordination and oversight structure. Thus, continuity is assured with sufficient flexibility to accommodate preferences of different Presidents. The statutory base also provides assurance that the Congress has access to call upon leaders to testify as necessary.

Another recent initiative is the GAO effort to introduce a new unified objective-oriented budget classification structure to assist both the Congress and the executive branch. This system is intended to provide information on all Federal R. & D. activities and is being structured to indicate Federal R. & D. allocations in relation to specific problems and objectives.

The presentation will facilitate identifying elements of work conducted by all agencies which are aimed at the solution of specific national problems or the accomplishment of national objectives. In this way, it can be used as an additional tool for relating the R. & D. budget to policies and priorities. This work, I might add, flows out of title VIII of the Congressional Budget Act of 1974.

Mr. Chairman, this concludes our statement. If you will note, in addition to the attachment listing GAO reports which we think are relevant to your hearings, we have also listed several questions which we believe might be of interest to the committee as it conducts this and further hearings on the subject.

Mr. THORNTON. Without objection, the attachments will be included as a part of the record.

[The above-referenced attachments are as follows:]

ATTACHMENT I.—PARTIAL LISTING OF GAO REPORTS CONTAINING REFERENCES
TO R. & D. COORDINATION

Manufacturing Technology—A Changing Challenge to Improved Productivity (LCD-75-436, June 3, 1976). (Summarized in text of testimony.)

Agricultural Research—Its Organization and Management (RED-76-92, April 9, 1976). The study describes the principal techniques employed by the U.S. Department of Agriculture and State institutions to plan and coordinate their research programs.

General Accounting Office Reviews of Federal Environmental Research and Development (RED-76-95, April 7, 1976). The reviews confirm that there is no overall Federal leadership for environmental research nor does there appear to be adequate coordination of the water, air, and pesticide research efforts.

SEASAT Project (PSAD-76-76, February 25, 1976). This report discusses, among other things, the need for firm commitments by users to participate in the project during its planning and development.

The Government's Role in East-West Trade—Problems and Issues (ID-76-13A, February 4, 1976). (Summarized in text of testimony.)

Land Satellite Project (PSAD-76-74, January 30, 1976). (Summarized in text of testimony.)

Federal Programs for Research on the Effects of Air Pollutants (RED-76-46, December 11, 1975). (Summarized in text of testimony.)

Federal Materials Research and Development: Modernizing Institutions and Management (OSP-76-9, December 2, 1975). (Summarized in text of testimony.)

Opportunities for Improved Management of the Research Applied to National Needs (RANN) Program (MWD-75-84, November 5, 1975). Primary areas for improvement are in research program development (views of major public and private interest groups are not always obtained), proposal evaluation (researchers suggested major changes in peer review system), and planning for use of research (early and active user involvement is needed).

The Need for a National Ocean Program and Plan (GGD-75-97, October 10, 1975). (Summarized in text of testimony.)

Federal State Solar Energy Research, Development, and Demonstration Activities (RED-75-376, June 10, 1975). One of the major findings of this report is that the executive branch has not issued guidelines on the allocation of solar energy R&D funds to avoid duplication of activities.

Need for a National Weather Modification Research Program (RED-74-176, August 23, 1974). During fiscal year 1974, seven Federal departments and agencies conducted weather modification research. This report discusses these fragmented research programs, as well as the role of the Federal Council for Science and Technology in weather modification research.

ATTACHMENT II.—QUESTIONS CONCERNING THE ROLE AND EFFECTIVENESS OF THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

1. What has been the major thrust of the Council's activities during the period of your involvement: (a) by subject areas, and (b) by types of issues or problems addressed?

2. What studies did the Council complete during the same period? Which of these were requested by the President, OMB, the President's Science Advisor, another agency, or were self-initiated by the Council? Of those studies which were self-initiated, what were the objectives and who were the intended users?

3. What have been the major accomplishments of the Council during this period and what have been the resulting impacts? For example, strengthened coordination of interagency R&D programs, improved administration of R&D, adoption of enlightened or new policies, new or revised legislation?

4. What criteria does the Council use to select the subjects for its studies?

5. What studies, if any, deemed important by the Council were not undertaken or were dropped for lack of resources or because they were considered inappropriate for the Council?

6. What progress has been made in establishing means to identify and effectively present early warning of potential major problems before they become crises?

7. What factors have limited the effectiveness of the Council and what types of issues is it best designed to address?

8. How has the Council and its committees been restructured recently in the light of changing priorities for its attention and in view of lessons learned from its past experience?

9. How will Public Law 94-282 impact on the Council's effectiveness?

10. How has the Council benefited its member agencies?

11. How could the Council be more effective in performing its central coordination function:

(a) to be of greater value to your agency?

(b) to better serve the Government as a whole?

12. To what extent have the Council recommendations impacted on the budget? How can the Council's role in the budget process be more effective?

13. In its consideration of science and technology issues, has the Council dealt adequately with their political, social, economic, and ecological aspects? Should

the Council's ability to formulate its recommendations in this broader context be improved? If so, how?

Mr. THORNTON. I want to express my appreciation for the work which has gone into this presentation and especially the work which has gone into the suggested questions. They do form a good structure for our subcommittee to begin the inquiry that we are undertaking. I very deeply appreciate your outlining the inquiry in the manner that you have.

Mr. STAATS, the program is one that has a great idea and has achieved some success, as you point out. Still there are limitations and problems which do require attention it seems to me.

The suggestion is made that perhaps action agencies are a way to achieve better coordination. But even there you frequently have the possibility of research falling through the cracks and not being coordinated with still other agencies, do you not? I am thinking of ERDA and NASA and those kinds of agencies?

Mr. STAATS. Mr. Chairman, there is no conceivable way in my experience that you can organize the Government so that you put everything dealing with a particular program or function into a single organizational box. It is just not possible. As we have pointed out, these cross-cutting relationships are very pervasive and so while we would fully endorse the idea of organizing on the basis of major function or responsibility so that you get as much coordination as you can by proper organization, nevertheless, you are never going to be able to organize the Government in such a way as to eliminate the need for some mechanism to coordinate common problems, not only in the field of research and development but in other fields as well.

My own feeling about the Council—and I sat in as a guest on all the meetings from 1959 to 1966, was that an appraisal of whether it is effective depends a great deal upon your recognition of the inherent limitations of a council.

In other words, the fact that you do not achieve full coordination is in no sense an argument against having a council. My own experience was that the Council was quite effective as a forum for debate and discussion. It was quite effective in terms of identifying issues which the science adviser could then take up, dealing with the White House or OMB or with the agency heads concerned.

The Council was very useful in developing staff papers. It was very useful in bringing issues to the attention of the Bureau of the Budget. That is why I was there. We felt many of these problems could be dealt with in that mechanism rather than directly by the OMB.

I think particularly, though, it can be useful to the science adviser, if he is an individual who knows how to work with that kind of machinery.

One thing has to be recognized on the other side and that is that a council of this type must be made up of chief scientists or assistant secretaries or their equivalents who have a responsibility for R. & D. in those agencies. They come uninstructed—and they should—in the sense that they do not come with directed agency positions on matters. If they did, then a lot of the usefulness of discussion would be lost.

So you have to recognize that when a council member talks about level of support for a particular activity, for example that he is sub-

ject to constraints within his own agency by the agency head in terms of a budget within which the agency has to operate. There may be other considerations other than R. & D. which he has to take into account. That still does not mean, though, that the science adviser cannot use that information.

He can talk to the agency head, the Director of the Budget and the President, if necessary, in terms of getting issues up to the point where they can be effectively examined.

A council of this type can be very useful as a means of communicating and identifying problems and raising issues which can be then resolved by the science adviser or by the science adviser in collaboration with the Director of OMB or the White House.

What I am trying to emphasize is that any judgment as to the worth and value of a council has to recognize that there are elements of coordination that cannot be effected through a council mechanism or any other type of committee-type mechanism. It may have to be done through Presidential directive or by OMB directive with the President's delegation.

Mr. THORNTON. We should have a proper understanding of what can be achieved by a council to bring issues to the surface for decision. That may be a most important function. I think also, if I understand what you have said, you have indicated that efficiency is not the supreme good of science research. There needs to be some cracks and crevices in which you can have some pluralism and some diversity. It might not be a good thing to put everything in a box and have it managed from the top.

Mr. STAATS. The only thing I would emphasize, based upon my own observation and experience, would be that the science advisor should have adequate staff to staff the various committees of the Council.

In other words, you need people who can develop the issue papers, can get around and talk with the people in the agencies and who can set up and maybe chair a task group that can develop issues and proposals and proposed programs—a staff that reports to the science adviser.

One of the great problems in any enterprise of this type is if it depends on staff detailed from the agencies. This is hard to do. It is very cumbersome and sometimes you end up not getting the best person. You get somebody who is available rather than the best person for that particular task. So I would emphasize the importance of having an adequate staff.

Another thing which I would emphasize is—I believe Dr. Stever refers to this in his statement, which I fully support—to rely as much as possible on ad hoc groups rather than standing committees.

Standing committees have their place and there should be some standing committees, but in many instances you have a standing committee to deal with what I would think would be better served if you had a group that could be organized where you would fix a timetable, give the report up and get it considered and then go out of business.

If you need another task group, then you set it up ad hoc for that purpose. Otherwise, you get a membership and then pretty soon substitutes are coming and then substitutes for the substitutes. And it tends to diminish status and it is not able to be very effective.

Mr. THORNTON. Thank you very much again, Mr. Staats.

Mr. Myers?

Mr. MYERS. Thank you, Mr. Chairman.

Mr. STAATS, is it not important to look at coordination of R. & D. perhaps in different categories? For instance, first of all, coordination of policy and then coordination of programs. And shouldn't we evaluate, first of all, whether we have good strong policies and then coordinate them, which essentially would then, in my opinion, identify agencies or arms of the Government which would have the general mandate to work out those policies.

Now whether or not we have overlap in individual programs or individual projects is almost a different evaluation that we may have to make. It seems to me if we just talk about R. & D. coordination as one entity, so to speak, that we lose sight of the fact that perhaps there are some parts of R. & D. coordination which may be doing well as compared to other parts and we should direct our attention to the individual parts of the whole mechanism.

Do you see it in that way as a policy and program coordination problem or can you conceptualize it as all of one sort of entity?

Mr. STAATS. Yes, I think I would agree with that. You cannot separate R. & D. out of the context of the program you are trying to achieve. And the OMB has emphasized this a great deal. Certainly, we do not disagree with that. I suppose we have had some disagreement with OMB on the point that we think there are many of these issues which cut across all agency lines. You cannot deal with the problem of the oceans without looking at the foreign policy aspect, for example. You cannot deal with the question of environment without looking at the effect on the cost of doing business. You have to make a judgment of whether the prospects of a breakthrough on R. & D., for example, in dealing with pollution, make it desirable to hold off the timetable on standards for pollution to a point where it can be done in a less costly manner. These are the kinds of interrelationships between science and technology and policy that we feel need to have the debate and discussion at the very highest levels in our Government, both in the Executive branch and Congress.

Mr. MYERS. But that is a completely different problem than to strive to evaluate whether a team of individual scientists here are duplicating what a team of individual scientists in another agency are doing.

Mr. STAATS. Yes.

Mr. MYERS. It seems to me that broad programs are going to be splintered into agencies to begin with, and certain legs of responsibility may have to be built from individual agencies. It would appear that if that is true, once a policy is formulated and coordinated among agencies at the highest levels, at least agencies are aware of what these objectives are. And it would appear also that if that would be well documented and well understood that perhaps we do not have to worry as much about duplication because there will be a knowledge of the fact that there are agencies working on the same problem. So knowing that, the individual terms of scientists will know that there are locations of possible duplicating information.

I think I would like to ask if you don't agree that a significant or very important part of any R. & D. program is an initial search for

information relating to the project you are working on, so that—I don't necessarily see that we should be looking into some narrow box, so to speak, of directing all information from there, but just the knowledge that a program or policy is being worked in this situation would be helpful.

Mr. STAATS. I agree.

Mr. MYERS. So that individuals scientists or teams have some sort of a direction of search to go for in eliminating the overlap. Is that not part of it?

Mr. STAATS I think so. Let me say this in answer to your question. A series of standing committees or ad hoc groups of the Federal Council could help in getting these kinds of information. In many studies we have done we have found that agencies doing work in an area where other agencies were doing related work were not even aware of it.

Now the Science Information Exchange administered by the Smithsonian Institution and supported by the various agencies is another mechanism by which you can find out who is undertaking research in what field.

There is no foolproof way to be sure that all of this kind of information exchange takes place. That is one of the reasons we have emphasized so much that part of the value of the Federal Council can be that individuals get to know each other.

If I can go back into my own personal experience, during the Eisenhower administration I ran for 5 years something called the Operations Coordinating Board of the National Security Council. In the beginning of that operation we frequently found people working in the same field who had never seen each other or had never talked to each other.

But the process of bringing them together in subcommittees means that after a while they get to know each other and instead of having to bring problems up to the top or exchange information at that level, they do it on their own level at luncheon discussions or ad hoc meetings. This comes about when people understand what the relationship is and get to know each other well enough to feel easy in communication. That is part of the point we are making here. A lot of the coordination which needs to take place on individual projects, of the type I believe you made reference to, ought to be done on a staff-to-staff or unit-to-unit-type basis. Then if there are problems which are identified they still have a way to bring them up to the Council, which has been established to have jurisdiction. But as much of this as you can get done on a person-to-person or unit-to-unit basis, I think the better it is.

Mr. MYERS. Are you aware or have you evaluated whether or not agencies which do R. & D., or portion of the government which do R. & D., have adequate search facilities which are available to outside inquiries, whether they are other agencies or State governments, or whatever?

This is a subject matter we should touch on, and maybe we should evaluate whether or not that would be an important point. It seems to me that part of the individual responsibility of the scientists is to be innovative enough to have some idea of where he can get some existing information either by title of his project or program or what-

ever, or even to the extent of being able to forecast what by title might seem to be a completely unrelated project and there might be some information in there.

So if you had qualified people who could interpret the full spectrum of the type of project going on, it would seem to me to be valuable so that they would be a central contact source from the outside for other agencies. Now I don't know whether that exists. Perhaps it does to some degree.

Mr. STAATS. Mr. Myers may have some reaction to your question.

Mr. MORTON MYERS. Good science certainly, Mr. Myers, does imply a literature search and knowing what is in fact going on. In terms of the existence of central mechanisms that can be used as a data bank to draw from rather easily, there are some difficulties. In the example given in Mr. Staats' testimony today on materials research and development, one very large segment of the materials R. & D. picture, namely, what is going on in the private sector, is not available in any central data bank. It is presumed to be important research. It is presumed to be sizable research.

In fact, there is little data regarding the private sector R. & D. on materials. We do recommend in that particular instance that such information be sought on a voluntary basis with coverage to be submitted to a Federal data bank. I think you have hit on something where frequently information is lacking.

Mr. STAATS. We also found in that case that dealing within the Federal Government, all of the information relevant to materials research was not being supplied by the agencies, so one of our recommendations was that the OMB issue the necessary directives to be sure that the agencies did cooperate and put that information into the data bank for the Science Information Exchange.

Mr. MYERS. Aside from that, it seems to me that a strong responsibility of an agency which has committed sizeable amounts of Federal dollars is that they organize to share that information. In other words, they are equipped, or we, as Members of Congress, should supply sufficient staff for them to share the information with inquiring agencies. Perhaps that would be a better way than trying to think about how we can bring everybody under one shield.

If we know that the individual agencies are generally given certain responsibility in policy decisions and will be working on that responsibility, then scientists in other agencies will know that they can reach into that agency with an adequate and highly qualified research facility available, perhaps rather than having everybody try to centralize into one central bank.

Maybe that is like throwing it to someone else. If an agency does research on R. & D. and says here it is we put it in the bank, it perhaps may not be felt that it is their responsibility beyond that point and it goes to somebody who has not really been involved and doesn't know the scope.

Mr. STAATS. The data bank can only be one way of assisting the agency or researcher to find out who is working in what area. It is in no sense a solution to the problem. In many instances he would be more likely to find out through his professional connections, going to association meetings or serving on committees of various professional societies. There are many ways in which this has to be done,

but what we are seeking through the science information exchange and through mechanisms like the Council is ways to facilitate that.

In no sense do you relieve the agency or the researcher from the obligation to find out all of the available information both here and abroad for that matter, in a given field.

Mr. MYERS. I think GAO is probably noted for its ability to put a dollar figure or some sort of numerical evaluation on problems, and I would like to know if there has been a numerical evaluation of the undesirable overlap of R. & D. in federal agencies.

Mr. STAATS. We have cited a number of examples here in this list, attachment I. In most of these instances we found what at least we thought were errors where there should have been improved coordination.

Mr. MYERS. In your opinion, could there be a valid statistical analysis by design on a random basis or some other basis to select out R. & D. projects that you know are going on and to take them and selectively pursue the whole course and determine the amount of evaluation? Would that in turn give you a reliable figure as to how large the problem is? We are having hearings and we are spending considerable time. I think we could pull out individual examples of the vast numbers of projects and the billions spent on R. & D. I think the examples are essentially the tip of the iceberg or, maybe it is the whole iceberg, but we should know that or have some sort of feeling for that.

Mr. STAATS. I am not sure there is any way I know of as to how you would develop an overall statistical measure or quantitative measure of any type as to the extent to which there might be something called undesirable duplication. As the chairman points out, in many instances you may deliberately want to encourage duplication because the problem is so serious that you want more than one approach to it.

Mr. MYERS. I think that since you have come with some examples, you have already given some opinion as to undesirable overlap, and that there must be some sort of standard. Somebody is going to make that judgment. Isn't it true that we either work in the dark on this problem or we work with some information? I am just asking is it possible to give us, as Members of Congress, some numerical value of what the size and scope of the problem is, or should we just continue to assume that because we have been able to identify some individual projects—

Mr. STAATS. Certainly we ought to consider it. I think it would be very difficult, but if there is any way we could give some overall measure or judgment on it, I think it would be quite appropriate for us to do so.

Mr. MORTON MYERS. Let me point out one thing, if I might, Mr. Myers. The examples presented today have in fact not been quantified, I think, in the sense you mean. I would point out, however, that they deal with functional areas of R. & D. In other words, we are talking about all materials R. & D. That involves 90 subdivisions in the Federal Government and perhaps some 21 different agencies of the Federal Government.

The same was true in the oceans case. It was a matter not of isolated examples but taking the entire function of oceans R. & D. being conducted by the Federal Government and being supported

by the Federal Government and finding this situation. So now rather than two examples, what I think we have instead is that poor coordination existed in two functional areas of research being conducted by the Federal Government. This is also true in weather modification, one of the examples listed in Mr. Staats' attachments.

I think that makes quite a difference in how these would be construed.

Mr. MYERS. Thank you very much.

Mr. THORNTON. Thank you very much, Mr. Myers.

I want to thank you again for your excellent testimony. I would like to get your comment very briefly on a statement which I think is most sound, which Dr. Stever will be bringing to us shortly; that one of the great, strong features of the Federal Council has been its flexibility and that as the role of science and technology in the formation of public policy becomes more complex that the trend to complexity demands a greater rather than a lesser degree of flexibility in approaching research problems than has existed in the past.

Can you comment with regard to that observation?

Mr. STAATS. If I interpret what is being said correctly, I would share that view. In all of these things you have to strike a balance between informality and flexibility with some degree of structure. The real secret in large part has to revolve around the individual, in this case the science advisor, who is going to have to make that judgment.

Certainly, as I see it, the statute now gives the charter. I don't believe the statute has any inflexibility in it. The one caution that I have—I do not think it is a real concern—is that the statute specifies the membership of the Council. If you just limit the Council to that membership, it could not deal with all of the kinds of concerns that need to be addressed. So there has to be flexibility, in other words, for the science advisor to bring in ad hoc, others who are interested in a given issue. There is nothing in the statute to prohibit him from doing that. It just does not recognize that need. That is all I am suggesting. It is quite obvious that these interrelationships are becoming increasingly complex. You cannot separate R. & D. from policy or vice versa. Therefore, you have to have flexibility. But the other kind of flexibility that I think is important is that within the workings of the Executive Office itself a great deal of the effectiveness of the Council and the OSTP is going to depend upon the kind of working relationship evolved between the OMB, for example, and the OSTP and the mechanism by which the science advisor is able to get the major issues before the president and the cabinet and the security council for consideration.

Mr. THORNTON. Thank you again, Mr. Staats, and thank you Mr. Fundingsland and Mr. Myers for your attendance and your testimony.

We are now privileged to hear from Dr. Guy Stever, Chairman of the Federal Council on Science & Technology and Director of the National Science Foundation, who is also Science Adviser to the President.

Dr. Stever, you come wearing many hats, as you often do to our committee. It is always a privilege and a pleasure to have you appear before us and to have the benefit of your always thoughtful, well-prepared and excellent statements. We do appreciate it and you are welcome and you may proceed as you choose.

[A biographical sketch of Dr. Stever follows:]

DR. H. GUYFORD STEVER

Dr. H. Guyford Stever assumed the post of Director of the National Science Foundation on February 1, 1972, following his nomination by the President to a six year term and his unanimous confirmation by the Senate. In May 1973 he became Chairman of the Federal Council on Science and Technology.

In addition to his duties as Director of the Foundation, Dr. Stever has been named Science Adviser and Chairman of the Federal Council for Science and Technology by the President.

He is also the U.S. Chairman of the U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation; member of the Board of Governors of the U.S.-Israel Bi-national Science Foundation; and former Chairman of the Energy R&D Advisory Council.

Dr. Stever is a member of the National Science Board and Chairman of the Board's Executive Committee. He is also a member of the Energy Resources Council; President's Committee on the National Medal of Science; National Council on Educational Research; National Cancer Advisory Board; National Cancer Institute; U.S.-Japan Committee on Scientific Cooperation; Federal Council on the Arts and the Humanities; and the Senior Executives Council of The Conference Board.

Prior to his appointment to head NSF, Dr. Stever had served as President of Carnegie-Mellon University (and one of its predecessors, Carnegie Institute of Technology) since February 1965. His presidency was marked by significant change and growth in the university.

Before his appointment to the Presidency of CMU, Dr. Stever served on the faculty of the Massachusetts Institute of Technology for more than 20 years. He held positions which included Head of the Departments of Mechanical Engineering, Naval Architecture, and Marine Engineering (1961-1965); Professor of Aeronautical Engineering (1956-1965); and Associate Dean of Engineering (1956-1959). He was Science Liaison Office at the London Mission of the Office of Scientific Research and Development from 1942 to 1945.

During the time he was at MIT, Dr. Stever achieved prominence as an educator and in his service to the Federal Government. He was Chief Scientist of the U.S. Air Force from 1955 to 1956 and was a member of the Advisory Panel to the House of Representatives Committee on Science and Astronautics from 1959 until 1972. He was a member of the President's Commission on the Patent System from 1965 to 1967 and Chairman of the Commission' Ad Hoc Science Panel. Dr. Stever also has headed many other aeronautical and scientific advisory committees at the Federal level.

Professionally, Dr. Stever has specialized in aeronautical, missile, and space-craft engineering, design, and performance, particularly aerodynamics; radiation physics; scientific and engineering education; university administration; and science policy, with principal contributions in the fields of high speed flows of compressible fluids and control and guidance of flight vehicles. He is best known for his work on condensation phenomena in high speed flows and the growth of the boundary layer behind a shockwave. He has pioneered in missile guidance, and increased our understanding of the stability and control of transonic aircraft.

As an internationally-known expert on aeronautical engineering and space technology, Dr. Stever has often been honored for his work in both fields and for his service to the Government. He is a member of the National Academy of Sciences, National Academy of Engineering (Chairman, Aeronautical and Space Engineering Board, 1967-1969), Institute of Aeronautical Sciences (Vice-President, 1957-1959; President, 1960-1962), American Physical Society, American Institute of Aeronautics and Astronautics (Fellow), American Academy of Arts and Science, Royal Aeronautical Association, American Association for the Advancement of Science, Phi Beta Kappa, and other organizations.

Dr. Stever received his A.B. from Colgate University in 1938 and his Ph. D. degree in physics from California Institute of Technology in 1941. He has received 15 honorary degrees and other honors, including the President's Certificate of Merit, 1948; Exceptional Civilian Service Award, U.S. Air Force, 1956; Scott Gold Medal, American Ordnance Association, 1960; Distinguished Public Service Medal, Department of Defense, 1968. He was named Pittsburgh's "Man of the Year" by the Junior Chamber of Commerce in 1966 and was appointed an Honorary Councilor of the Superior Council for Scientific Research of Spain in 1975.

He is the author of more than 56 published articles, papers, or chapters on scientific, technical, educational, and science policy matters.

Dr. Stever, who was born in Corning, New York, in 1916, is married to the former Louise Risley Floyd. They have two daughters, Sarah Newell and Margarette Risley, and two sons, Horton Guyford, Jr. and Roy Risley.

STATEMENT OF DR. H. GUYFORD STEVER, CHAIRMAN, FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY; DIRECTOR, NATIONAL SCIENCE FOUNDATION AND SCIENCE ADVISER TO THE PRESIDENT

Dr. STEVER. Mr. Thornton and Mr. Myers, as you are aware, we are in a phase of transition and I'm not sure I am wearing any hat. [Laughter.]

Nevertheless, let me take the opportunity to discuss with you today the coordination of research and development activities in the Federal Government.

Last April, you will recall, I appeared before this subcommittee to comment on the relationship between R. & D. and our national economy. From background material and testimony presented at those hearings, I think we all would agree that the U.S. economy has benefited greatly from R. & D. in terms of economic growth and national productivity.

But as I emphasized at that time, the future will require even better coordination within Government as well as increasing cooperation among Government, industry, universities, and the general public. Therefore, I believe your hearings this week to review broadly R. & D. conducted by all departments and agencies of the Federal Government, focusing particularly on existing mechanisms for coordination, can be extremely useful and particularly timely.

I am testifying before you today from the viewpoint of my role as Chairman of the Federal Council for Science and Technology since 1973 when I was designated Science Adviser by the President. You are, of course, familiar with the history of the FCST. I have with me today the current and recent Executive Secretaries of the Federal Council, Dr. William C. Bartley and Dr. Russell C. Drew, who will assist in responding to any questions that you may have about the operation of the FCST.

Mr. Chairman, just let me take a slight digression. When I was appointed Science Adviser in addition to my role as Director of the National Science Foundation, there was a period in which I, and several of my colleagues in the Executive branch, looked at the work of the Federal Council for Science and Technology to see if in fact we would recommend that it be continued. There was a thought that a smaller council might be better, and in fact within the halls of the administration a lot of the criticisms of the Federal Council were voiced in those discussions.

We finally concluded that we should continue the Federal Council for Science and Technology but that we should look at all of its functions and all of its committees. In fact, we had a—I will not call it an exercise, but an operation in which every one of the committees and subcommittees of the Federal Council as it existed before came to defend their existence.

As I listened to Mr. Staats, it was quite interesting that among the different groupings of Federal Council committees actively each defended its existence on different bases, some that he mentioned—some argued essentially for keeping an awareness amongst agencies of what was going on; some of the ad hoc types argued that they were addressing an important issue that would come and go.

Mr. THORNTON. I am very interested in this. I take it that informally there does continue an effort to analyze and see how well programs are working within the Executive branch and to make decisions. It seems to me that this is what we are struggling toward in our Special Oversight over science research and development, to get a handle on how decisions are made and how structures can be improved and how you can accomplish policies.

Is it informal, Dr. Stever?

Dr. STEVER. Yes, relatively informal. Certainly, it was informal at that time, because we were being quite critical of ourselves, all of us being previous members of the Federal Council on Science and Technology. The Federal Council, which was started back in about 1959, was reexamined in 1972, not perhaps as broadly as it was examined before it was established. But it was then decided to reestablish it for the need was felt—although different people had quite different ideas on how it should operate. As you know, within the near future we will be putting into place within the Executive Office of the President a new Office of Science and Technology Policy established by the National Science and Technology Policy Organization and Priorities Act of 1976, Public Law 94-282, signed by the President on May 11, 1976.

Title IV of that law establishes on a statutory basis the Federal Coordinating Council for Science, Engineering and Technology (FCCSET). So, it has had two or three examinations and each time it has been given rebirth. Perhaps this is something that we should note because this gives added strength to arguments that it has a continuing strength.

Mr. THORNTON. Which withstands criticisms directed to it even though the criticisms have some validity?

Mr. STEVER. Yes.

The law abolishes the Federal Council for Science and Technology (FCST), established by Executive order in 1959. We are again in a transition state. The FCCSET has not been established yet, and the FCST is continuing to work informally. A number of our active subcommittees continue.

While the new Council remains purely advisory in nature and involves no exercise of authority over the agencies, whose participation is governed by their applicable statutes, the change is significant when viewed in the total context of Public Law 94-282.

Let me emphasize, Mr. Chairman, that the membership of the FCCSET is mandated, its activity is placed in the framework of a new articulation of national policy goals for science and technology, and the advisory mechanism is established in the Executive Office of the President. Engineering and technology clearly become more important elements of the Council's mandate. I am quite sure that you and other Members of Congress have felt the need for the engi-

neering community to have more visibility in all of the science structure of the Federal Government.

I think these are appropriate changes, especially when we consider the evolution of federally sponsored R. & D. during the 1960's and 1970's and the newer developments in the civilian mission agency programs.

The Director of the new OSTP, who shall also serve as Chairman of FCCSET, will no doubt wish to review carefully the record of the FCST as he works with designated representatives from the member agencies in planning the work of the new FCCSET. I am certain that the analyses, comments and suggestions presented in these 3 days of oversight hearings, as well as the Congressional Research Service study of the FCST commissioned by your committee, will be invaluable in organizing an effective FCCSET.

A review of the effectiveness of the Federal Council for Science and Technology can provide us some useful lessons and a better understanding of what can be accomplished with this type of inter-agency coordinating mechanism.

Let me say parenthetically that I have seen a draft of the report and have been very interested in one or two of the comments. One of the comments I believe in the draft is that there is no visibility, the Federal Council for Science and Technology has no telephone number in Washington. You do have to call the National Science Foundation and ask for somebody there, although FCST has been listed consistently in the U.S. Government Manual, so there is not a great deal of visibility.

On the other hand, it is noted that the attendance at the meetings is better than it was before. Now I don't know what the significance of this is. I have a suspicion that it is because there are actually fewer meetings, the meetings being scheduled, with the exception of some annual plenaries, only when we have a problem rather than on a regular basis. A regular basis meeting schedule may tempt everyone to send his assistant.

From the review before setting up an FCCSET structure I hope would come:

1. An improved understanding of what we mean by coordination as it relates to the work of the agencies of the executive branch and an advisory mechanism such as the Federal Council.

2. Some criterion for the kinds of Federal R. & D. activities most effectively coordinated through a "Federal Council" mechanism. I note Mr. Staats made the point that there were differences.

3. Some guidelines suggesting those kinds of Federal R. & D. programs inappropriate for use of the Federal Council mechanism.

For example, when we review the history of FCST, we find that this mechanism for "coordination" of interagency R. & D. programs was most effective when operated at the "macro" level rather than at the "micro" level. A group made of policy-rank agency representatives is not likely to be particularly effective at sitting down and designing a detailed scientific research program. This is the sort of thing that should be undertaken by scientists and program managers and their advisory groups within the agencies, with advice from other sources, including the National Academy of Sciences and the National Acad-

emy of Engineering, and a host of universities and industries and so on. What a group like this can do, however, is to orchestrate a program among the key R. & D. Federal agency players.

What kinds of Federal R. & D. are most effectively coordinated through a Federal Council mechanism? I believe that examination of the history of the Federal Council will show greatest effectiveness in the following:

Securing voluntary agreement among agencies on general principles for the management of R. & D.

Dealing with issues or functional areas in which there is a need to ascertain the possible contribution of various agencies' R. & D. efforts.

By the way, Mr. Chairman, I believe that to be particularly important. Every now and then, problems—both small and large—have come to me in the last 2 or 3 years in my role as Science Adviser in which I said we better get some people together to coordinate a solution and determine who the players are, I would then get information that agency A, B and C should be brought together; but it always turned out, where we notified the FCST that we were getting together on a given problem, more agencies would turn out at the meeting and we would discover more agencies with an interest in that problem and with capability. So, the FCST, through its very existence acted as a communications link to tell people when a problem was being discussed and was actually "catalytic" in its role as coordination mechanism.

Mr. THORNTON. It sounds as if it may be invisible to a casual observer but not necessarily to those people who are really concerned.

Dr. STEVER. I was always amazed that in spite of people's expressed concern regarding the Council's effectiveness, at FCST meetings there always turned out to be a larger attendance and interest than one would have expected when the meeting was called.

I think that history will show also great effectiveness of FCST in:

Dealing with issues or functional areas in which the multi-agency council mechanism can make a contribution of a kind not available through an individual or two-agency approach.

Dealing with issues for which several agencies are responsible for large pieces of the overall program, but no agency has or could logically be assigned the sole responsibility for program coordination. (Such an issue, by the way, before an ERDA was started, would have been energy R. & D. No agency had everything there, but clearly now one does.)

Dealing with a planning frame for a set of issues for which the R. & D. is lengthy, involving substantial long-term commitments, expensive facilities or other support activities, and large experiments, such as in astronomy.

Dealing initially with problems that lack sufficient cohesion and visibility to be adequately addressed in the normal course of governmental affairs without some focus at the interagency level.

Throughout its history, the FCST and its chairmen have had to address these. Their judgments have resulted in the development of a mixed strategy of continuing committees, ad hoc committees, and sub-

committees of the FCST. In recent years, with a growing range of federally sponsored R. & D., the effectiveness of ad hoc committees has seemed especially evident. This is something that Mr. Staats pointed out when he was testifying.

There are three areas that seem particularly appropriate for the ad hoc kind of task force that we have organized in the past under the Federal Council. These would include the following kinds of problems:

The policy issue requiring substantial R. & D. input for its solution. Typically this is the kind of problem demanding a new type of Federal scientific, engineering or technological response. Often, after a period of time, other arrangements are established for program coordination and policy response.

Mr. Chairman, we established a Committee on an International Geodynamics Project. We also established one on the International Magnetospheric Study. These are two areas in which the science community around the world began to bubble and boil a little hotter because of progress made in the field and they wanted more coordination. They wanted a mechanism of getting together, and so we established an ad hoc committee to help bring them together.

Another problem item to be handled on an ad hoc basis is issues for which the policy response must be produced in a relatively short period of time. These would exclude problems that normally would fall within the jurisdiction of an already existing Federal Council subcommittee or other appropriate interagency group.

Here, we have the example of IMOS, Task Group on the Inadvertent Modification of the Stratosphere. The Interagency Coordinating Committee on Astronomy was another that was brought in as an ad hoc arrangement.

Mr. THORNTON. Those are quite different in complexity and degree of cooperation; are they not?

Dr. STEVER. Yes. The Interagency Coordinating Committee on Astronomy had a particularly difficult ad hoc problem. In recent times when it became clear that the Department of Defense could no longer justify and support the Sacramento Peak Solar Observatory, a superb scientific facility. And so we got a committee together to look at it and we moved and got outside help. And that has been transferred now to NSF with participation by NASA and by ERDA in this operation.

And there are cases of problems, cases where other branches of the Government, legislative or judicial, are heavily involved in the problem or program in such a way as to require coordinated Executive branch response at a high level.

For example, the drafting of the omnibus administration bill on Government patent policy is the kind of thing and we did this through the FCST Committee on Government Patent Policy.

There are also categories of problems and issues of an interagency nature that are more effectively handled through other governmental coordinating mechanisms. These would include:

The ongoing planning and specific conduct of R. & D. programs that have clear delineation in agency programs and budgets. These are quite probably best coordinated through the usual formal and informal planning and budget mechanisms involving the agencies and OMB.

The Federal energy program and the space program are examples. Programs, where only two or three mission agencies are involved, which can be more effectively handled on a two-agency basis or through the leadership of a single agency.

I think the Committee on RANN Coordination or Earthquake Mitigation would be good examples.

A subject area of insufficient importance to warrant attention at the Federal Council level. Such an area can be coordinated more informally or by some other type of interagency advisory council or task force.

The new FCCSET and its Chairman will have to address the question of committee or task group structure. FCST experience indicates that discipline-oriented interagency committees like the Interdepartmental Committee on Atmospheric Sciences (ICAS) and the Interagency Committee on Marine Science and Engineering (ICMSE), can deal effectively with interagency scientific issues, either directly or through the use of subcommittees for specific items of interest, for example weather modification and the status of research ships.

However, when issues broaden and when they involve many disciplines the problem becomes more difficult. This is particularly apparent when more than one broad scientific field is touched. A current example of such a problem is the inadvertent modification of the stratosphere.

The Interagency Task Force on the Inadvertent Modification of the Stratosphere (IMOS) presents an excellent example of how to attack and successfully solve a multidisciplinary interagency issue. IMOS is also an example of an ad hoc interagency effort in which the Federal Council provided a vehicle for effective response to a specific science policy problem. This group was created jointly in January, 1975, by Dr. Russell Peterson, Chairman of the Council on Environmental Quality and myself as Chairman of the Federal Council. A copy of its charter is submitted with this testimony for your information. It was created specifically in response to the growing concern within Government, industry and the scientific community over the hypothesis first published 6 months earlier that emission to the atmosphere of certain fluorocarbons used primarily in air conditioning and refrigeration and as aerosol propellants might be contributing to a reduction of the Earth's protective ozone layer.

The IMOS acts as a broad-based committee for the development of basic policy recommendations. It is composed of agency representatives from such diverse fields as chemistry, economics, medicine, international affairs, law, agriculture, and atmospheric science. The goals and approaches inherent in these areas are understandably widely divergent; it would therefore be expected that agreement would be difficult to achieve on even the most basic ideas under normal circumstances and procedures. However, IMOS has been able to reach agreements and compromises and to form useful recommendations.

At a less intense level and wholly in a field of basic research, the Interagency Coordinating Committee on Astronomy (ICCA) is an example of another kind of coordinating problem that can be effectively addressed by an ad hoc Federal Council group. As mentioned above, this committee contributed to a Federal-wide review and interagency transfer of the Sacramento Peak Solar Observatory from the

Air Force to NSF, after the Department of Defense determined that it could no longer provide full-time support of this facility.

A key to an effective task force for a multidisciplinary interagency issue lies in the selection of its leadership. In the disciplinary or functionally focused committee such as the ICAS, the members are generally motivated by their common experience, education, and training, and therefore tend to have common interests and goals.

In the multidisciplinary committee, goals are frequently so diverse that in many instances they appear to conflict. And in cases where science and technology are parts of complex public policy issues, only the most skillful and patient leadership can bring these goals into harmony. I have no prescriptions concerning leadership. It is a continuing and fundamental problem in public service.

I believe that we will want to use more and more an ad hoc task group mode of operation like IMOS for addressing Federal R. & D. problems that require multiagency coordination. However, there is also a need to use some "standing" committees—although they may be established as ad hoc groups and reviewed annually—to provide continuing overview in a number of areas.

One cannot deny that a main strength of the Council in the past has been its committee structure and the leadership of the various committee chairmen. There are many examples of other FCST standing committee activities, but I will not go through what I have mentioned in the prepared testimony.

Mr. THORNTON. Without objection, the testimony as presented has been made a part of the record.

Dr. STEVER. I will not take time to discuss all of the committees, but I will jump to the conclusion. There are, however, emerging Federal R. & D. tasks and issues for which FCST does not have a currently active group. For example, a Committee on Scientific and Technical Information (COSATI), formerly was active under FCST for more than a decade, 1962 to 1973, with the primary objective of developing a coordinated but decentralized scientific and technical information system for scientists and engineers and other technical professions. Public Law 94-282 specifically calls for the Federal Government to promote prompt, effective, reliable, and systematic transfer of scientific and technological information. I would think that a group concerned with science information coordination would be logical under the new FCCSET.

Also, the FCST established in 1959, upon recommendation of the President's Science Advisory Committee, the International Committee concerned with the U.S. Government participation in and support of international scientific activities. It was decided in June 1973, that this committee would be discontinued as a committee of the FCST and that its responsibilities should be assumed by the Department of State.

It was agreed, however, that the FCST should continue to keep abreast of international developments and that ad hoc committees on specific international science and technology issues could be set up by the FCST whenever the need for such committees is demonstrated. This would provide, when appropriate, recommendations to the Council on such matters as opportunities to further international sci-

tific cooperation—including support for international scientific programs—official U.S. participation in science programs on intergovernmental organizations, and the general rationale for support of research outside the United States by Federal agencies. The need for an FCCSET international committee should be reviewed.

Mr. Chairman, as I look back over my own experience as Chairman of the FCST, I think it fair to say that it has contributed a great deal to our consideration of problems in which science and technology have become involved. A hallmark of the FCST of which I have had growing appreciation is its organizational flexibility—it has been an organization that has been able to evolve and change. The role of science and technology in the formation of public policy is growing steadily more complex; indeed, as I see it, the trend to complexity demands a greater—certainly not a lesser—degree of flexibility than has been available to us in the more recent past.

Consider, for a moment, a few of the areas in which science and technology now are being asked to contribute new knowledge and workable solutions. A partial list ranges all the way from economics and environment to food and climate to political stability and nuclear power. Obviously, the Federal role in science and technology is expanding perceptibly from its former concentration upon military and space science to greater efforts in areas of both domestic and world concern.

In this context, I have found the FCST's contributions to the Chairman and Science Adviser to be most helpful, and I expect the new FCCSET to be equally valuable to the Science Adviser and the Executive Office of the President.

This concludes my prepared testimony, Mr. Chairman, and I will be pleased to answer any questions you may have.

[The complete prepared statement of Dr. Stever is as follows:]

PREPARED STATEMENT OF DR. H. GUYFORD STEVER, SCIENCE ADVISER TO THE
PRESIDENT AND DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. Chairman and Members of the Subcommittee: I am happy to have this opportunity to discuss with you today the coordination of research and development activities in the Federal Government. Last April, you will recall, I appeared before this Subcommittee to comment on the relationship between R&D and our national economy. From background material and testimony presented at those hearings, I think we all would agree that the United States economy has benefited greatly from R&D in terms of economic growth and national productivity. But, as I emphasized at that time, the future will require even better coordination within government as well as increasing cooperation among government, industry, universities and the general public. Therefore, I believe your hearings this week to review broadly R&D conducted by all departments and agencies of the Federal government—focusing particularly on existing mechanisms for coordination—can be extremely useful and particularly timely.

I am testifying before you today from the viewpoint of my role as Chairman of the Federal Council for Science and Technology since 1973 when I was designated Science Adviser to the President. You are, of course, familiar with the history of the FCST. I have with me today the current and recent Executive Secretaries of the Federal Council, Mr. William C. Bartley and Dr. Russell C. Drew, who will assist in responding to any questions that you may have about the operation of the FCST.

Within the very near future we will be putting into place in the Executive Office of the President a new Office of Science and Technology Policy (OSTP) established by the National Science and Technology Policy, Organization and Priorities Act of 1976, Public Law 94-282, signed by President Ford on May 11,

1976. Title IV of that law establishes on a statutory basis the Federal Coordinating Council for Science, Engineering and Technology (FCCSET). The law abolishes the Federal Council for Science and Technology (FCST), established by executive order in 1959. While the Council remains purely advisory in nature and involves no exercise of authority over the agencies whose participation is governed by their applicable statutes, the change is significant when viewed in the total context of P.L. 94-282.

Let me emphasize, Mr. Chairman, that the membership of the FCCSET is mandated, its activity is placed in the framework of a new articulation of national policy goals for science and technology, and the advisory mechanism is established in the Executive Office of the President. Engineering and technology clearly become more important elements of the Council's mandate. These are appropriate changes, especially when we consider the evolution of Federally sponsored R&D during the 1960's and 1970's and the newer developments in the civilian mission agency programs.

The Director of the new OSTP, who shall also serve as Chairman of FCCSET, will no doubt wish to review carefully the record of the FCST as he works with designated representatives from the member agencies in planning the work of the new FCCSET. I am certain that the analyses, comments, and suggestions presented in these three days of oversight hearings, as well as the Congressional Research Service study of the FCST commissioned by your committee, will be invaluable in organizing an effective FCCSET.

A review of the effectiveness of the Federal Council for Science and Technology can provide us some useful lessons and a better understanding of what can be accomplished with this type of interagency mechanism. From this review I would hope would come:

(1) An improved understanding of what we mean by "coordination" as it relates to the work of the agencies of the Executive Branch and an advisory mechanism such as the Federal Council.

(2) Some criteria for the kinds of Federal R&D activities most effectively coordinated through a "Federal Council" mechanism,

(3) Some guidelines suggesting those kinds of Federal R&D programs inappropriate for use of the Federal Council mechanism.

For example, when we review the history of FCST, we will find that this mechanism for "coordination" of interagency R&D programs was most effective when operated at the "macro" level rather than at the "micro" level. A group made of policy-rank agency representatives is not likely to be particularly effective at sitting down and designing a *detailed* scientific research program. This is the sort of thing that should be undertaken by scientists and program managers and their advisory groups within the agencies, with advice from other sources, including the National Academy of Sciences and the National Academy of Engineering. What a group like this can do, however, is to orchestrate a program among the key R&D Federal agency players.

What kinds of Federal R&D are most effectively coordinated through a Federal Council mechanism? I believe that examination of the history of the Federal Council will show greatest effectiveness in the following:

Securing voluntary agreement among agencies on general principles for the management of R&D.

Dealing with issues or functional areas in which there is a need to ascertain the possible contribution of various agencies' R&D efforts.

Dealing with issues or functional areas in which the multi-agency council mechanism can make a contribution of a kind not available through an individual or two-agency approach.

Dealing with issues for which several agencies are responsible for large pieces of the overall program, but no one agency has or could logically be assigned the sole responsibility for program coordination.

Dealing with a planning time frame for a set of issues for which the R&D is lengthy, involving substantial long-term commitments, expensive facilities or other support activities, and large experiments, such as in astronomy.

Dealing initially with problems that lack sufficient cohesion and visibility to be adequately addressed in the normal course of governmental affairs without some focus at the interagency level.

Throughout its history, the FCST and its Chairmen have had to address these. Their judgments have resulted in the development of a mixed strategy of continuing committees, ad hoc committees, and subcommittees of the FCST. In

recent years, with a growing range of Federally sponsored R&D, the effectiveness of ad hoc committees has seemed especially evident.

There are three areas that seem particularly appropriate for the ad hoc kind of task force that we have organized in the past under the Federal Council. These would include the following kinds of problems:

The policy issue requiring substantial R&D input for its solution. Typically this is the kind of problem demanding a new type of Federal scientific, engineering or technological response. Often, after a period of time, other arrangements are established for program coordination and policy response.

Issues for which the policy response must be produced in a relatively short period of time. These would exclude problems that normally would fall within the jurisdiction of an already existing Federal Council subcommittee or other appropriate interagency group.

Cases where other branches of the government (Legislative or Judicial) are heavily involved in the problem/program in such a way as to require coordinated Executive Branch response at a high level.

There are also categories of problems and issues of an interagency nature that are more effectively handled through other governmental coordinating mechanisms. These would include:

The ongoing planning and specific conduct of R&D programs that have clear delineation in agency programs and budgets. These are quite probably best coordinated through the usual formal and informal planning and budget mechanisms involving the agencies and OMB.

Programs—where only two or three mission agencies are involved—which can be more effectively handled on a two-agency basis or through the leadership of a single agency.

A subject area of insufficient importance to warrant attention at the Federal Council level. Such an area can be coordinated more informally or by some other type of interagency advisory council or task force.

FCCSET and its Chairman will have to address the question of committee or task group structure. FCST experience indicates that discipline-oriented interagency committees like the Inter-departmental Committee on Atmospheric Sciences (ICAS), and the Interagency Committee on Marine Science and Engineering (ICMSE), can deal effectively with interagency scientific issues, either directly or through the use of subcommittees for specific items of interest, e.g. weather modification and the status of research ships. However, when issues broaden and when they involve many disciplines the problem becomes more difficult. This is particularly apparent when more than one broad scientific field is touched. A current example of such a problem is the inadvertent modification of the stratosphere.

The Interagency Task Force on the Inadvertent Modification of the Stratosphere (IMOS) presents an excellent example of how to attack and successfully solve a multi-disciplinary interagency issue. IMOS is also an example of an *ad hoc* interagency effort in which the Federal Council provided a vehicle for effective response to a specific science policy problem. This group was created jointly in January, 1975 by Dr. Russell Peterson, Chairman of the Council on Environmental Quality, and myself as Chairman of the Federal Council. (A copy of its charter is submitted with this testimony for your information.) It was created specifically in response to the growing concern within government, industry and the scientific community over the hypothesis first published six months earlier that emissions to the atmosphere of certain fluorocarbons used primarily in air conditioning and refrigeration and as aerosol propellants might be contributing to a reduction of the earth's protective ozone layer.

The IMOS acts as a broad-based committee for the development of basic policy recommendations. It is composed of representatives from such diverse fields as chemistry, economics, medicine, international affairs, law, agriculture, and atmospheric science. The goals and approaches inherent in these areas are understandably widely divergent; it would therefore be expected that agreement would be difficult to achieve on even the most basic ideas under normal circumstances and procedures. However, IMOS has been able to reach agreements and compromises and to form usable recommendations.

At a less intense level and wholly in a field of basic research, the Interagency Coordinating Committee on Astronomy (ICCA) is an example of another kind of coordinating problem that can be effectively addressed by an ad hoc

Federal Council group. This committee contributed to a federal-wide review and interagency transfer of the Sacramento Peak Solar Observatory from Air Force to NSF, after the Department of Defense determined that it could no longer provide full-time support of this facility.

A key to an effective task force for a multi-disciplinary interagency issue lies in the selection of its leadership. In the disciplinary or functionally focused committee such as the ICAS, members are generally motivated by their experience, education and training, and therefore tend to have common interests and goals. In the multidisciplinary committee, goals are frequently so diverse that in many instances they appear to conflict. And in the cases where science and technology are parts of complex public policy issues, only the most skillful and patient leadership can bring these goals into harmony. I have no prescriptions concerning leadership. It is a continuing and fundamental problem in public service.

I believe that we will want to use more and more an ad hoc task group mode of operation like IMOS for addressing Federal R&D problems that require multi-agency coordination. However there is also a need to use some "standing" committees—although they may be established as ad hoc groups and reviewed annually—to provide continuing overview in a number of areas. One cannot deny that a main strength of the council in the past has been its committee structure and the leadership of the various committee chairmen. Examples of other FCST standing committee activities include:

Interdepartmental Committee for Atmospheric Sciences (ICAS).—In addition to its continuous involvement in the fluorocarbon-ozone issue in recent months, the ICAS reviews and evaluates important federal activities in the atmospheric sciences. Among these have been the DOT Climatic Impact Assessment Program and High Altitude Pollution Program, the Cooperative Meteorological Rocket Network, the National Hail Research Experiment and other weather modification programs, and the International Magnetospheric Study. ICAS has published more than 20 major reports reviewing or recommending Federal R&D programs related to the atmospheric sciences. Currently ICAS and its several subcommittees are preparing plans for a coordinated national climate program and a national plan for upper atmospheric research in addition to more specific plans in the areas of stratospheric monitoring, stratospheric measurement and instrumentation systems, and an updated plan for fluorocarbon-related research.

Committee on Domestic Technology Transfer.—This committee developed the Directory of Federal Technology Transfer, a source book which describes the programs of 43 Federal agencies facilitating transfer of R&D results to state and local governments and to private industry. Approximately 5,000 copies are in circulation. The publication, its distribution, and the user reaction were described in detail in the report of the November, 1975 hearings of this Subcommittee. In a survey of recipients and users of the directory, 98 percent indicated the document satisfied a need; 89 percent found the value of the information and the format good to excellent. The Directory is now being revised and updated; the second edition will be available early in 1977. In this instance, the Federal Council acted as the focus for common interests of the participating agencies, and R&D "coordination" has occurred as an extension of this common interest.

Another kind of FCST role has involved the Committee Laboratories, which has looked into questions on R&D management. It has sponsored workshops where middle-management personnel from Federal and private sector laboratories discuss problems of mutual concern. These have been successful and will be continued. This committee also recently established within GSA a questionnaire/data bank system with the objective of keeping an up-to-date listing of available Federal laboratory space.

I will not take time to discuss all of the present FCST committees but there are equally important examples one could cite from current active work. (Attached is a full listing of FCST committees as of May 1976).

There are, however, emerging Federal R&D tasks and issues for which FCST has not had a currently active group. For example, a Committee on Scientific and Technical Information (COSATI), formerly was active under FCST for more than a decade (1962-73) with the primary objective of developing a coordinated but decentralized scientific and technical information system for scientists and engineers and other technical professions. Public Law 94-282 specifically calls for the Federal government to promote prompt, effective, reliable and

systematic transfer of scientific and technological information. I would think that a group concerned with science information coordination would be logical under the new FCCSET.

Also, FCST established in 1959, upon recommendation of the President's science advisory committee, the international committee concerned with United States government participation in and support of international scientific activities. It was decided in June, 1973 that this committee would be discontinued as a committee of the FCST and that its responsibilities should be assumed by the Department of State. It was agreed, however, that the FCST should continue to keep abreast of international developments and that ad hoc committees on specific international science and technology issues could be set up by the FCST whenever the need for such committees is demonstrated. This would provide, when appropriate, recommendations to the council on such matters as opportunities to further international scientific cooperation (including support for international scientific programs), official United States participation in science programs on intergovernmental organizations, and the general rationale for support of research outside the United States by Federal agencies. The need for an FCCSET international committee should be reviewed.

Mr. Chairman, as I look back over my own experience as Chairman of the FCST, I think it fair to say that it has contributed a great deal to our consideration of problems in which science and technology have become involved. A hallmark of the FCST of which I have had growing appreciation is its organizational flexibility—it has been an organization that has been able to evolve and change. The role of science and technology in the formation of public policy is growing steadily more complex; indeed, as I see it, the trend to complexity demands a greater—certainly not a lesser—degree of flexibility than has been available to us in the more recent past.

Consider, for a moment, a few of the areas in which science and technology now are being asked to contribute new knowledge and workable solutions. A partial list ranges all the way from economics and environment to food and climate to political stability and plutonium power. Obviously, the Federal role in science and technology is expanding perceptibly from its former concentration upon military and space science to greater efforts in areas of both domestic and world concern.

In this context, I have found the FCST contributions to the Chairman and science adviser to be most helpful, and I expect the new FCCSET to be equally valuable to the science adviser and the Executive Office of the President.

This concludes my prepared testimony, Mr. Chairman. I will be pleased to answer any questions that you or members of the subcommittee may have.

Mr. THORNTON. Thank you very much, Dr. Stever, for your excellent testimony. I am pleased to hear that you want to recommend a review of the involvement of the FCCSET in the field of international exchanges of science information. It seems to me that that is an area of increasing attention and concern for our country. Some of our Nation's policies, patent policies, public disclosure of information developed through research, appear to have some inhibiting effects upon our exchange of information with other countries. Do you have any comment?

Dr. STEVER. You say "inhibiting." What I would say is that we deal with a whole host of countries which do things differently. As a consequence, the rules and regulations and the patterns and customs just do not come together.

The one you mention, the patent policy or the possession of intellectual knowledge, was one of the most difficult things to work out with the Soviet Union, for example, in establishing our exchange commissions with them. You will find other countries in which there is a much deeper involvement with the Federal Government in supporting the technology which goes into the industry associated with the production of products.

Now the United States does not have very much Federal support of the technology which goes into lots of products.

Mr. THORNTON. The private sector?

Dr. STEVER. That is correct. It does in some, for example, where the Government is the sole customer. In space and military, it obviously helps in the technology, whereas in many areas it does not. Other countries do that, and again we find an inequality or difference in the approach to problems.

I would say, I don't know that patent policies are always inhibiting; the effects can be quite different. Certainly we must understand them and learn to work under a new set of rules.

Mr. THORNTON. I suppose I was expressing a concern in those instances where it might be inhibiting.

Dr. STEVER. There are cases where it might be inhibiting, no question about it. Of course, this is also a characteristic which has grown. This characteristic of international exchange of science and technology has come to public attention in many different forms very rapidly over the last few years.

The energy crisis certainly brought it on—the increase in number of agreements we have with other countries, S&T is a medium of foreign exchange which we did not imagine 5 or 10 years ago.

Mr. THORNTON. There is a growing awareness, I believe, that our country does not necessarily command the lead in all areas of research.

Dr. STEVER. That is correct, yes. Again, I point out that I don't think that we have been sluggish in our R. & D. It is just that other countries have recognized the great importance of it and have put an immense effort into it. Small and large countries are very proud of their accomplishments.

Mr. THORNTON. You mentioned the growing arena, economics and environment, food and climate, political stability, plutonium power. It does seem to me that this arena is growing and there is increasingly a recognition of the vital role of science research and technology in connection with each of these problem areas. Is that also your perception?

Dr. STEVER. Yes, but there is the reverse of that coin too, and that is the increased recognition of the fact that science and technology cannot solve the problems by themselves. Essentially, I believe more and more we realize that science and technology mix into all the other kinds of activities of our civilization in a much more complete way than we had expected.

When the science and technology apparatus of this country was really centralized back in the 1950's, the principal problems were aimed right at space and military which had the characteristic of high performance and single customer, the Government is the customer, in which once a decision to proceed on a project was made, science and technology could take over as the principal feature. But that is not necessarily the case in so many of the things that science and technology is involved in today. It is much more involved with other aspects of our lives.

Mr. THORNTON. I suppose then the role of the Federal council with regard to other agencies might be a varying role, depending on the subject matter that is at issue in that particular analysis.

Dr. STEVER. Yes.

Mr. THORNTON. For example, generally, how do you conceive the proper relationships of the FCCSET relative to the OMB?

Dr. STEVER. I think the FCCSET—it is getting hard to get those initials in. It's a shame they couldn't have been more efficient to change something with the initials FCST to something with fewer initials rather than 50 percent more.

But the role of the FCCSET and of the new OSTP with the OMB I think should be a very strong one. In fact, the legislation indicates that it should. It has been my experience in the 3 years that I have served part time as science adviser that the OMB works pretty hard to understand and follow what the scientific groups in FCST or other groups of the science adviser put together. They do not always agree with them because they have the role of holding that budget together as a unit for the President and not simply one that is completely torqued by the science and technology issues involved.

Nevertheless, they are very anxious to be involved with it. For example, in a recent exercise on IMOS, let us take a particular one, it became clear that the first activities that were taken up by the IMOS committee were aimed at finding out what would happen to the stratosphere, the ozone in the stratosphere.

As you know, that still is an open issue, but a lot of the work focused on finding that out. But the issue of what harm would be done if the ozone did change substantially was not addressed as thoroughly. There are several different aspects of that. We all know the story about the increase in skin cancer. But the possible effect on all living systems, plants and so on, is not so well known. The long term effect on climate is still another unanswered question. And so out of one exercise grew still another: What are the effects as well as what are the results of the change, as well as what is the change itself? The OMB followed that very carefully and all of the agencies that could participate looked at their budgets and programs to see what kind of programs they had to contribute. It turns out that some things were filled in pretty well and some weren't. And so OMB now knows when the budgets are put together, if they are to tackle this particular problem, they have to make sure that certain things are taken care of.

Mr. THORNTON. Can you explain to me with regard to science policy matters, budgetary matters, how that communication is developed? Is it initiated by one party or the other, by OMB or by the science community?

Dr. STEVER. Quite often OMB asks a question of FCST or the science adviser or other units of the Executive Office.

Mr. THORNTON. Does it work in the opposite direction?

Dr. STEVER. Yes, you mean does OMB listen when a problem is brought?

Mr. THORNTON. The agency brings the problem.

Dr. STEVER. Certainly. In fact, the disposition of the solar observatory is a good example. The Air Force, in readjusting its programs, decided it would not support the solar observatory after a certain time and essentially went to OMB and said that was the case, subsequently, the OMB asked the science adviser to consider the problem and we got together a team to work on it, and it is solved at the present time. I think it is a good solution for our country.

Mr. THORNTON. What relationship exists between the FCCSET or its predecessor and the Domestic Council?

Dr. STEVER. There is an interaction. For instance, the domestic council asked the science adviser and the OMB to get together with the Domestic Council staff to look at the Federal Government's work in earthquake prediction and the problems of earthquake mitigation—engineering buildings and dams and so on to reduce damage. Hence the domestic council and OMB and the science adviser were all together in that. You know, Mr. Staats pointed out that once you get an organization like this going on some problems, some real issues, it brings people together and they suddenly know one another and then one doesn't have to go at problems quite the way he did before because there is this relatively easy interaction.

And all the people of OMB, the people in the science adviser's office, and the people in the Domestic Council at the staff level know one another. When there is a problem, they quite often talk informally.

Mr. THORNTON. What criteria do you consider in making a judgment of whether a particular research effort should be coordinated into a new agency where you center everything in one agency or where it should be done by a lead agency in cooperation with others, or simply have a coordinating function?

Dr. STEVER. I think it depends on a lot of things. It depends upon the relative magnitude of, say, one agency versus another. If there is a program involved with space, NASA has so much strength in space that it obviously often goes in that direction.

Mr. THORNTON. There are many instances where it is automatic?

Dr. STEVER. Yes.

In the field of oceans, however, I do not see it as being quite so automatic. One looks at the capabilities of several different agencies that work in ocean science and technology and the nature of the problem and one tries to figure out for each of these problems who should kind of take the lead.

Sometimes it should be a very formal setting of the lead and sometimes a less formal setting of the lead.

Mr. THORNTON. Dr. Stever, I don't know if you have had an opportunity to review the 13 questions that Mr. Staats included as an appendix to his testimony. They are comprehensive, broad policy type questions. If you would consent to do so, I would like to ask that you have an opportunity to respond to these questions, possibly in writing later, rather than going through them now, unless you see something that you would like to respond to.

Dr. STEVER. I think some of these are so embarrassing I would rather do it in writing. [Laughter.]

He has a very good understanding of the importance of FCST I think and so my comment should not be unfriendly. I noted one comment that he made though, and I have to call your attention to it. He implied that the new OSTP should be able to man and fund all of the activities of the new FCCSET. The old FCST was a fraternal organization in which various agencies chipped in, depending upon their interest in various problems. The biggest chip often came off the National Science Foundation because we were the smallest boy. [Laughter.]

We couldn't fight off the others. And, besides, we did have some funds added to our budget by the Congress. But in his noting that the new OSTP should staff and fund the activity of the FCCSET, that is not going to be too easy with the limitation of personnel that one has. I am not saying that the White House should have a larger operation, but Mr. Staats speaks from the power of an organization with 5,000 employees. The science advisor will speak from an organization with the power of 30 employees. So, it's not going to be easy to do that. I will call this to his attention. [Laughter.]

Mr. THORNTON. Out of a sense of fairness, would you like to suggest some questions that we might ask him? [Laughter.]

Dr. STEVER. Yes; I would.

You know, it is an interesting thing, I don't know when it is going to be solved in our Government, but I mentioned the emerging problem of science and technology information storage and exchange. He has established in science and technology an information bank, and I am sure recognizes that he should plan to participate in this; the Library of Congress is another such case. So when we reach the point of having a satisfactory handling of scientific and technological information storage and exchange in our country, it will be more than just an administration operation.

And so I think he will have to join that.

Mr. THORNTON. Dr. Stever, it is always a pleasure to have you appear before our subcommittee. We may have some questions that we would like to submit to you in writing at the conclusion of these hearings. There may be other areas of interest that will develop. If you would consent to do so, I would like to have permission to forward those to you.

Dr. STEVER. Yes; thank you.

Mr. THORNTON. The hearing is adjourned.

[Whereupon, at 11:50 a.m., the subcommittee was adjourned to resume at 10 a.m. on Wednesday, July 21, 1976.]

INTERAGENCY COORDINATION OF FEDERAL SCIENTIFIC RESEARCH AND DEVELOPMENT

Special Oversight Hearings

WEDNESDAY, JULY 21, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL
SCIENTIFIC PLANNING AND ANALYSIS,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Ray Thornton, chairman of the subcommittee presiding.

Mr. THORNTON. The hearing will come to order.

Our first witness this morning is Dr. Henry Lambricht who is director of the Science and Technology Policy Center at the Syracuse Research Corp., and who is a Professor of Political Science and Public Administrator at Syracuse University in Syracuse, N.Y.

Dr. Lambricht, I have enjoyed the privilege of getting to know you on a panel recently in Boston, and I appreciate the good testimony which you have prepared. I am looking forward this morning to reviewing with you the material with respect to this subject.

I am going to ask my colleague, Mr. Scheuer, if he will, to act as chairman of these hearings for a time to allow me to attend the floor of the House for business that I have over there. And I will return very shortly.

Mr. Scheuer?

Mr. SCHEUER. It is a pleasure to have you, Dr. Lambricht. Why don't you give us your testimony? Your full written testimony will be printed at this point in the record, so if you wish you may summarize or speak to us off the cuff at your pleasure.

[A biographical sketch of Dr. Lambricht is as follows:]

DR. W. HENRY LAMBRIGHT

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Date of Birth: July 9, 1939.

Marital Status: Married (Nancy Tuner Lambricht) : two children.

PRESENT POSITIONS

Professor, Political Science and Public Administration, The Maxwell School, Syracuse University.

Director, Science & Technology Policy Center, Syracuse Research Corporation.

EDUCATION

Ph.D. Columbia University, 1966; M.A. Columbia University, 1962; A.B. The Johns Hopkins University, 1961.

Honors: Outstanding Senior Award, Johns Hopkins University; International Fellow, Columbia University.

FIELD OF SPECIALIZATION

Science, technology, and public policy

PREVIOUS POSITIONS

Special Assistant, Office of University Affairs, National Aeronautics and Space Administration, 1970.

Assistant Director, Inter-University Case Program, Inc., 1966-1969.

Assistant Professor of Political Science, Syracuse University, 1966-1969.

Associate Professor of Political Science and Public Administration, Syracuse University, 1969-1976.

Guest Scholar, The Brookings Institution, 1965-1966.

PUBLICATIONS

Book

Governing Science and Technology, Oxford University Press, New York, N.Y. 1976.

Monographs

Shooting Down the Nuclear Plane, Bobbs-Merrill, 1967.

"Launching NASA's Sustaining University Program," I.C.P., 1969.

Articles and Chapters

"Government, Industry, and the Research Partnership: The Case of Patent Policy," *Public Administration Review*, May-June 1968.

"Womanpower: The Next Step in Manpower Policy," *Public Personnel Review*, January 1970.

"Weather Modification: The Politics of an Emergent Technology," *Proceedings of the 2nd National Conference on Weather Modification*, American Meteorological Society, 1970.

"Public Administration Is Public Policymaking," chapter in *Toward a New Public Administration*, San Francisco: Chandler, 1971.

"Public Administration and Science: A Changing and Problematic Relationship," chapter in *Public Administration in a Time of Turbulence*, Dwight Waldo, ed., San Francisco: Chandler, 1971.

"Government and Technological Innovation: Weather Modification as a Case in Point," *Public Administration Review*, January/February 1972.

"Technology Assessment and Weather Modification," *University of Southern California Law Review*, Spring 1972 (with Jack C. Oppenheimer).

"Using Universities: The NASA Experience," *Public Policy*, Winter 1972 (with Laurin L. Henry).

"Notes on Weather Modification and Public Policy," *Science and Public Policy Studies Group Newsletter*, August/September 1972.

"Federal Research Policy and University Governance," *Maxwell Review*, Syracuse University, Vol. 9, No. 1, Winter 1972-73 (with Albert H. Teich).

"ERTS: Notes on a Leisurely Technology," *Public Science*, August/September 1973.

"Policy Determinants of Weather Modification," *Proceedings of the 4th Annual Conference on Weather Modification*, American Meteorological Society, 1974 (with Edith B. Weiss).

"Technology Transfer as a Problem in Interorganizational Relationships," scheduled for publication in *Administration and Society*, summer 1976 (with Albert H. Teich).

"Terminating Federal Research and Development Programs," scheduled for publication in a special issue of *Policy Sciences*, summer 1976 (with Harvey M. Sapolsky).

"Organizations and Research," commissioned for publication in *The Handbook of Organizational Design*, William H. Starbuck, ed., Amsterdam, Holland: Elsevier Scientific Publishing Company (with Albert H. Teich).

Reports

"Science Policy and the Universities of the Empire State," prepared for the New York State Office of Science and Technology, 1969.

"A Study of Current and Proposed DOT Relationships with the Higher Education Community," prepared for the Department of Transportation, Summer 1971 (with John C. Honey).

"Innovating in Urban Mass Transportation Technology: Background for Launching of the Dial-A-Ride System," prepared for the Urban Mass Transit Administration, Department of Transportation, 1972.

Federal Laboratories and Technology Transfer: Institutions, Linkages, and Processes. Report on study for the National Science Foundation, March 1974 (with Albert H. Teich).

"The Transfer of Public Technology: A Critical Look." Issue paper prepared for the Commission on Critical Choices for Americans, August 1974 (with Albert H. Teich).

Redeploying Big Science: A Study of Diversification at Oak Ridge National Laboratory. Report on study for the National Science Foundation, September 1975 (with Albert H. Teich).

Basic Research and Federal Laboratories: Problems of Institutional Choice. Report on study for the National Science Foundation, December 15, 1975 (with Albert H. Teich and Paul J. Flynn).

Sponsor Diversification in Federal High Technology Laboratories. Report on study for the National Science Foundation, forthcoming (with Albert H. Teich).

Adoption and Utilization of Urban Technology: A Decision-Making Study. Report on study for the National Science Foundation, forthcoming.

Book Reviews

Review of *The Impacts of Snow Enhancement: Technology Assessment of Winter Orographic Snowpack Augmentation in the Upper Colorado River Basin*, compiled by Leo W. Weisbecker and Stanford Research Institute Associates (Norman, Oklahoma: University of Oklahoma Press, 1974) published in the *American Meteorological Society Bulletin*, Vol. 56, No. 11, November 1975.

Review of *The Brain Bank of America* by Philip M. Boffey (New York: McGraw-Hill, 1975) and *Advice and Dissent* by Joel Primack and Frank von Hippel (New York: Basic Books, 1974) published in *The Chronicle of Higher Education Review*, Vol. XI, No. 15, December 22, 1975.

Papers Delivered

"Weather Modification: The Politics of an Emergent Technology," delivered at the 2nd National Conference on Weather Modification, American Meteorological Society, 1970.

"Politics of Large-Scale Technological Programs: The Nuclear Airplane," delivered at the American Association for the Advancement of Science, 1970.

"Public Administration and Science: A Changing and Problematic Relationship," delivered at the American Political Science Association Convention, Fall 1969.

"Government and Technological Innovation: Weather, Modification as a Case in Point," delivered at the American Society for Public Administration National Conference, Spring 1971.

"Using Universities: The NASA Experience," delivered at the American Political Science Association Convention, Fall 1971.

"Technology Transfer as a Problem in Interorganizational Relationships," delivered at the American Society for Public Administration National Conference, 1974 (with Albert H. Teich).

"Policy Determinants of Weather Modification," delivered at the 4th Annual Conference on Weather Modification, American Meteorological Society, November 1974 (with Edith Brown Weiss).

"Technoscience Management and Institutional Change," delivered at the American Society for Public Administration National Conference, 1975 (with Albert H. Teich).

"The Adoption and Use of Urban Technology: Notes on Research in Progress," delivered at the American Society for Public Administration Conference, April 1976 (with Paul J. Flynn).

SELECTED OTHER ACTIVITIES

Member of Executive Committee, Syracuse University Energy Institute, February 1976—present.

Co-Chairman of panel, "State and Local Decision-Making and Energy Policy," American Political Science Association Convention, April 1976.

Principal Investigator, study of *Adoption and Utilization of Urban Technology: A Decision-Making Study*, sponsored by a grant from the National Science Foundation, 1975-77.

Co-Principal Investigator with Albert H. Teich, study of *Sponsor Diversification in Federal High Technology Laboratories*, sponsored by a grant from the National Science Foundation, 1974-76.

Discussant on panel, "The Evaluation of Federal Research," American Association for the Advancement of Science Conference, held in Boston, Mass., February 1976.

Chairman of panel, "International Consequences of Changes in Weather and Climate," International Studies Association 16th Annual Convention, February 1975.

Consultant to the Office of Planning and Policy Analysis, National Science Foundation, 1975.

Consultant to the Institute for Public Policy Alternatives, State University of New York, 1975.

Member of the Personnel Committee of the Department of Public Administration, Syracuse University, 1973-74; 1975-76.

Member of the Admissions Committee of the Department of Public Administration, Syracuse University, 1974-75; 1975-76.

Member of the Undergraduate Committee of the Department of Political Science, Syracuse University, 1974-75.

Principal Advisor, Department of Political Science, Syracuse University, 1972-74.

Member of the Committee on Science and Technology in Government, American Society for Public Administration, 1974-75.

Consultant to the Commission on Critical Choices for Americans, 1974.

Co-Principal Investigator with Albert H. Teich, study of *Federal Laboratories and Technology Transfer: Institutions, Linkages, and Processes*, sponsored by a contract from the National Science Foundation, 1973.

Consultant to the Division of Social Systems and Human Resources, National Science Foundation, 1973.

Discussant on panels, "Changing Public Administration: Intellectual Content and Institutional Contexts," and "Putting Science and Technology to Work in the Public Service," American Society for Public Administration Conference, 1973.

Chairman, Syracuse Committee on Non-Departmental Courses and Programs, Syracuse University, 1972-73.

Chairman of panels of the Science and Public Policy Studies Group, American Association for the Advancement of Science Convention, 1972.

Chairman of panel, "New Priorities in Science and Technology: Domestic R&D," American Society for Public Administration Conference, 1972.

Trustee, Science and Public Policy Studies Group, Inc., 1971-72.

Associate Director, Syracuse/NASA Program, Syracuse University, 1971.

Consultant to the Office of Public Understanding of Science and Intergovernmental Science Programs, National Science Foundation, 1971.

Consultant to the Department of Transportation, Summer 1971.

Consultant to the New York Office of Science and Technology, 1969.

Assistant Director, Inter-University Case Program, Syracuse University, 1966-69.

MEMBERSHIPS

American Association for the Advancement of Science; American Meteorological Society; American Political Science Association; American Society for Public Administration.

STATEMENT OF DR. W. HENRY LAMBRIGHT, PROFESSOR OF POLITICAL SCIENCE AND PUBLIC ADMINISTRATION, THE MAXWELL SCHOOL, SYRACUSE UNIVERSITY, AND DIRECTOR, SCIENCE AND TECHNOLOGY POLICY CENTER, SYRACUSE RESEARCH CORPORATION, SYRACUSE, NEW YORK

Dr. LAMBRIGHT. Thank you, Mr. Chairman, and members of the committee and members of the staff. It is an honor to be asked to testify on this important subject and I am delighted that John Holmfeld, a member of the staff, was able to reach me just as I was about to set sail on an airplane to the mountains of Tennessee. But he did reach me and I was able to prepare this testimony, and I am delighted to have the opportunity.

COORDINATING SCIENCE AND TECHNOLOGY IN THE EXECUTIVE BRANCH

Coordination. A wonderful word. Everyone is for it. No one admits to being against it. Coordination, the "motherhood" and "cherry pie" of Federal administrators, evokes the image of bureaucratic efficiency and effectiveness. Down with duplication. Down with redundancy. Up with the optimum use of the public's resources in pursuit of the public's goals. Up with coordination.

What is coordination? Mooney says coordination is no less than "the determining principle of organization, the form which contains all other principles, the beginning and end of all organized effort."

Seidman adds that coordination is concerted action, animated by common purpose, responding to recognized signals and utilizing practical skills. Coordination describes both a process, the act of coordination, and a goal: The bringing together of diverse elements into a harmonious relationship in support of common objectives."

If coordination is such a fine idea, why is there not more of it? Today's hearings suggest coordination is an ideal, still to be realized in science and technology. Why? Is it not obvious to all that coordination is in the public interest? Why does "A" not cooperate with "B" in pursuit of "C"? The answer may lie in ignorance or human perversity. More often it rests in the fact that "A" and "B" interpret "C" differently. Agencies, by law, are assigned various goals or missions. Those missions reflect the different, often conflicting, goals of Americans generally. We want industrial development—without pollution. We want energy, perhaps even nuclear power—but please, do not locate the power facility near us. Americans have multiple, contradictory goals, and our Government mirrors this fact. Moreover, since agencies are established piecemeal over time, goals tend to promote American interests of the past as well as present. Indeed, it may be the greatest coordinating problem of all to find room in such a past-oriented bureaucracy for research and development—R. & D.—on the new problems that have yet to emerge, and thus receive bureaucratic representation.

It is because agencies have different goals that they cannot reach consensus. If "A" and "B" start from different assumptions, they are not likely to agree on the meaning of "C." Under such conditions,

coordination takes place only when one coordinates and the other follows. All agencies prefer to coordinate and do not wish to be coordinated. What is in the coordinator's interest may not be in that of the coordinated. Nor, given the nature of Government, is it likely to be in the interest of those elements in Congress and society that support the agency to be coordinated.

So, there is much more talk than action about coordination, and this is too bad. Coordination does matter. Today's big Government has a multitude of giant agencies spending billions of dollars and making decisions that affect the life, liberty, and property of us all. Our stakes in the better management of bureaucracy are high. This is probably more true of science and technology than any other function. Science and technology are an investment in our future. We spend over \$20 billion in R. & D. How well are we directing the machinery that allocates that money? Does anyone know? Finding the answer to that question is, I am sure, one of the reasons for these hearings and the preparation of the Library of Congress background report.

It is not my purpose to duplicate what Government witnesses can do far better than I; namely, supply specific items about the work of the Federal Council for Science and Technology, FCST, Office of Science and Technology, OST, and Office of Management and Budget, OMB. As one from outside Government, I merely observe, as best I can, from the sidelines. Consequently, I will try to discuss the processes and problems of coordinating Federal science and technology in general, using illustrations involving these key actors to clarify my points.

I wish to comment on two approaches to coordination in the executive branch. I call these the horizontal and vertical strategies. Both involve informal and formal aspects. Coordination works most satisfactorily when both are used in tandem in pursuit of a reasonably clear goal.

THE HORIZONTAL APPROACH

The horizontal approach emphasizes coordination among peers. The great, great bulk of coordination that takes place in science and technology and virtually all other fields is of this kind. Most of it is invisible to all except those involved and concerns matters that are low voltage. One administrator calls another on the phone, or meets with him at a cocktail party, or exchanges an interoffice memo. This is the stuff of coordination at the horizontal level, and it makes the Government wheels move. Without it, there would be no action. It is possible because individuals can solve problems and keep organizational issues out of the line of fire. When organizations get involved, coordination becomes a counter in bureaucratic politics. Questions of power now enter. They generally determine how much coordination gets done, by whom, and over what.

This is well demonstrated by the long history of the National Science Foundation—NSF—as a horizontal coordinator. NSF was originally conceived as playing a central science role in the postwar design of Federal science and technology. But it took 5 years to get NSF off the ground, in 1950. By that time, the Defense Department, Atomic Energy Commission, and National Institutes of Health had all moved into territory NSF might have claimed. Thus, NSF was

left with legislative authority to coordinate national science policy, but little else. Realizing it could not stand up to its larger bureaucratic brethren, it chose to fill the gaps in science support among the other agencies' programs, coordinating, in effect, by becoming itself the coordinated.

In 1958, the National Aeronautics and Space Administration—NASA—appeared on the scene. By 1961, it had a mission to go to the moon and was beginning to flex its muscles. The Administrator of NASA decided that his agency should not only have a basic science program, but that it should provide institutional grants to universities around the country. NASA not only was getting into NSF's jurisdiction, it was also stepping considerably beyond. Naturally, NASA coordinated. NASA's method was to inform NSF of its decision to launch a university program. It then asked how NSF would help in implementing the NASA decision. Such is horizontal coordination among unequals.

NSF had what would be called, in the present vernacular, lead status in basic science and related graduate education. However, it meant little in actual day-to-day administrative work. Lead agency status, which often is designated by a vertical authority, means little unless it is backed up constantly.

One of the more lively fields of science and technology that cuts across several agencies today is weather modification. For years, there has been debate on who should take the lead in coordinating a national program. The peers cannot decide. The chief competitors are the Bureau of Reclamation in the Department of Interior, and National Oceanic and Atmospheric Administration (NOAA) in Department of Commerce. Study after study has shown that present weather modification activities are fragmented and subcritical in scale. All call for more coordination. Who is to coordinate? If Bureau of Reclamation coordinates, the program would reflect its mission, which is to deliver water to the arid West, and thus stress rainmaking. If NOAA has the program leadership, there would be a more balanced approach—fine for NOAA but not BuRec, and the important interests it represents.

Coordination among peers is easy where the stakes do not involve vital organizational interests. Where they do, it becomes very hard to achieve. What helps, sometimes, are formal mechanisms for agency discussion and negotiation of interests. Such entities as interagency committees are probably the most important institutional devices for coordinating across horizontal lines. The Federal Coordinating Council for Science, Engineering, and Technology—formerly the Federal Council for Science and Technology—is an example of such an interagency committee.

It is obvious that Government cannot function without interagency committees; however, they are much criticized. Seidman, for example, calls the interagency committee the "crab grass in the garden of Government institutions. Nobody wants them, but everyone has them. Committees seems to thrive on scorn and ridicule, and multiply so rapidly that attempts to weed them out appear futile."

The interagency committee is scorned because it brings into visibility the problems of coordination. Perhaps critics would just as soon have them hidden from view. If so, such problems would merely be

worse. The interagency committee at least allows problems to be discussed, if not decided, at regular meetings. Because they are formal institutions—and agencies do not wish to be excluded from formal institutions—they tend to involve all the parties necessary for coordinating an activity. Visibility, participation, regularity—these attributes have a potential for moving decisions forward. Interagency committees also are more likely to produce decisions that are equitable from the standpoint of smaller agencies than are those reached through ad hoc, informal bureaucratic bargaining.

Having given the positive side, it is necessary to show the negative. Interagency committees—the Federal Council included—are susceptible to three fatal diseases during the course of their lifetimes. Bailey calls these “confederationitis,” “progressive deputization,” and “implemental anemia.”

CONFEDERATIONITIS

Because agencies are peers, decisions tend to be made by consensus. Consensus decisions may be agreeable, and thus, workable; but they may not be very meaningful. They tend toward finding the lowest common denominator. Thus, instead of having one lead agency in a coherent national—but interagency—program, different agencies would take the lead—for whatever they were already doing. The interagency decision would merely legitimate their own choices.

PROGRESSIVE DEPUTIZATION

Interagency committees, to be effective, need policy-level people to attend their deliberations; but policy people are busy. Moreover, as in the case of the old Federal Council, subcommittees proliferate. Policy people cannot attend these subcommittee meetings which, as in Congress, often tend to be where the important work of the general body gets done. The policy-level administrator sends his deputy, who, in turn, sends a lower official. The lower official may, or may not, be an expert in the subject matter of the committee. In either event, he is too low in the hierarchy to be able to speak authoritatively in behalf of his agency.

IMPLEMENTAL ANEMIA

Interagency committees do not implement. Their member agencies do. Their staff and resources, if any, are the gifts of the members. Thus, interagency committees can decide, but they cannot execute their decisions. If an agency disagrees, the committee cannot coerce the agency.

There are limits to horizontal coordination. The approach works for many issues that divide agencies, but not for the most vital issues. For those issues, the second approach, vertical coordination, becomes necessary.

THE VERTICAL APPROACH

The vertical approach to coordination involves, directly or indirectly, the power and prestige of the President. The key vertical coordinators for science and technology have been Presidential staff agencies, particularly the Office of Management and Budget (OMB),

and the former Office of Science and Technology (OST). The latter, of course, is now resurrected with a slightly different name, the Office of Science and Technology Policy (OSTP).

Vertical coordination can take place either at the upper level of Presidential budgetmaking, or the lower of operational coordination. The second involves considerable intervention on the part of Presidential staff offices in the bureaucratic jungle. To the extent it is undertaken at all, however, its effectiveness derives less from the persuasiveness of staff operatives, and more from their association with the budget process. It was the perceived lack of such a proximity on the part of OST in the Nixon years that weakened that organization when it sought to become a vertical coordinator in the operating-level world.

With respect to the Presidential budget as a coordinating device, it should suffice to say that it is the most important single instrument that the President has for bringing coherence to executive branch activity. What the Jackson Subcommittee on National Policy Machinery stated in 1961 remains true today:

The American system provides no good alternative to reliance on the budget process as a means for reviewing the on-going activities of the departments and raising periodically for Presidential decision issues of effectiveness in actual performance.

The budget process has the effect of raising coordination to an issue of Presidential perspective. It provides at least the opportunity for him to relate on a governmentwide basis goals, priorities, allocation of resources, organizational structures, and administrative successes and failures.

The budget process does not assure coordination in science and technology. However, it does provide a vehicle by which crosscuts of Federal R. & D. as a whole can be discussed and integrated with decisions concerning the science and technology expenditures of specific agencies. The budget process is thus an important tool for coordination. It has the advantage also of being institutionalized. It permits attention to coordinated activity every year—as a routine.

There is a difference between budgetary coordination and operational coordination. It is one matter to coordinate budgets, and another to bring operating agencies and programs into line. This requires a very different kind of effort than budgeteering. It is one where the Office of Science and Technology Policy, backed by OMB, might take the lead.

Vertical intervention in operational programs must be pursued extremely selectively. The number of problems that could use vertical coordination are such as to absorb all the time of all the members of OSTP and OMB, and both of these offices have other tasks to accomplish. There are some who feel OST frittered away too much energy in firefighting. The trouble is that some firefighting is probably essential. The key is to distinguish the small from the large fires, those that can be contained at lower levels from those that require topside action.

Vertical coordination can accomplish some important functions. One is that of refereeing bureaucratic squabbles that are holding up programs of national significance. For example, in the early 1960's, NASA and the Weather Bureau were contesting over the readiness of weather

satellites for operations. NASA wished to push ahead toward the next generation of satellites, while Weather Bureau wanted to pause and deploy the system already developed. At issue was control of the weather satellite program. The Bureau of the Budget (BOB), OMB's predecessor, intervened. It sided with Weather Bureau and obtained an agreement between the two agencies. The agreement provided for a long-term, interagency relationship, in the weather satellite field and assured the use of the satellites earlier than otherwise would have been the case.

Another function that vertical coordination can achieve is that of expediter or broker. OMB and OST both were instrumental in helping the transfer of laboratory facilities from NASA to Department of Transportation, and from Army to NIH. In these instances, the parent agency had to dispose of the facility. Above-the-agency brokers could facilitate redeployment of the laboratories to new tasks for agencies that could use them. For those employed by the laboratories, the time of transfer, no doubt, was too long. Without help from the Executive Office, however, the movement of a major governmental facility from one agency to another would have been extremely difficult to achieve at all.

Finally, vertical coordinators can advocate certain programs that fall between existing agency missions but that may, nevertheless, be important to the Nation. Most new programs have difficulty getting started and are delayed interminably by prevailing agency power structures and commitments. The programs are stepchildren. They need help, allies. Given its role as institutional skeptic, OMB is not necessarily the best agency to be an advocate. But OSTP could play this role, and it is a role that is needed. However, such advocacy should be weighed carefully, and should clearly reflect not just an OSTP, but a Presidential decision that a given program needs encouragement and special attention. Otherwise, OSTP will find OMB skeptical of it. If OSTP cannot coordinate horizontally with OMB, it will not be able to coordinate vertically with anyone else.

CONCLUSION

Discussed have been two basic approaches to coordinating the Federal science and technology apparatus. Both are difficult to accomplish. What is involved in coordination is leadership toward common objectives that may not be obvious or even favorable to the interests of the parts. Moving an agency toward a common goal is difficult because agencies have constituencies in Congress and the public at large. Those constituent elements must be brought into concert along with the agencies. Coordination works best where it has the benefit of a convergence of horizontal and vertical pressures. Placing the Director of OSTP in charge of the Federal Coordinating Council would appear to combine vertical and horizontal approaches in a sensible way. What is elegant in theory may break down in practice, however.

Coordination presents many dilemmas. But what are the alternatives? One alternative is to do nothing. If each agency is permitted to go its own way, however, what sense does government, much less

democratic government, make at all? This is not an attractive course. Some critics take another direction. Despairing of bringing any coherence to particular fields with which they are concerned, they opt for major surgery. They do not cut elements, although they often begin by thinking they are doing that. Rather, they combine them into new agencies through reorganizations. A new agency can give the semblance of solution to difficulties of administrative fragmentation. If all the elements concerned with a given function are placed in an agency of their own, there is the appearance of coherence. In reality, what occurs is the shift, intraagency, of what had been an interagency problem. What was formerly an issue for President and Congress becomes one for the new agency head.

The real difficulty with this strategy is that it is a temporary solution at best. Once set up, the agency perpetuates itself and expands—becoming a part of future interagency problems for a President and Congress a few years down the road. There may be perfectly sound reasons for forming new agencies, relating to the desire to create concentrated bureaucratic power in order to promote certain functions. However, it should be realized that when a new, self-perpetuating agency is created, the overall governmentwide coordination problem is being exacerbated, not simplified. No solution to the current coordination problems in science and technology would be more illusory, for example, than launching a Department of Science and Technology. Such a department would create more problems than it would solve. Indeed, its success in concentrating R. & D. in one place might hurt the public interest. There is an argument to be made for decentralization in science and technology, for putting R. & D. in proximity to the mission agency needs. Overconcentration can be as bad as too much decentralization.

My own view is that a primary goal of any coordination effort would be to strengthen the science and technology programs of mission agencies in the civilian domestic sphere. We continue to do better, much better, at innovating weapons and space satellites than we do in housing and urban transit.

The horizontal and vertical strategies discussed are relatively conservative. They combine existing organizational elements in novel ways toward emerging goals. They do not create new permanent agencies that exercise yet additional claims on the Federal Treasury. They reflect a "steady state" philosophy that might well be applied generally to the executive branch, one in which we work toward organizational renewal rather than new organizations. The horizontal and vertical strategies would make use of existing resources with an eye toward flexibility and adaptability of structure.

Adaptability of administrative structure—that is what coordination ultimately is all about. It is a means to bring resources to bear on objectives. As objectives change, so the administrative tools must adjust, or be adjusted. The science and technology apparatus, so absorbed substantively in change, ought to be made a model of administrative flexibility. With executive leadership and congressional support, this kind of coordination may yet be achieved.

[The complete prepared statement of Dr. Lambright follows:]

PREPARED STATEMENT OF W. HENRY LAMBRIGHT, PROFESSOR OF POLITICAL SCIENCE AND PUBLIC ADMINISTRATION, MAXWELL SCHOOL, SYRACUSE UNIVERSITY AND DIRECTOR OF SCIENCE AND TECHNOLOGY POLICY CENTER, SYRACUSE RESEARCH CORP.

COORDINATING SCIENCE AND TECHNOLOGY IN THE EXECUTIVE BRANCH

Coordination. A wonderful word. Everyone is for it. No one admits to being against it. Coordination, the "motherhood" and "cherry pie" of federal administrators, evokes the image of bureaucratic efficiency and effectiveness. Down with duplication. Down with redundancy. Up with the optimum use of the public's resources in pursuit of the public's goals. Up with coordination.

What is coordination? Mooney says coordination is no less than "the determining principle of organization, the form which contains all other principles, the beginning and end of all organized efforts."¹ Seidman adds that coordination is concerted action, animated by common purpose, responding to recognized signals and utilizing practical skills. Coordination describes both a process, the act of coordination, and a goal: the bringing together of diverse elements into a harmonious relationship in support of common objectives."²

If coordination is such a fine idea, why is there not more of it? Today's hearings suggest coordination is an ideal, still to be realized in science and technology. Why? Is it not obvious to all that coordination is in the public interest? Why does "A" not cooperate with "B" in pursuit of "C"? The answer may lie in ignorance or human perversity. More often it rests in the fact that "A" and "B" interpret "C" differently. Agencies, by law, are assigned various goals or missions. Those missions reflect the different, often conflicting, goals of Americans generally. We want industrial development—without pollution. We want energy, perhaps even nuclear power—but please, do not locate the power facility near us. Americans have multiple, contradictory goals, and our government mirrors this fact. Moreover, since agencies are established piecemeal over time, goals tend to promote American interests of the past as well as present. Indeed, it may be the greatest coordinating problem of all to find room in such a past-oriented bureaucracy for research and development (R & D) on the new problems that have yet to emerge, and thus receive "bureaucratic representation."

It is because agencies have different goals that they cannot reach consensus. If "A" and "B" start from different assumptions, they are not likely to agree on the meaning of "C." Under such conditions, coordination takes place only when one coordinates and the other follows. All agencies prefer to coordinate and do not wish to be coordinated. What is in the coordinator's interest may not be in that of the coordinated. Nor, given the nature of government, is it likely to be in the interest of those elements in Congress and society that support the agency-to-be-coordinated.

So, there is much more talk than action about coordination, and this is too bad. Coordination does matter. Today's big government has a multitude of giant agencies spending billions of dollars and making decisions that affect the life, liberty, and property of us all. Our stakes in the better management of bureaucracy are high. This is probably more true of science and technology than any other function. Science and technology are an investment in our future. We spend over 20 billion dollars in R & D. How well are we directing the machinery that allocates that money? Does anyone know? Finding the answer to that question is, I am sure, one of the reasons for these hearings and the preparation of the Library of Congress background report.

It is not my purpose to try to duplicate what government witnesses can do far better than I; namely, supply specific items about the work of the Federal Council for Science and Technology (FCST), Office of Science and Technology (OST), and Office of Management and Budget (OMB). As one from outside government, I merely observe, as best I can, from the sidelines. Consequently, I will try to discuss the processes and problems of coordinating federal science and technology in general, using illustrations involving these key actors to clarify my points.

¹ James D. Mooney, "The Principles of Organization," in *Papers on the Science of Administration*, edited by Luther Gulick and L. Urwick, Institute of Public Administration, 1937, p. 93.

² *Ibid.*

I wish to comment on two approaches to coordination in the executive branch. I call these the horizontal and vertical strategies. Both involve informal and formal aspects. Coordination works most satisfactorily when both are used in tandem in pursuit of a reasonably clear goal.

The horizontal approach

The horizontal approach emphasizes coordination among peers. The great, great bulk of coordination that takes place in science and technology and virtually all other fields is of this kind. Most of it is invisible to all except those involved and concerns matters that are low voltage. One administrator calls another on the phone, or meets with him at a cocktail party, or exchanges an inter-office memo. This is the stuff of coordination at the horizontal level, and it makes the government wheels move. Without it, there would be no action. It is possible because individuals can solve problems and keep organizational issues out of the line of fire. Once that occurs, coordination becomes a counter in bureaucratic politics. Questions of power now enter. They generally determine how much coordination gets done, by whom, and over what.

This is well demonstrated by the long history of the National Science Foundation (NSF) as a horizontal coordinator. NSF was originally conceived as playing a "central science" role in the postwar design of federal science and technology. But it took five years to get NSF off the ground (in 1950). By that time, the Defense Department, Atomic Energy Commission, and National Institutes of Health had all moved into territory NSF might have claimed. Thus, NSF was left with legislative authority to coordinate national science policy, but little else. Realizing it could not stand up to its larger bureaucratic brethren, it chose to fill the gaps in science support among the other agencies' programs, coordinating, in effect, by becoming itself the coordinated.

In 1958, the National Aeronautics and Space Administration (NASA) appeared on the scene. By 1961, it had a mission to go to the moon and was beginning to flex its muscles. The Administrator of NASA decided that his agency should not only have a basic science program, but that it should provide institutional grants to universities around the country. NASA not only was getting into NSF's jurisdiction, it was also stepping considerably beyond. Naturally, NASA coordinated. NASA's method was to inform NSF of its decision to launch a university program. It then asked how NSF would help in implementing the NASA decision. Such is horizontal coordination among unequals.

NSF had what would be called, in the present vernacular, "lead" status in basic science and related graduate education. However, it meant little actual day-to-day administrative work. Lead agency status, which often is designated by a vertical authority, means little unless it is backed-up constantly.

One of the more lively fields of science and technology that cuts across several agencies today is weather modification. For years, there has been debate on who should take the "lead" in coordinating a national program. The peers cannot decide. The chief competitors are the Bureau of Reclamation in the Department of Interior, and National Oceanic and Atmospheric Administration (NOAA) in Department of Commerce. Study after study has shown that present weather modification activities are fragmented and sub-critical in scale. All call for more coordination. Who is to coordinate? If Bureau of Reclamation coordinates, the program would reflect its mission, which is to deliver water to the arid West, and thus stress rainmaking. If NOAA has the program leadership, there would be a more "balanced" approach—fine for NOAA but not BuRec, and the important interests it represents.

Coordination among peers is easy where the stakes do not involve vital organizational interests. Where they do, it becomes very hard to achieve. What helps, sometimes, are formal mechanisms for agency-discussion and negotiation of interests. Such entities as inter-agency committees are probably the most important institutional devices for coordinating across horizontal lines. The Federal Coordinating Council for Science, Engineering, and Technology (formerly the Federal Council for Science and Technology) is an example of such an inter-agency committee.

It is obvious that government cannot function without inter-agency committees; however, they are much criticized. Seidman, for example, calls the inter-agency committee the "crab grass in the garden of government institutions. Nobody wants them, but everyone has them. Committees seem to thrive on scorn and ridicule, and multiply so rapidly that attempts to weed them out appear futile."³

³ *Ibid.*, p. 171.

The inter-agency committee is scorned because it brings into visibility the problems of coordination. Perhaps critics would just as soon have them hidden from view. If so, such problems would merely be worse. The interagency committee at least allows problems to be discussed, if not decided, at regular meetings. Because they are formal institutions—and agencies do not wish to be excluded from formal institutions—they tend to involve all the parties necessary for coordinating an activity. Visibility, participation, regularity—these attributes have a potential for moving decisions forward. Inter-agency committees also are more likely to produce decisions that are equitable from the standpoint of smaller agencies than are those reached through ad hoc, informal bureaucratic bargaining.

Having given the positive side, it is necessary to show the negative. Inter-agency committees—the Federal Council included—are susceptible to three fatal diseases during the course of their lifetimes. Bailey calls these “confederationitis,” “progressive deputization,” and “implemental anemia.”⁴

Confederationitis. Because agencies are peers, decisions tend to be made by consensus. Consensus decisions may be agreeable, and thus, workable; but they may not be very meaningful. They tend toward finding the lowest common denominator. Thus, instead of having one lead agency in a coherent national (but inter-agency) program, different agencies would take the lead—for whatever they were already doing. The inter-agency “decision” would merely legitimate their own choices.

Progressive deputization. Inter-agency committees, to be effective, need policy-level people to attend their deliberations; but policy-people are busy. Moreover, as in the case of the old Federal Council, subcommittees proliferate. Policy-people cannot attend these subcommittee meetings which, as in Congress, often tend to be where the important work of the general body gets done. The policy-level administrator sends his deputy, who, in turn, sends a lower official. The lower official may, or may not, be an expert in the subject matter of the committee. In either event, he is too low in the hierarchy to be able to speak authoritatively in behalf of his agency.

Implemental anemia. Inter-agency committees do not implement. Their member agencies do. Their staff and resources, if any, are the gifts of the members. Thus, inter-agency committees can decide, but they cannot execute their decisions. If an agency disagrees, the committee cannot coerce the agency.

There are limits to horizontal coordination. The approach works for many issues that divide agencies, but not for the most vital issues. For those issues, the second approach, vertical coordination, becomes necessary.

The vertical approach

The vertical approach to coordination involves, directly or indirectly, the power and prestige of the President. The key vertical coordinators for science and technology have been Presidential staff agencies, particularly the Office of Management and Budget (OMB); and the former Office of Science and Technology (OST). The latter, of course, is now resurrected with a slightly different name, the Office of Science and Technology Policy (OSTP).

Vertical coordination can take place either at the “upper” level of Presidential budget-making, or the “lower” of operational coordination. The second involves considerable intervention on the part of Presidential staff offices in the bureaucratic jungle. To the extent it is undertaken at all, however, its effectiveness derives less from the persuasiveness of staff operatives, and more from their association with the budget process. It was the perceived lack of such a proximity on the part of OST in the Nixon years that weakened that organization when it sought to become a vertical coordinator in the operating-level world.

With respect to the Presidential budget as a coordinating device, it should suffice to say that it is the most important single instrument that the President has for bringing coherence to executive branch activity. What the Jackson Subcommittee on National Policy Machinery stated in 1961 remains true today: “the American system provides no good alternative to reliance on the budget process as a means for reviewing the on-going activities of the departments and raising periodically for Presidential decision issues of effectiveness in actual performance.”⁵ The budget process has the effect of raising coordination to an issue of

⁴ S. K. Bailey, “Managing the Federal Government,” *Agenda for the Nation*, edited by K. Gordon (Washington, D.C.; Brookings, 1968), p. 309.

⁵ U.S. Senate Committee on Government Operations, Subcommittee on National Policy Machinery, “Organizing for National Security,” Vol. III, p. 22, cited in Seidman, *op. cit.*, p. 189.

Presidential perspective. It provides at least the opportunity for him to relate on a government-wide basis goals, priorities, allocation of resources, organizational structures, and administrative successes and failures.⁶

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Vertical intervention in operational programs must be pursued extremely selectively. The number of problems that could use vertical coordination are such as to absorb all the time of all the members of OSTP and OMB, and both of these offices have other tasks to accomplish. There are some who feel OST frittered away too much energy in fire-fighting. The trouble is that some fire-fighting is probably essential. The key is to distinguish the small from the large fires, those that can be contained at lower levels from those that require topside action.

Vertical coordination can accomplish some important functions. One is that of refereeing bureaucratic squabbles that are holding up programs of national significance. For example, in the early 1960's, NASA and the Weather Bureau were contesting over the readiness of weather satellites for operations. NASA wished to push ahead toward the next generation of satellites, while Weather Bureau wanted to pause and deploy the system already developed. At issue was control of the weather satellite program. The Bureau of the Budget (BOB), OMB's predecessor, intervened. It sided with Weather Bureau and obtained an agreement between the two agencies. The agreement provided for a long-term inter-agency relationship in the weather satellite field and assured the use of the satellites earlier than otherwise would have been the case.

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Finally, vertical coordinators can advocate certain programs that fall between existing agency missions but that may, nevertheless, be important to the nation. Most new programs have difficulty getting started and are delayed interminably by prevailing agency power structures and commitments. The programs are step-children. They need help, allies. Given its role as institutional skeptic, OMB is not necessarily the best agency to be an advocate. But OSTP could play this role, and it is a role that is needed. However, such advocacy should be weighed carefully, and should clearly reflect not just an OSTP, but a Presidential decision that a given program needs encouragement and special attention. Otherwise, OSTP will find OMB skeptical of it. If OSTP cannot coordinate horizontally with OMB, it will not be able to coordinate vertically with anyone else.

CONCLUSION

Discussed have been two basic approaches to coordinating the federal science and technology apparatus. Both are difficult to accomplish. What is involved in coordination is leadership toward common objectives that may not be obvious or even favorable to the interests of the parts. Moving an agency toward a common goal is difficult because agencies have constituencies in Congress and the public-at-large. Those constituent elements must be brought into concert along with the agencies. Coordination works best where it has the benefit of a convergence of horizontal and vertical pressures. Placing the Director of OSTP in charge of

⁶ *Ibid.*

the Federal Coordinating Council would appear to combine vertical and horizontal approaches in a sensible way. What is elegant in theory may break down in practice, however.

Coordination presents many dilemmas. But what are the alternatives? One alternative is to do nothing. If each agency is permitted to go its own way, however, what sense does government, much less democratic government, make at all? This is not an attractive course. Some critics take another direction. Disparaging of bringing any coherence to particular fields with which they are concerned, they opt for major surgery. They do not cut elements, although they often begin by thinking they are doing that. Rather, they combine them into new agencies through reorganizations. A new agency can give the semblance of solution to difficulties of administrative fragmentation. If all the elements concerned with a given function are placed in an agency of their own, there is the appearance of coherence. In reality, what occurs is the shift *intra*-agency of what had been an *inter*-agency problem. What was formerly an issue for President and Congress becomes one for the new agency head.

The real difficulty with this strategy is that it is a temporary solution at best. Once set up, the agency perpetuates itself and expands—becoming a part of future inter-agency problems for a President and Congress a few years down the road. There may be perfectly sound reasons for forming new agencies, relating to the desire to create concentrated bureaucratic power in order to promote certain functions. However, it should be realized that when a new, self-perpetuating agency is created, the overall government-wide coordination problem is being exacerbated, not simplified. No solution to the current coordination problems in science and technology would be more illusory, for example, than launching a Department of Science and Technology. Such a department would create more problems than it would solve. Indeed, its “success” in concentrating R & D in one place might hurt the public interest. There is an argument to be made for decentralization in science and technology, for putting R & D in proximity to the mission agency needs. Over-concentration can be as bad as too much decentralization.

The horizontal and vertical strategies discussed are relatively conservative. They combine existing organizational elements in novel ways toward emerging goals. They do not create new permanent agencies that exercise yet additional claims on the federal treasury. They reflect a “steady state” philosophy that might well be applied generally to the executive branch, one in which we work toward organizational renewal rather than new organizations. The horizontal and vertical strategies would make use of existing resources with an eye toward flexibility and adaptability of structure.

Adaptability of administrative structure—that is what coordination ultimately is all about.⁷ The science and technology apparatus, so absorbed substantially in change, ought to be made a model of administrative flexibility. With executive leadership and congressional support, this kind of coordination may yet be achieved.

Mr. THORNTON. Dr. Lambright, I want to thank you for a very fine presentation. It contains a good analysis, I think, of the difficulties which are inherent in any effort to balance the many competing needs for outstanding research capability.

In pointing out the difficulties and giving this analysis, I am sure that you do not mean to suggest that continuing efforts to achieve a balance should not be made. You do think that efforts must be made in this direction, do you not, sir?

Dr. LAMBRIGHT. Yes. As I say, the alternatives seem to be: (1) do nothing, which is the worst alternative; (2) combine all of science and technology into one place, one huge department, which you see more easily and therefore deal with, presumably, better. I do not think that is a good alternative because one of two results is going to happen.

⁷ For an important statement on this issue in terms of one agency, see James Webb, “NASA as an Adaptive Organization,” John Diebold Lecture on Technological Change and Management, Harvard Graduate School of Business Administration, Boston, Massachusetts, September 30, 1968.

You may actually succeed in putting everything in one place. This will create the problem of weakening the mission agencies. I think science and technology should be construed as an instrumental means toward broader goals and not as a goal unto itself. Perhaps basic science can be seen as a goal unto itself, but certainly technology and applied science cannot. The other possibility is that you may not succeed at all. You will have created a new Department of Science and Technology.

In addition the mission agencies continue to do research and development as they always have in the past. You have thus increased the number of agencies to be coordinated and have augmented your original problem.

So, the alternative is to take this more middle-of-the-road kind of strategy which is to work with your existing instruments. As I say, the horizontal and vertical approaches are really a conservative strategy. They involve efforts to utilize the instruments that you have at the peer level, such as a Federal council or interagency committee, plus some vertical instruments, Presidential staff agencies, to achieve a better coherence of approach.

I am essentially an advocate of better coordination of science and technology. As I have tried to indicate, it is an extremely important problem. It is an important problem. An uncoordinated effort is not entirely devoid of coordination; the question is where the coordination is coming from.

Nature abhors a vacuum. If there is no coordination in a broad general sense, the coordination will bubble up from wherever there is power at a given point in government. And those that have functional strengths will promote their particular programs. Those who do not have functional strengths, I mean functions in terms of functions of government, will remain fairly weak. And as a consequence, you get great unevenness across the board in Federal science and technology policy. You get some programs going fast and hard and others being suffocated for lack of support and funds. So the absence of coordination creates serious problems in coherence, and the disharmonies have high stakes for us all. So there has to be this kind of effort, and I think this kind of effort is one that attempts to work at the peer level and also work at the vertical level.

I might add, incidentally, that I did not discuss Congress too much, because of the fact that this was a paper on the Federal executive branch. But one could have drawn a diagonal line along with a horizontal and vertical because Congress is very much involved in the administration of science and technology. And one of the means that could be utilized to bring a convergence of horizontal and vertical forces would be congressional leverage on the executive branch.

Mr. THORNTON. Let us get to some things we can agree upon as being needed. Can we agree that communication and sharing of information as to what research programs are going on, what their dimensions are, is an important objective? Can we analyze it in this way: Is that an important function of a Federal council or congressional committee seeking in a special oversight to review the entire spectrum of science research? Communication and exchange of information seems to be the one thing we can agree upon as being a useful objective.

Then is there a body of passive information exchange as contrasted with a kind of active or management role, and is it in the management role or direction of programs that you begin to run into problems of balancing?

Dr. LAMBRIGHT. As I see it, you can look at the Federal executive science and technology apparatus as having a division of labor. There is a working level where science and technology actually is done, where research is conducted, and where laboratories exist. The work of those laboratories, the work of that R. & D., is really of broad and general use. This is the working level. We even, in fact, call some of our laboratories "national laboratories," even though they are under specific agencies. That information has broad use. But, because the laboratories and/or the contractors or grantees are under a particular sponsor agency—the upper level, which we call the administrative level—there seems to be a distortion that takes place. There is a national resource down there at the science and technology working level, but, as it filters up through the sponsor or bureaucratic administrative level, it tends to become proprietary.

For one thing, a lot of information is thrown out that could be useful to other agencies, because it is not useful to a particular sponsor. And there does not seem to be much incentive for the sponsor agency to communicate with an agency next door about some work that is being done for it which could be relevant to the other agency.

So I think the answer to your question is: there is a great need for positive effort at communication that tries to get the administrative level to view the working level as a resource for the Federal Government, the Nation as a whole, rather than just as a resource for the agency. I guess the best example would be the labs, the Federal Government's own laboratories. Most of the big agencies in science and technology have laboratories.

These laboratories in some cases are called national laboratories, but they tend to be viewed as agency laboratories and constrained in the kinds of programs they do and the kinds of resources they have that could be brought to bear on another particular agency's problem. I am not sure, but I suspect there is a very poor communications system across the Federal Government as to just what resources are there, in those laboratories.

So if one agency wanted to tap those resources, aside from all other constraints—legal, et cetera—it probably wouldn't know what is there to be tapped.

Mr. THORNTON. How do you address that problem? Is there a need for interdisciplinary generalists who have sufficient academic background and training to understand some of the complications or different research areas and the ability to individually crosscut? I guess I am talking about one-man committees. Is there any training ground for that? Is there a need for that type of individual in a committee formalized structure?

Dr. LAMBRIGHT. I think there is. The general problem, of course, is that the way the system—that is, the Federal Executive branch—tends to work is that it tends to compartmentalize knowledge and people. You seem to find, not just a Federal civil service structure but an agency civil service structure. As a consequence of years of socializa-

tion, they tend to think as agency men rather than Government men, because agencies tend to be often dominated by particular disciplines or particular kinds of professional perspectives that add to the narrowness of their point of view.

I think that in America, in general, our agencies are extremely technical in the sense of being specialized. What you are getting at, as I see it—and I think perhaps the whole problem of coordination is the fact that we are dealing with a problem of specialization—we have work to be done and we compartmentalize it out to specific agencies which tend to be controlled by specific professional groups, all of whom tend to approach life from a fairly narrow perspective because that is the way the training takes place. Then, once you get into an administrative system that promotes from within or promotes along certain career patterns, that process tends to strengthen the narrowness of perspective. There are few incentives for a man who wants to rise in his agency to develop a breadth of perspective, to reach out beyond his agency. The incentives work toward specialization.

We do need those kinds of people you were talking about, that is, the broad kind of individual, in Government and in other walks of life. I have heard them described as "T-shaped" men. Those are the people who start off as specialists in a field, but at some point in their career they are capable of getting out of that narrowness of disciplinary and professional perspective.

The question, of course, is how do you encourage that in a bureaucracy,

Mr. THORNTON. So much of our rewards really go to encourage increased specialization.

Dr. LAMBRIGHT. Especially in science and technology.

Mr. THORNTON. Yes; and so what we are confronted with is either to devise means of putting these specialists together within structures that allow an exchange of ideas or to develop some way of communicating across disciplinary lines.

Dr. LAMBRIGHT. Absolutely, because, as I tried to indicate, the key is really adaptability. Coordination doesn't tell you very much. Coordination for what? You want to use your resources in the best possible way toward goals. Goals are constantly changing. The problem, of course, is that there tends to be a real lag between the goals set by the President and Congress that the Nation wishes to pursue and the work that is being done by the science and technology performers. The reasons often lie in the inertia of the administrative apparatus that lies between the political and scientific estates.

And you get serious problems. One problem is that in one agency there is a crying lack of ability to get at resources to do the work while, at the same time in another agency just down the street—talking about DOT and NASA, for example—you have a situation where they are laying off people by the droves, and you get unemployment problems. This is why coordination is not just a chestnut for public administration professors. It is a serious problem that goes to very deep and serious stakes, that of getting the job done and keeping people from being unemployed.

Mr. THORNTON. To give you an illustration, a graphic illustration, of an incident which I think has now been resolved, this committee

reported out—and recently as a member of the conference committee we moved forward with a bill to call for advanced automotive propulsion design.

As a part of that bill was included the authority to construct some test bed vehicles; you know, having a motor and a transmission and a differential and a power train to transmit the advanced engineering of propulsion units is not sufficient unless it will fit into some kind of car. And it won't necessarily fit into a type of car which is not designed for that particular apparatus.

We ran squarely into objections by the Department of Transportation which doesn't mind if ERDA does the propulsion, but they don't want them meddling with designing the frame and the chassis of a car to carry this unit. The problem has been resolved. But it is exactly this kind of thing you have been talking about, a little bit of concern that one agency may be moving into an area where another agency, the Department of Transportation, has a great interest.

Dr. LAMBRIGHT. The problem has a solution and the solution requires a group of people cooperating at the working level on a given problem. But those people are not allowed to participate, if they happen to be in different agencies, unless the administrative level allows them to. And often the administrative level says, "No, you are our people and you work on this problem." You run into this kind of problem all the time, it seems to me. There are national problems and national needs and they require an attack by a group of people at the science and technology level, the working level. Now the problem there, of course, is to get that link between the need and the working people; that is, the scientists and engineers. You have to go through an apparatus called administration which is divided and compartmentalized by law according to certain missions.

You may want to get so-and-so to work in this particular area on this particular problem because his skills are needed, but you cannot, because the Agency says, "We need so-and-so to work on our program and it is a higher level or higher priority program than this national program." The national program doesn't seem to have as much power behind it in our system as the administrative level programs. And that is what coordination seems to be about. How do you permit our science and technology capability to be brought to bear on our big problems as they emerge quickly? How do you make that middle layer, the administrative level, more flexible, so that it doesn't hurt you rather than help you as you deal with your problems?

Mr. THORNTON. Thank you.

Mr. Scheuer?

Mr. SCHEUER. Mr. Chairman, I don't have any questions. I thoroughly enjoyed the testimony and I found it most stimulating, but a little bit depressing. I want to thank the witness very much for his enormously thoughtful testimony.

Mr. THORNTON. Thank you, Mr. Scheuer.

Mr. Myers?

Mr. MYERS. I have no questions.

Mr. THORNTON. Dr. Lambright, I want to thank you again for your testimony. We have been furnished already by some of our witnesses with some questions which might be addressed to various witnesses. I

am not going to ask you to respond to each of those questions which have been addressed, but would you agree to respond in writing to some questions that may be submitted to you later on as the hearings develop?

Dr. LAMBRIGHT. Yes, Mr. Chairman.

Mr. THORNTON. I want to thank you again for your very stimulating and helpful testimony.

Dr. LAMBRIGHT. Thank you.

Mr. THORNTON. Our next witness is Dr. Bruce L. R. Smith who is professor of political science at Columbia University in New York. Dr. Smith has written several books. He graduated with a Ph. D. from Harvard. We are very pleased to have you with us today, Dr. Smith, and I would like to ask you to proceed.

[A biography of Dr. Smith follows:]

DR. BRUCE L. R. SMITH

Professor Bruce L. R. Smith has been at Columbia University since 1966. His recent publications include: *The New Political Economy: The Public Use of the Private Sector* (ed.) 1975; *The Politics of School Decentralization* (with G. R. La Noue), 1973; *The Dilemma of Accountability in Modern Government* (with D. C. Hague), 1971; and *The Rand Corporation*, 1966.

He received the Ph.D in the Department of Government from Harvard University in 1964. He has worked in Federal and State Government, and has served widely as consultant to numerous government agencies in areas related to government R and D, intergovernment relations, and political/economic issues.

STATEMENT OF DR. BRUCE L. R. SMITH, PROFESSOR OF POLITICAL SCIENCE, COLUMBIA UNIVERSITY, NEW YORK, NEW YORK

Dr. SMITH. Thank you very much, Mr. Chairman and members of the committee. I am delighted to appear before the subcommittee this morning to testify on the subject of coordination of research and development activities in the Federal Government.

As I understand it, your subcommittee has already heard testimony from several witnesses, including Comptroller General Elmer B. Staats, and I now understand that you will hear testimony from Dr. Charles V. Kidd, former Director of the Federal Council on Friday.

Mr. THORNTON. That is correct. We have heard from Dr. Stever.

Dr. SMITH. I will jump down to the bottom of the page, Mr. Chairman.

Mr. THORNTON. Fine. Your prepared testimony has been made a part of the record. And I would like to ask you to proceed to summarize or outline it or give it as you feel most appropriate.

Dr. SMITH. Thank you, Mr. Chairman.

I will not attempt to cover the whole subject of coordination in R. & D. activities. Rather, I will focus instead on several themes that seem important as we look ahead to the functioning of the new Office of Science and Technology Policy and its relationship to the reconstituted Federal Council and to the Office of Management and Budget.

As a point of departure, it seems useful to recall that when we speak of R. & D. in the Federal Government we are not talking about something divorced from the great purpose and operating missions of the Government. There is no such thing as policy toward R. & D. in

the abstract, as if it were something existing in a vacuum apart from energy, transportation, health, defense, and the other functions of the Federal Government. R. & D. in our Government is largely conducted as a means by which the mission-oriented departments go about the task of promoting better health of our citizens, more effective transportation, stronger national defense, and the like. Very few agencies traditionally have been devoted to the advance of science and technology for their own sakes. Those agencies that have been devoted to advancing technology as an end rather than as a means to some larger goal—I refer there to such agencies as the former Atomic Energy Commission, National Aeronautics and Space Administration, the old National Advisory Committee on Aeronautics—have sometimes pushed a particular technology in a way that leads to unbalanced public policy. For example, the funds invested in nuclear R. & D. by the AEC may have steered our defense strategy unduly toward reliance on atomic weapons.

Because the nuclear warhead was a “free good” to the defense planner—that is, it did not show up on the defense budget and thus cost the DOD nothing—it was easy to rely heavily on the nuclear option in the Department’s planning. Similarly, when Congress reorganized the AEC into the present Energy Research and Development Administration, it did so in part out of the conviction that a more balanced R. & D. effort beyond simply nuclear power was needed if the Nation was to solve its energy problem. The lesson we learned from this and other experiences was that primary reliance on the mission agencies for conducting the Nation’s R. & D. was a sensible pattern.

Yet, at the same time, it is clear that there is a close reciprocal relationship between technological means and policy ends. At times we need to push a technology in order to have policy options to choose. Without the NACA patiently building up the Nation’s capacity in aeronautical research, the later defense uses and the civilian aircraft industry would not have developed as they did. With the fundamental research that plays an important part in the Nation’s total technological effort, the special role of the National Science Foundation in keeping a broad base of scientific results available is particularly important. The mission agencies may not take a sufficiently broad view of the total health of the Nation’s scientific and technological enterprise. Hence, there is a need from time to time for the special technological agency to advance a new technology that is neglected by the mission agencies. There is a need for an agency to watch out for the health of the basic sciences as a whole and to nurture those important parts of the Nation’s scientific and technical effort that are relatively neglected by the mission agencies. And, very importantly, there is a need for a broad look from the Congress and executive branch at the overall functioning of the Government agencies involved in scientific and technological activities. This, of course, is what the Congress had in mind in assigning to this subcommittee a new Special Oversight function for science and technology in January 1975.

Indeed, in my opinion, Mr. Chairman, this function can only grow in importance. For science and technology, by constantly throwing up new problems cutting across traditional jurisdictional lines, gives a dynamism to our governing system that makes constant review of

organizational roles and functions inevitable. The need for "coordination" of activities that spill over established jurisdictions is implicit in the dynamic changes resulting from science and technology. Rapid change contributes to the continuing need to reconcile conflicting aspects of related programs.

In the abstract we can talk of a "normal cycle" of launching new Government programs: a need for Government action is identified through the political process; existing programs are surveyed and evaluated; new programs are designed; responsibility is assigned to the appropriate agency; and the resulting programs are reviewed by the Congress, the President, and the public. Such tidy logic and symmetry, however, seldom prevails given the complexity of modern government. Many activities impinge on the missions of more than one agency and the result is a need for interagency coordination (and, within the large departments, for intraagency coordination). Agencies may fight to become the main users or supporters of a new area of technological development. As a major part of the business of Government becomes a search by the various departments to find ways that technology can accomplish their missions more effectively, the prospects for overlap, competition, blurring of roles become substantial.

Rarely is there such a clear assignment of functions that no problems of coordination remain. Coordination is thus an essential feature of modern government. It is not a "problem" that can be permanently "solved"; rather, it is a never-ending process. But reorganization is the reverse side of the coin of coordination. The problems of coordination are usually most severe when there is confusion over what policy should be, what agency should have the major responsibility for a function, and what is to be done. When these difficult choices are made, the problem is temporarily resolved—until the loose ends give rise to a new problem or until some new development changes the assumptions behind the previous decision.

I hasten from this background to make two further points that seem to me useful in approaching the subject; first, we should have realistically limited expectations about what can be expected from coordination efforts. By the very nature of the activity, coordination is an unspectacular, slow-moving, confusing process, marked by a good deal of floundering as the participants grope to define their goals and responsibilities. I have not met anyone who thinks that the Federal Council's activities since 1973 have been marked by exceptional vigor and effectiveness. There is doubtless substantial room for improvement, and for a more vigorous role with more staff resources for the Federal Council in the new OSTP advisory system. We will return to that point.

For now let us recall that when we speak of "coordination we are speaking of several kinds of activities: at one level, we are concerned with the exchange of information so that different officials know what each other is doing; the discussion of common problems but without any participant having clear authority to direct the others to do anything is another meaning; and finally, we can mean the activity of one party inducing another to do what the first wants. In our governing system, it is evident that there are many candidates for the job of coordinator, but few victims eager to be coordinated by somebody else.

Small agencies are more apt to like coordination from the highest levels of government because they are anxious to have friends with access to the President or to OMB at budget time. Big agencies ignore, defy, or evade central coordinators, assuming they will be able to get their way without outside help and not wishing interference with their "turfs." This is clearly not a recipe for dramatic results; rather, it is the sort of situation where problems may get clarified or where attention is called to serious issues. Then, occasionally, high-level intervention may follow, and the efforts at interagency coordination will be superseded by far-reaching Presidential or congressional action.

Note that I am not saying here that coordination is unimportant, only that it involves a part of the policy process that deals with "problem defining" and with "mopping up" after a major initiative. Little agencies cannot coordinate each other or big agencies; big agencies gingerly work out treaties with each other when they have to but otherwise stay out of each other's way. Central staffs have natural friends in the pygmies of government, natural enemies in the giants of government; they can exert some influence when they work hard, command some attention from high political authority, and play a part in influencing budget decisions. Coordinating staffs have a natural dilemma; they have to command high-level attention to be taken seriously, but high-level officials are busy and have a limited attention span. If you go too high up in the membership of the officials who make up the coordinating body, the result may be ritualistic meetings of individuals too far removed from the problem; if the membership is too low level, they may understand the problems being dealt with, but they have little power to do anything about them. All in all, a little compassion is in order for those attempting to play a role as R. & D. coordinators.

A second and related point is that we should not think of coordination as something that is divorced from the wider policy battles of the Government. It would be a mistake to think that coordination is some sort of neutral activity, a narrow management or efficiency game that can be judged in some abstract fashion. The reason that it is so difficult to "coordinate" R. & D. activities, or any other Government programs, is that officials believe deeply in their own programs and purposes, and they resist efforts they see as threatening to those purposes. There is no such thing as an "efficient" assignment of an R. & D. function, or appropriate coordination between agencies engaged in overlapping R. & D. activities, on the basis of expert knowledge alone.

Efficiency in the narrow sense can only be obtained with those activities characterized by a clear, agreed upon goal which is to be maximized. Clearly, most of the problems we are worried about concerning R. & D. coordination—energy, environment, oceanography, materials science, population, and the rest—are marked by confusion, uncertainty, or disagreement as to the proper goals to be pursued. When we ask, "How do we want to coordinate R. & D. activities in a given area?" we are really asking, "What do we want Government to do?" Who reports to whom, who gives what information to which agency, who is the "lead agency" for what—all these matters are ways of defining what the broad purposes of Government action will be with respect to a problem. This is natural and it is desirable. The co-

ordination function, and those who perform it, should not be independent and free floating any more than should budgeteers, planners, or other specialists. Government seems so uncoordinated because so many purposes are in conflict, and we are often so undecided about what we want from Government in this very complex situation in domestic and international policy we find ourselves in today.

Mr. THORNTON. I would like to interrupt to endorse the observations you have just made, Dr. Smith. Those are very sound statements and a very good analysis. It is most difficult to coordinate programs if you don't have a policy that has been agreed upon. In fact, I suppose it is impossible to coordinate without having an objective or series of objectives.

At the same time, I think you are also saying that it is not always desirable to have a single set of objectives and to force everything into that box. There needs to be some room for give and take and decision-making and selection of ideas. I do not mean to interrupt your testimony, but I felt I should say that you have struck a responsive chord.

Dr. SMITH. Thank you very much, Mr. Chairman. I think your comment is important. Sometimes we think of planners as wanting to set out a goal for everything in advance and they spin it out from the clouds. In reality, many of our goals evolve from the policy process itself as we grope to understand the problem. The process of congressional action and executive action and public debate throws out the choices.

So I am very pleased to have your support and your helpful comment, Mr. Chairman.

I would like to turn now to two specific issues: The relationship between the Federal Coordinating Council for Science, Engineering and Technology and the new OSTP; and the relationship between OSTP and the OMB. It seems to me essential that the Federal Council should be an integral part of the OSTP and the Council staff should be intimately familiar with the rest of OSTP operations. I do not believe that it is either possible or desirable for the OSTP Presidential advisory function to be separated from the coordinating function for R. & M. that the Council should perform. The Council will derive authority and weight from its association with the totality of OSTP's staff advisory role vis-a-vis the President. When I reviewed the functioning of the old OST in 1968 for Dr. Donald Hornig, President Johnson's Special Assistant for Science and Technology, I was struck by the importance of keeping the coordinating function an integral part of OST activities. Under the able leadership of Dr. Kidd, whom you will hear from on Friday, the old Federal Council performed a valuable function in part because there was effective liaison between the Council and other parts of the science advisory system in the Executive Office. Agenda items were relevant to broad administration policy, agency officials—especially from the smaller agencies—cooperated because they needed access to the President and to the Budget Bureau, and the level of activity of the whole operation was fairly considerable. It is my impression, though I have not followed developments since 1973 very closely, that the older system was marked by a much higher level of activity in coordinating efforts than has been the case in recent years.

The level of staffing for the reconstituted Council does not need to be large, though it must surely be larger than the very modest numbers of recent years.

How should the OSTP-Coordinating Council system, forming a new science advisory mechanism in the Executive Office, be related to the OMB? Again, I would strongly urge that the coordinating function should be closely related to the budgetary process. I was pleased to note that Professor Lambright, my colleague, endorsed that idea too in his testimony.

It follows from this observation that the OSTP staff should work closely with OMB staff. Indeed, I believe the OST system worked best when the OST served essentially as the science and technology arm of the Budget Bureau. This role was never wholly free of tensions and frustrations. Budget staff sometimes regarded the OST staff as advocates for technology and science—as something of a trojan horse in the President's household—as individuals who should have been more sensitive to the special constraints and more associated with serving as staff aides to the President. OST people, in turn, sometimes saw budget staff as stodgy wielders of the meat axe who saw the world from their own narrow vantage point—often that of the heroic battler against pork barrel projects of all sorts, including scientific and technological pork. The most effective OST staffers, however, were sensitive to the special complexities of their role, and served skillfully until the frictions of the Vietnam war began to erode the usefulness of the office.

It was not, however, only the war that hampered the OST role. In my judgment there is a special dilemma with the OSTP function that must be frankly faced. The Director of OSTP—who will assume the role of the President's Science Advisor—will probably never have the same intimacy and degree of access to the President as the President's generalist aides who work with him on a daily basis. Access to the President will be important but the new Director cannot realistically expect the same degree of access as a Kissinger, Califano, Sorenson, or Adams.

I believe this will be so whoever is President. I might interject, Mr. Chairman, that if by chance a science adviser was very close to a President, he would ask for and get a more prestigious job. He would rather be Secretary of Defense or a Kissinger. The old OST structure occupied a middle area between the most institutionalized of the President's staff resources—the BOB—and the least institutionalized, namely, the intimate advisers occupying their positions temporarily as the President's men. This position was not always a comfortable one, for the OST people were neither clearly career staffers in the BOB sense nor part of the President's team of long-time dividers and top aides. The new OSTP will very likely function in the same ambiguous middle area. Because of the limits of OSTP Director's relationship to the President, it will be particularly important for him—or her—to see his—or her—role in the budget process as crucial.

The OSTP Director and staff should work hard to forge the closest working relationship with OMB. In this way the coordinating role of the OSTP/Council will be facilitated; the agencies will cooperate because they know that the OSTP staff will have an influence on budget

decisions. At the same time, OSTP staff will very likely be more "free-wheeling" than OMB staff, and on occasion function more as advocates, gadfly critics of OMB and other parts of the permanent bureaucracy, or in other ways resemble the political appointee. On the whole I think this kind of pattern for the OSTP is desirable for the country, through a difficult role for the individuals involved.

This means that we would have essentially one staff for the OSTP, with individuals wearing a number of different hats—a coordinator hat, a budget hat, a Presidential advisory hat. It may be necessary to have a small separate staff to handle the duties of the Coordinating Council; if this is so, I would recommend that the senior official in charge of the coordinating activities be a member of the OSTP staff, attend OSTP staff meetings, and be in close working contact with the OSTP Director.

Of course, from time to time, staff would be borrowed from the agency. The arrangements described here would be somewhat untidy; the OSTP would be serving partly as an OMB staff arm but would be organizationally independent of the OMB. The OSTP would work in the institutionalized processes of government but also with a tie to the White House staff, thus bringing a presidential perspective to the task of R. & D. coordination and providing an additional channel of access to the President. The system should be judged by virtue of its effectiveness or lack of effectiveness, not by orderliness or hierarchy on the organizational chart. It is desirable, I believe, for the OSTP to function somewhat independently of OMB even while closely allied with it. One factor that strained relations between the OST and BOB in the past was the presence of the President's Science Advisory Committee (PSAC) as part of the science advisory system. The revival of PSAC is not contemplated in the current plans for OSTP, and its absence should make an effective working relationship between OMB and OSTP easier to achieve.

MR. THORNTON. Dr. Smith, I must interrupt at this point to advise that we are now having a quorum call on the floor of the House. It will be necessary for me to attend and record my presence there. Therefore, I must recess these hearings for approximately 10 minutes until I can return.

Dr. SMITH. Fine.

[Recess.]

Mr. THORNTON. The hearing will come to order.

Dr. Smith, would you please continue?

Dr. SMITH. Thank you, Mr. Chairman.

Mr. Chairman, it seems to me that your subcommittee can make a very important contribution by concentrating on the role of the new OSTP as one line of inquiry for your work. It would probably be unwise to worry too much about the exact division of responsibilities among the various staff components of the Executive Office agencies involved in the coordinating role, or to attempt to define precisely through legislation how the OSTP/Council should relate to the OMB or to the President. Personalities inevitably play a large role in shaping effective working relationships at this level. The President will always seek to impose his style on Executive Office operations and will be uncomfortable with staffing arrangements mandated for him. He will simply ignore Executive Office machinery that does not suit him,

and should properly have wide discretion to use his resources for budget, coordination, and other high-level staff activities in ways that he finds congenial. The subcommittee, by reporting on the past problems of the OST and suggesting the likely future difficulties to anticipate, can greatly assist in shaping the evolution of the new OSTP office. Moreover, I believe the subcommittee should play an active part in setting the working agenda and priorities for the new office when it began to function.

This role will be especially important if I am correct in suspecting that R. & D. policy in the future will reflect some sharp differences from the past. In the 1960's, decisions on R. & D. activities tended to be made within the executive branch to a substantial degree, and to be made by specialists and experts with technical backgrounds. The Congress has become in recent years a much more active participant in decisions relating to R. & D. activities. This trend will continue. It is, therefore, important that the kind of broad view of Federal R. & D. programs taken by this subcommittee be a part of Congress oversight task.

R. & D. decisions are also likely to become more public in the sense that the logic and rationale for decisions will need to be apparent to, and communicated to, a large segment of the attentive public. The controversy over recombinant DNA in Cambridge, Mass., and elsewhere, the triga reactor squabble at Columbia University, and the nuclear proposition in California are indicative of the growing public mood of skepticism toward the experts and the desire to be involved in decisions that once might have been left to the technicians.

Finally, R. & D. policy in the future will have the important difference that we will not be predominantly seeking to develop large-scale technologies with the Federal Government itself acting as the sole customer or purchaser. Defense and space technologies were examples of large-scale and expensive technologies, developed on an urgent basis, which were then used by the Government. There will still be some of this sort of technical effort in the future, but to a larger extent than before the Federal role will be to stimulate R. & D. efforts with the goal of affecting the decisions of consumers and producers in the private sector. In energy, for example, we do not have the situation of the Federal Government buying a powerplant for one of its agencies; rather, the aim is to encourage the development of solar, nuclear, fossil fuel sources of energy that can be produced in the economy at prices that consumers can afford.

Mr. THORNTON. Dr. Smith, if I may interrupt, you are pointing out the interconnection between these various policies and you mentioned a couple of controversies that were given attention by the public, the recombinant DNA problems and the nuclear problems in California.

I would appreciate knowing for the record more about the Triga reactor squabble at Columbia University. The other two I am familiar with. Apparently I have missed that.

Dr. SMITH. It is a small one and it is not surprising that you have missed it. I do not think it has gotten much national attention. It is very much in the category of the recombinant DNA in that our local politicians have jumped on the bandwagon together with critics within the university who say that the reactor is dangerous. It is easy to win some votes by whipping Columbia on the west side.

Mr. THORNTON. It is not energy research but has to do with formation of DNA?

Dr. SMITH. It could be considered energy in the sense that it is essentially a training reactor rather than a research one and it is training people in the area of nuclear power, ultimately fusion sources of power. It is a small facility. It really doesn't represent much of a threat. There are those who say that it is kind of a meaningless thing and not very good for research or training anyway, so why are we worrying about it. The president of the university is concerned that outside groups could come in and tell university departments and researchers what kind of work they can do. And you get a number of the faculty—who are involved—as in the recombinant DNA business. It is really started in part by some members of the faculty who go to the press or go to the outside and say this is a menace and you are threatening black children and Puerto Rican children and the university should not endanger the community and we should stop this dangerous reactor development.

Then, of course, it gets picked up in the wider public. The media gets it. Somehow, it has not gotten much national attention. The university is proceeding carefully. The controversy has been dragging on for 3 years or more. I think McGill is so concerned with it because he wants to establish the principle that, once the safety issue has been settled, the university should not withdraw from an important area of research just because some critics still object.

Mr. THORNTON. If the university is not eager to bring national attention to the problem, perhaps we should pass on and get back to the world economy and food and materials and other related issues.

Dr. SMITH. It is a nice little case though. The DNA matter was quite fascinating. I was just up in Cambridge visiting MIT and they were very concerned.

Mr. THORNTON. That one has a great need for developing safeguards. When you start recombining genes so as to create new forms of life, the risks are large and safeguards do need to be agreed upon in connection with that research.

Dr. SMITH. You are certainly right, Mr. Chairman. Here is one kind of coordination issue we are concerned about in that some parts of Government are rightfully worried about occupational health and safety, and they are mandating certain changes in equipment and facilities. Then the question is, who pays for these things. They mandate them, but the universities and the feuding agencies have a hard time paying for a containment facility. This kind of containment facility costs \$500,000. It is a very difficult issue. I'm not sure what the answers are, but it is interesting to watch how the different parties react.

There was a very interesting city council hearing recently in Cambridge. You know, you wheel on a Harvard professor—there is a very effective mayor who has been running against Harvard and MIT for quite a few years and he broadens the inquiry to say "Now, aren't you fellows dumping chemicals into the sewage of the city," and the whole thing escalates rather rapidly.

Mr. THORNTON. Any use at all of the facilities—if you dump water into the system, you are dumping chemicals, I suppose. They might not be harmful chemicals. I did not mean to interrupt. I was un-

familiar with that particular problem and though it would be useful to touch bases.

Dr. SMITH. I think the Triga issue is a more clearcut and simple issue than DNA. As you suggest, that is much more difficult.

Mr. THORNTON. You were saying that there needs to be interconnection between energy and environment, et cetera.

Dr. SMITH. Although it is clear that technology is part of the answer to the energy crisis, other actions of a nontechnological character, such as energy conservation and changes in consumption habits, are also likely to be needed. Technologies on a smaller scale, more readily adapted into the civilian economy, may be desired as part of solution to the energy problem. We do not necessarily want to race ahead with the "crash" development of a new source of power until we also have some notion of what the environmental effects will be. There will be all sorts of complicated interconnections between the various policies pursued with respect to energy, the environment, the structure of the United States and the world economy, food and materials, and other related issues.

All of which argues that the policy process with respect to R. & D. will be a very complex affair, involving spillover effects between the technological agencies and other parts of the Government, and among the various departments engaged in the support of research. The ramifications will also extend to the private sector, to what individual consumers decide, to the structure of the economy and the decisions of producers. This process will be more public in character than many technological decisions of the past, and will necessarily place a heavy burden on the Congress as the chief instrument for educating our fellow citizens to the complexities of the choices that we have to make. This subcommittee, because it can take a broad look at the problems without worrying about jurisdictional lines, is in a special position to trace out the linkages between policies pursued by different agencies.

Mr. Chairman, I would like to close by commenting on a few of these areas which seem to me to deserve priority attention from the OSTP and the subcommittee. First, the OSTP should not be afraid of addressing itself to the great issues of energy, food, materials, population, and the environment. Although it is true that there are many players in these areas already, and executive staffs and committee assignments in profusion already dealing with the R. & D. aspects of these problems, major attention will be devoted to these issues for a long time, and the relatively broad look that the OSTP, aided and encouraged and critically reviewed by the subcommittee, might take of points of overlap and lack of coordination could yield important benefits. We want policy coherence on the energy issue—not isolated actions by numerous agencies that cancel each other out—and such coherence can only come from central staff review on the executive side and broad oversight from the Congress.

Food research has a powerful sponsor and client in the Department of Agriculture. But, as two recent reviews of agriculture R. & D. by the Pound committee and the Witwer committee have shown, an effective research program in the agricultural sciences should involve extramural research support from NIH, NSF, and other agencies as well. With a number of departments playing a role in supporting research

programs in the agricultural sciences, issues of coordination and policy coherence will surely arise.

Materials research programs are an almost classic case of spillover and overlap of programs resulting from developments in technology. Numerous agencies are involved in materials research programs, and perhaps until our broad-policy goals are more fully clarified it is desirable to have many programs being pursued from different points of departure. But if the Nation at some point wishes to make a major push to develop substitute materials to lessen dependence on external sources of supply, the decentralized and rather scattered effort we have now may need to be replaced with a more integrated program.

R. & D. in the environmental area for some time was too closely tied to the regulatory activities of EPA. A reorganization several years ago sought to create more favorable conditions for long-range research related to environmental needs. Environmental R. & D., and especially the interrelations between energy and the environment, will require close scrutiny to help assure that programs reinforce each other instead of working at cross-purposes.

In my opinion, the OSTP should not exclude national security concerns from its purview. When Dr. Lee Dubridge took the old OST out of the defense business in 1969, it seems to me that he removed the office from a major area of governmental activity and diminished the potential influence of the office. There were no doubt special difficulties and strains resulting from the war at that time that account for the decision. But the R. & D. activities of the Defense Department are so large, with so much impact across the whole spectrum of the Nation's scientific and technological capabilities, that to ignore the national security area would be a mistake.

There is one last area that should be high on the OSTP's agenda, and a special problem in the coordinating activities of the Council. I am engaged in a major study of the role of the universities in the Nation's research and development effort together with a team of colleagues. While the Nation's science effort in the universities is still strong, we are finding a number of emerging problems that result in part from the lack of coordination among Federal extramural research support programs. There are conflicting regulations, cross-purposes, and confusing contradictions in the way Federal programs affect the universities. We need to make sure that sudden swings in Federal policy, or the lack of coordination between agencies, do not impair the ability of the universities to perform R. & D. of high quality in the national interest.

We have touched on many issues this morning. I hope that I have been responsive to the subcommittee's concerns and I will be very pleased to try to answer any questions you may have. Thank you very much for giving me the opportunity to express my views to you.

PREPARED STATEMENT OF PROFESSOR BRUCE L. R. SMITH, DEPARTMENT OF PUBLIC LAW AND GOVERNMENT, COLUMBIA UNIVERSITY

Mr. Chairman, I am delighted to appear before the Subcommittee this morning to testify on the subject of Coordination of Research and Development activities in the Federal Government.

As I understand it, your Subcommittee has already heard testimony from Comptroller General Elmer B. Staats, former Director of the Federal Council Charles V. Kidd, Professor Henry Lambricht of the Maxwell School as well as

others on this broad subject, and you have also had prepared an excellent history and analysis of the Federal Council for Science and Technology by Dorothy Bates of the Library of Congress. I will, therefore, not attempt to cover the whole subject of coordination in R and D activities. Rather, I will focus instead on several themes that seem important as we look ahead to the functioning of the new Office of Science and Technology Policy and its relationship to the re-constituted Federal Council and to the Office of Management and Budget.

As a point of departure, it seems useful to recall that when we speak of R. & D. in the Federal government we are not talking about something divorced from the great purposes and operating missions of the government. There is no such thing as policy toward R. & D. in the abstract, as if it were something existing in a vacuum apart from energy, transportation, health, defense, and the other functions of the federal government. R. & D. in our government is largely conducted as a means by which the mission-oriented departments go about the task of promoting better health of our citizens, more effective transport, stronger national defense, and the like. Very few agencies traditionally have been devoted to the advance of science and technology for their own sakes. Those agencies that have been devoted to advancing technology as an end rather than as a means to some larger goal—I refer here to such agencies as the former Atomic Energy Commission, National Aeronautics and Space Administration, the old National Advisory Committee on Aeronautics—have sometimes pushed a particular technology in a way that leads to unbalanced public policy. For example, the funds invested in nuclear R. & D. by the AEC may have steered our defense strategy unduly toward reliance on atomic weapons. Because the nuclear warhead was a “free good” to the defense planner—that is, it did not show up on the defense budget and thus cost the DOD nothing—it was easy to rely heavily on the nuclear option in the department’s plan. Similarly, when Congress reorganized the AEC into the present Energy Research and Development Administration, it did so in part out of the conviction that a more balanced R. & D. effort beyond simply nuclear power was needed if the nation was to solve its energy problem. The lesson we learned from this and other experiences was that primary reliance on the mission agencies for conducting the nation’s R. & D. was a sensible pattern.

Yet, at the same time, it is clear that there is a close reciprocal relationship between technological means and policy ends. At times we need to push a technology in order to have policy options to choose. Without the NACA patiently building up the nation’s capacity in aeronautical research, the later defense uses and the civilian aircraft industry would not have developed as they did. With the fundamental research that plays an important part in the nation’s total technological effort, the special role of the National Science Foundation in keeping a broad base of scientific results available is especially important. The mission agencies may not take a sufficiently broad view of the total health of nation’s scientific and technological enterprise. So there is a need from time to time for the special technological agency to advance a new technology that is neglected by the mission agencies. There is a need for an agency to watch out for the health of the basic sciences as a whole and to nurture those important parts of the nation’s scientific and technical effort that are relatively neglected by the mission agencies. And, very importantly, there is a need for a broad look from the Congress and Executive branch at the overall functioning of the government agencies involved in scientific and technological activities. This, of course, is what the Congress had in mind in assigning to this committee a new “Special Oversight” function for science and technology in January 1975.

Indeed, in my opinion, Mr. Chairman, this function can only grow in importance. For science and technology, by constantly throwing up new problems cutting across traditional jurisdictional lines, gives a dynamism to our governing system that makes constant review of organizational roles and functions inevitable. The need for “coordination” of activities that spill over established jurisdictions is also implicit in the dynamic changes resulting from science and technology. Rapid change contributes to the continuing need to reconcile conflicting aspects of related programs.

In the abstract we can talk of a “normal cycle” of launching new government programs: a need for government action is identified through the political process; existing programs are surveyed and evaluated; new programs are designed; responsibility is assigned to the appropriate agency; and the resulting programs

are reviewed by the Congress, the President and the public. Such tidy logic and symmetry, however, seldom prevails given the complexity of modern government. Many activities impinge on the missions of more than one agency and the result is a need for inter-agency coordination (and, within the large departments, for intra-agency coordination). Agencies may fight to become the main users or supporters of a new area of technological development. As a major part of the business of government becomes a search by the various departments to find ways that technology can accomplish their missions more effectively, the prospects for overlap, competition, blurring of roles become substantial. Rarely is there such a clear assignment of functions that no problems of coordination remain. Coordination is thus an essential feature of modern government. It is not a "problem" that can be permanently "solved"—rather, it is a never-ending process. But reorganization is the reverse side of the coin of coordination. The problems of coordination are usually most severe when there is confusion over what policy should be, what agency should have the major responsibility for a function, what is to be done. When these difficult choices are made, the problem is temporarily resolved—until the loose ends give rise to a new problem or until some new development changes the assumptions behind the previous decision.

I hasten from this background to make two further points that seem to me useful in approaching the subject: first, we should have realistically limited expectations about what can be expected from coordination efforts. By the very nature of the activity, coordination is an unspectacular, slow-moving, confusing process, marked by a good deal of floundering as the participants grope to define their goals and responsibilities. I have not met anyone who thinks that the Federal Council's activities since 1973 have been marked by exceptional vigor and effectiveness. There is doubtless substantial room for improvement, and for a more vigorous role with more staff resources for the Federal Council in the new OSTP advisory system. We will return to that point.

For now let us recall that when we speak of "coordination" we are speaking of several kinds of activities: at one level the exchange of information so that different officials know what each other is doing; the discussion of common problems but without any participant having clear authority to direct the others to do anything; and finally, the activity of one party inducing another to do what the first wants. In our governing system, it is evident that there are many candidates for the job of coordinator, but few victims eager to be coordinated by somebody else. Small agencies are more apt to like coordination from the highest levels of government because they are anxious to have friends with access to the President or to OMB at budget time. Big agencies ignore, defy, or evade central coordinators, assuming they will be able to get their way without outside help and not wishing interference with their "turf." This is clearly not a recipe for dramatic results; rather, it is the sort of situation where problems may get clarified or where attention is called to serious issues. Then, occasionally, high-level intervention may follow, and the efforts at inter-agency coordination will be superseded by far-reaching Presidential or Congressional action.

Note that I am not saying here that coordination is unimportant, only that it involves a part of the policy process that deal with "problem-defining" as with "mopping up" after a major initiative. Little agencies cannot coordinate each other or big agencies; big agencies gingerly work out treaties with each other when they have to but otherwise stay out of each other's way. Central staffs have natural friends in the pygmies of government, natural enemies in the giants of government; they can exert some influence when they work hard, command some attention from high political authority, and play a part in influencing budget decisions. Coordinating staffs have a natural dilemma: they have to command high-level attention to be taken seriously, but high-level officials are busy and have a limited attention span. If you go too high up in the membership of the officials who make up the coordinating body, the result may be ritualistic meetings of individuals too far removed from the problem; if the membership is too low-level, they may understand the problems being dealt with but they have little power to do anything about them. All in all, a little compassion is in order for those attempting to play a role as R and D coordinators.

A second and related point is that we should not think of coordination as something that is divorced from the wider policy battles of the government. It would be a mistake to think that coordination is some sort of neutral activity, a narrow management or efficiency game that can be judged in some abstract fashion. The reason that it is so difficult to "coordinate" R and D activities, or

any other government programs, is that officials believe deeply in their own programs and purposes, and they resist efforts they see as threatening to those purposes. There is no such thing as an "efficient" assignment of an R and D function, or appropriate coordination between agencies engaged in overlapping R and D activities, on the basis of expert knowledge alone. Efficiency in the narrow sense can only be obtained with those activities characterized by a clear, agreed upon goal which is to be maximized. Clearly, most of the problems we are worried about concerning R and D coordination—energy, environment, oceanography, materials science, and the rest—are marked by confusion, uncertainty, or disagreement as to proper goals to be pursued. When we ask, "How do we want to coordinate R and D activities in a given area?" we are really asking "What do we want government to do?" Who reports to whom, who gives what information to which agency, who is the "lead agency" for what—all these matters are ways of defining what the broad purposes of government action will be with respect to a problem. This is natural, and it is desirable. The coordination function, and those who perform it, should not be independent and freefloating any more than should budgeteers, planners, or other specialists. Government seems so uncoordinated because so many purposes are in conflict, and we are often so undecided about what we want from government in this very complex situation in domestic and international policy we find ourselves in today.

I would like to turn to two specific issues: the relationship between the Federal Coordinating Council for Science, Engineering and Technology and the new OSTP; and the relationship between OSTP and the OMB. It seems to me essential that the Federal Council should be an integral part of the OSTP and the Council staff should be intimately familiar with the rest of OSTP operations. I do not believe that it is either possible or desirable for the OSTP Presidential advisory function to be separated from the coordinating function for R and D that the Council should perform. The Council will derive authority and weight from its association with the totality of OSTP's staff advisory role vis-a-vis the President. When I reviewed the functioning of the old OST in 1968 for Dr. Donald Hornig, President Johnson's special assistant for Science and Technology, I was struck by the importance of keeping the coordinating function an integral part of OST activities. Under the able leadership of Dr. Kidd, whom you have already heard from, the old Federal Council performed a valuable function in part because there was effective liaison between the Council and other parts of the science advisory system in the Executive Office. Agenda items were relevant to broad administration policy, agency officials (especially from the smaller agencies) cooperated because they needed access to the President and to the Budget Bureau, and the level of activity of the whole operation was fairly considerable. It is my impression, though I have not followed developments since 1973 very closely, that the older system was marked by a much higher level of activity in coordinating efforts than has been the case in recent years.

The level of staffing for the reconstituted Council does not need to be large, though it must surely be larger than the very modest numbers of recent years.

How should the OSTP-Coordinating Council system, forming a new science advisory mechanism in the Executive Office, be related to the OMB? Again, I would strongly urge that the coordinating function should be closely related to the budgetary process. It follows from this observation that the OSTP staff should work closely with OMB staff. Indeed, I believe the OST system worked best when the OST served essentially as the science and technology arm of the Budget Bureau. This role was never wholly free of tensions and frustrations. Budget staff sometimes regarded the OST staff as "advocates" for technology and science—as something of a trojan horse in the President's household—as individuals who should have been more sensitive to the special constraints and mores associated with serving as staff aides to the President. OST people, in turn, sometimes saw budget staff as stodgy wielders of the meat axe who saw the world from their own peculiar vantage point—often that of the heroic battler against pork barrel projects of all sorts, including scientific and technological pork. The most effective OST staffers, however, were sensitive to the special complexities of their role, and served skillfully until the frictions of the Vietnam War began to erode the usefulness of the office.

It was not, however, only the war that hampered the OST role. In my judgment there is a special dilemma with the OSTP function that must be frankly faced. The Director of OSTP (who will assume the role of President's Science Advisor) will probably never have the same intimacy and degree of access to

the President as the President's generalist aides who work with him on a daily basis. Access to the President will be important but the new Director cannot realistically expect the same degree of access as a Kissinger, Califano, Sorenson or Adams.

I believe this will be so whoever is President. The old OST structure occupied a middle area between the most institutionalized of the President's staff resources—the BOB—and the least institutionalized, namely, the intimate advisors occupying their positions temporarily as the President's men. This position was not always a comfortable one, for the OST people were neither clearly career staffers in the BOB sense nor part of the President's team of long-time advisors and top aides. The new OSTP will very likely function in the same ambiguous middle area. Because of the limits of OTP Director's relationship to the President, it will be particularly important for him (or her) to see his (or her) role in the budget process as crucial. The OSTP Director and staff should work hard to forge the closest working relationship with OMB. In this way the coordinating role of the OSTP/Council will be facilitated; the agencies will cooperate because they know that the OSTP staff will have an influence on budget decisions. At the same time, OSTP staff will very likely be more "free-wheeling" than OMB staff, and on occasion function more as advocates, gadfly critics of OMB and other parts of the permanent bureaucracy, or in other ways resemble the political appointee. On the whole I think this kind of pattern for the OSTP is desirable for the country, though a difficult role for the individuals involved. This means that we would have essentially one staff for the OSTP, with individuals wearing a number of different hats—a coordinator hat, a budget hat, a presidential advisory hat. It may be necessary to have a small separate staff to handle the duties of the Coordinating Council; if this is so, I would recommend that the senior official in charge of the coordinating activities be a member of the OSTP staff, attend OSTP staff meetings, and be in close working contact with the OSTP Director.

The arrangements described here would be somewhat untidy; the OSTP would be serving partly as a OMB staff arm but would be organizationally independent of the OMB. The OSTP would work in the institutionalized processes of government but also with a tie to the White House staff, thus bringing a presidential perspective to the task of R and D coordination and providing an additional channel of access to the President. The system should be judged by virtue of its effectiveness or lack of effectiveness, not by orderliness or hierarchy on the organizational chart. It is desirable, I believe, for the OSTP to function somewhat independently of OMB even while closely allied with it. One factor that strained relations between the OST and BOB in the past was the presence of the President's Science advisory Committee (PSAC) as part of the science advisory system. The revival of PSAC is not contemplated in the current plans for OSTP, and its absence should make an effective working relationship between OMB and OSTP easier to achieve.

Mr. Chairman, it seems to me that your Subcommittee can make a very important contribution by concentrating on the role of the new OSTP as one line of inquiry for your work. It would probably be unwise to worry too much about the exact division of responsibilities among the various staff components of the Executive Office agencies involved in the coordinating role, or to attempt to define precisely through legislation how the OSTP/Council should relate to the OMB or to the President. Personalities inevitably play a large role in shaping effective working relationships at this level.

The President will always seek to impose his style on Executive Office operations and will be uncomfortable with staffing arrangements mandated for him. He will simply ignore Executive Office machinery that does not suit him, and should properly have wide discretion to use his resources for budget, coordination and other high-level staff activities in ways that he finds congenial. The Subcommittee, by reporting on the past problems of the OST and suggesting the likely future difficulties to anticipate, can greatly assist in shaping the evolution of the new OSTP office. Moreover, I believe the Subcommittee should play an active part in setting the working agenda and priorities for the new office when it begins to function.

This role, it seems to me, will be especially important if I am correct in suspecting that R and D policy in the future will reflect some sharp differences from the past. In the 1960's, decisions on R and D activities tended to be made within the executive branch to a substantial degree, and to be made by spe-

cialists and experts with technical backgrounds. The Congress, I believe, has become in recent years a much more active participant in decisions relating to R and D activities. This trend will continue. It is, therefore, important that the kind of broad view of Federal R and D programs taken by this Subcommittee be a part of Congress' oversight task. R and D decisions are also likely to become more *public* in the sense that the logic and rationale for decisions will need to be apparent to, and communicated to, a large segment of the attentive public. The controversy over recombinant DNA in Cambridge, Mass. and elsewhere, the triga reaction squabble at Columbia University, and the nuclear proposition in California are indicative of the growing public mood of skepticism toward the experts and the desire to be involved in decisions that once might have been left to the technicians.

Finally, R and D policy in the future will have the important difference that we will not be predominantly seeking to develop large-scale technologies with the Federal Government itself acting as the sole customer or purchaser. Defense and space technologies were examples of large-scale and expensive technologies, developed on an urgent basis, which were then used by the government. There will still be some of this sort of technical effort in the future, but to a larger extent than before the Federal role will be to stimulate R and D efforts with the goal of affecting the decisions of consumers and producers in the private sector. In energy, for example, we do not have the situation of the Federal Government buying a powerplant for one of its agencies; rather, the aim is to encourage the development of solar, nuclear, fossil fuel sources of energy that can be produced in the economy at prices that consumers can afford.

Although it is clear that technology is part of the answer, other actions of a non-technological character, such as energy consumption habits, are also likely to be needed. Technologies on a smaller scale, more readily adapted into the civilian economy, may be desired as part of solution to the energy problem. We do not necessarily want to race ahead with the "crash" development of a new source of power until we also have some notion of what the environmental effects will be. There will be all sorts of complicated interconnections between the various policies pursued with respect to energy, the environment, the structure of the U.S. and the world economy, food and materials, and other related issues. All of which argues that the policy process with respect to R and D will be a very complex affair, involving spillover effects between the technological agencies and other parts of the government, and among the various departments engaged in the support of research. The ramifications will also extend to the private sector, to what individual consumers decide, to the structure of the economy and the decisions of producers. This process will be more public in character than many technological decisions of the past, and will necessarily place a heavy burden on the Congress as the chief instrument for educating our fellow citizens to the complexities of the choices that we have to make. This Subcommittee, because it can take a broad look at the problems without worrying about jurisdictional lines, is in a special position to trace out the linkages between policies pursued by different agencies.

Mr. Chairman, I would like to close by commenting on a few of the areas which seem to me to deserve priority attention from the OSTP and the Subcommittee. First, the OSTP should not be afraid of addressing itself to the great issues of energy, food, materials, and the environment. Although it is true that there are many players in these areas already, and executive staffs and committee assignments in profusion already dealing with the R and D aspects of these problems, it seems to me that major attention will be devoted to these issues for a long time, and that the relatively broad look that the OSTP, aided and encouraged and critically reviewed by the Subcommittee, might take of points of overlap and lack of coordination could yield important benefits. We want policy coherence on the energy issue—not isolated actions by numerous agencies that cancel each other out—and such coherence can only come from central staff review on the executive side and broad oversight from the Congress.

Food research has a powerful sponsor and client in the Department of Agriculture. But, as two recent reviews of agriculture R and D by the Pound Committee and the Witwer Committee have shown, an effective research program in the agricultural sciences should involve extra-mural research support from NIH, NSF, and other agencies as well. With a number of departments playing a role in supporting research programs in the agricultural sciences, issues of coordination and policy coherence will surely arise.

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In my opinion, the OSTP should not exclude national security concerns from its purview. When Dr. Lee Dubridge took the old OST out of the defense business in 1969, it seems to me that he removed the office from a major area of governmental activity and diminished the potential influence of the office. There were no doubt special difficulties and strains resulting from the war at that time that account for the decision. But the R and D activities of the Defense Department are so large, with so much impact across the whole spectrum of the nation's scientific and technological capabilities, that to ignore the national security area would be a mistake.

There is one last area that should be high on the OSTP's agenda, and a special problem in the coordinating activities of the Council. I am engaged in a major study of the role of the universities in the nation's research and development effort together with a team of colleagues. While the nation's science effort in the universities is still strong, we are finding a number of emerging problems that result in part from the lack of coordination among Federal extramural research support programs. There are conflicting regulations, cross purposes, and confusing contradictions in the way Federal programs affect the universities. We need to make sure that sudden swings in Federal policy, or the lack of coordination between agencies, do not impair the ability of the universities to perform R and D of high quality in the national interest.

We have touched on many issues this morning. I hope that I have been responsive to the Subcommittee's concerns and I will be very pleased to try to answer any questions you may have. Thank you very much for giving me the opportunity to express my views to you.

Mr. SCHEUER. May I ask you a question?

Mr. THORNTON. Go ahead.

Mr. SCHEUER. I notice when you talk about energy, environment and resources, and food you leave out population. Isn't the galloping rate of population growth a factor that must be fed into the computer before you can rationalize or even set desirable levels of use of non-renewable resources or commodities, energy consumption levels?

Dr. SMITH. Absolutely.

Mr. SCHEUER. I notice throughout your statement when you talked about, as I said, energy, environment, food and materials that you left out population. I take it that that was inadvertent.

Dr. SMITH. I would put it back in.

Mr. SCHEUER. Thank you.

Again, let me restate that I think this is very excellent and thoughtful testimony as was the testimony of the first witness and maybe I can ask the preceding witness also to answer the same question.

Mr. THORNTON. Would you come back to the table, Dr. Lambricht?

Mr. SCHEUER. I have the feeling that in our science establishment we are not putting population into the mix and we are ignoring it in ways that I think are destructive in setting a national population policy as well as figuring out what we can do to help the underdeveloped

countries do a better job in containing their rates of population growth. For example, the Congress passed in 1970 the Population Research and Family Planning Act. It was supposed to cover the 5 million women who were in their childbearing years who did not have access to family planning. About a third of our counties have no family planning programs whatsoever. About three-quarters of the women in metropolitan areas are covered. About a quarter of the women in their childbearing years are not covered at all have no facilities available to them.

In 1970, the bill which was passed said we will reach all of the women in their childbearing years who do not have access to family planning within 5 years. Now 1975 has come and gone and here we are in 1976 and there are still between 3 and 3½ million women who do not have access to family planning, yet, the Secretary of HEW, Dr. Mathews, is now recommending that the family planning reports, which identify to him the areas of the country that are not being covered and should suggest to him the type of programmatic activities that would present an intelligent and thoughtful interface with other health-related activities and should be an essential tool to him in meeting the goal that Congress gave him to meet, he is now suggesting that those family planning reports be discontinued. The same thing abroad. We are giving far more abroad in terms of food than we are in family planning assistance, basically on the order of magnitude of 10 to 1. Now if you stop and think about that for a moment, we are playing a cruel and massive game of triage. Do you know what I mean when I say triage? By saving one child today with food and not giving those countries the kind of help they need to control their population and not giving the stimulus and encouragement and leadership they need, we are almost mandating that 15 years from now when that child, be he or she male or female, when they enter their child-bearing years, are going to bear anywhere from 5 to 10 children, whom it will be almost a mathematical impossibility to feed.

We have a total imbalance in our foreign aid efforts between food and other kinds of aid and health care that are going to keep people alive and population control assistance which would create some kind of balance and at some kind of tolerable level. It seems to me that some of the blame rests on the scientific establishment for not cranking population into the computer just as you have failed to do.

Dr. SMITH. Congressman Scheuer, I think this is an important point you raise. Part of the difficulty of getting a grip on the problem is that it is not clear whether the R. & D. side of it is the main thing or whether the key is that we have not moved on a policy level to make the tough decisions with the R. & D. to some extent at least, already in hand.

Mr. SCHEUER. May I interrupt there?

Dr. SMITH. Yes.

Mr. SCHEUER. We don't begin to have the R. & D. going that would give us the ideal family planning system we need nor the delivery methods to get it to the population groups we are talking about. We do not know how to dress it up to make it attractive to women. In Indonesia they are doing some things and in Taiwan they are doing other things and in Hong Kong something else and in Sri Lanka they are doing other things which seem to be successful, but we have not

pulled it all together. We still do not have anything like the ideal family planning system that would not involve repetition or counting and would be safe and convenient and inexpensive and above all that would not require the services of the medical profession and which would be long lasting, nothing like that.

The pill is totally ill-suited to a developing population. So we have a long way to go, and it seems to me in our scientific planning as well as in our biomedical research there is a real gap there. I hold the social scientists as well as the hard scientists responsible for our failure to put the whole population question into the mix. And I think it is significant that you left it out. In several places in your paper where you mention environment, materials resources, and energy, you left it out.

Dr. SMITH. Mr. Congressman, I am going to throw that back to you. In a brief incarnation I was a member of the board which I guess would be called a multinational corporation, even though it was a tiny one. We worked for a major pharmaceutical. Of course, there is great R. & D. effort going on in the pharmaceutical companies, but this company—

Mr. SCHEUER. Now hold the phone. Those pharmaceutical efforts by a profitmaking firm—I have to footnote that by saying I believe in the profit system. It has done OK by me. That is why I'm here in Congress. But a profitmaking firm is not going to develop a one-shot, long-lasting thing, whatever it is, whether it is a drug or a subcutaneous implant, when they can sell pills every day. That is why we have developed pills but we haven't developed a kind of thing, be it a system or a device or a chemical or a what-not, that is a one-time, inexpensive, and long lasting and doesn't require the services of the medical profession.

Mr. THORNTON. I believe I understood Dr. Smith to say that that is exactly the point he was trying to make.

Dr. SMITH. Because of the nature of the regulatory process—of course, that is a tough one because the public doesn't want thalidomides but it wants miracle drugs.

Mr. SCHEUER. Sure.

Dr. SMITH. It is hard to work this out. Sure, they are going to sell what they have and they are not going to push the R. & D. But the position they take is not altogether without good sense. They say whatever we come up with—even if we come up with a pill you can take once and it will last 20 years—well, there still might be some objections to that. So you will never solve it totally through the R. & D. approach alone.

One of the options we have is to say, "Well, let's change people's attitudes so that they are able to use the technology which now exists." And there is some pretty good technology, from the IUD to all kinds of pills and the implants and the other things you mentioned. So I think we have a mixture here of partly an R. & D. problem, which I agree we have to push ahead with, and also a problem related to public attitudes, which may be either receptive to or not receptive to the use of birth control.

Mr. SCHEUER. That is part of the R. & D. problem, the business of attitudinal change is social science R. & D. You would not perceive R. & D. as only being the hard sciences?

Dr. SMITH. I wouldn't, but it gets pretty tricky when you start getting into social engineering. It may be kind of crazy to get into this, but I would be very nervous about having a vasectomy. Maybe it is entirely desirable that this happen. I don't want any more children. I have two lovely children and I hope they grow up healthy, but I can't see anyone chopping me up either. I have a residual feeling—that is my body, leave it alone. A simple vasectomy is a very uncomplicated and easy R. & D. option. I don't know about you, Mr. Congressman, but if it were possible, would you want to mandate for the country that after so many children men should have vasectomies? That is tough.

Mr. SCHEUER. We are not talking about mandating anything. We are talking about giving men and women options. Right now we don't have an option for a man or a woman that is really appropriate for them. I suppose you would like to have an option, a male birth control device or system that does not involve chopping you up and that is reversible. A woman certainly doesn't have an option now of something that, as I said before, is long lasting, reversible, cheap, safe, convenient and not requiring a doctor.

Dr. SMITH. Would you want public policy to wait that long until we have such a thing before we do something about population growth?

Mr. SCHEUER. I'm not saying that either, but I'm saying that the R. & D. ought to be going on to develop both the actual biomedical and the attitudinal research. How do you create delivery systems that make whatever biomedical devices you have developed acceptable to people? How do you make it relate to their religious and cultural and ethnic and national heritage, their backgrounds?

Dr. LAMBRIGHT. If I may add a point, I think I agree with you and I think it is an important problem. It seems to me that we have developed a very fine system for identifying contingencies and threats and what have you and then developing programs of R. & D. based upon those contingencies and threats. It seems to me we do this all the time in the defense sector. They do threat assessments to go 10, 15, and 25 years into the future and then develop R. & D. programs on weapon systems which may or may not be useful 10, 15, or 25 years hence. We do not do this outside of the space and defense sectors. I think you are dealing with just as significant a threat, the population problem, and yet it has not been identified in that way and we don't have a system for identifying the threat.

Mr. SCHEUER. You are giving my complaint.

[Laughter.]

Mr. SCHEUER. I want to thank you both for your testimony. Your testimonies have both been superb at a very high professional level, articulate, stimulating and thoughtful, and I thank you both.

Mr. THORNTON. Thank you, Mr. Scheuer.

Dr. SMITH. I would like to say, if I may, that I am very pleased and delighted to appear before the subcommittee, and I am grateful for the opportunity to give my views.

Mr. THORNTON. We ranged pretty far into a specific problem which was of interest to a member, but it does show the wide range of science research and how important it is that we seek to foresee problems and

to work toward solutions to those problems in advance of their becoming of crisis dimensions to the general public.

The first talk I made on becoming a Member of Congress nearly 4 years ago now was on the same day that the President of the United States said there was no energy crisis. And I said there was. And I identified it as being related to the problems of providing food for an expanding world population, not because of any great wisdom on my part, because the information was available to everyone. I included the projections for energy use and the comparison of energy use for agriculture, et cetera, which have since been proven out.

It seems to me that we have a duty in Government and we need to find ways in the science community of identifying problems and bringing them to the attention of those people who can make decision in advance of the time that they are widely perceived. Do you have any comment about the role of the Federal Council in doing this or the President's Science Adviser?

Dr. Smith, I will let you begin.

Dr. SMITH. Mr. Chairman, I think that is one of the vital functions it can perform. And when I was in the OST looking at this, they could perform a broad—I guess overview is kind of a cliché word—but they could follow the technological efforts of all the agencies. They could develop a sense for what are the big ones coming down the line like energy, food, population, and some other things, and then how do we begin to draw some attention to them and get some focused energy and some resources. First of all, you have to state what is happening and publish that. That is a very vital function, particularly given the speed with which things develop. I would just endorse those comments, and I would think that would be a vital role that this new Council should perform. And we want them to do that. They can get lost in a lot of the shrubbery. I think we would want them to not be too pedantic and play around with a lot of little problems but keep their sights up to look for the big ones that are going to be the really dangerous ones down the line.

Mr. THORNTON. It is not enough to look back and review or even look at the present case. There should be an effort made to identify future problems; is that what you are saying.

Mr. SMITH. That is part of good staff work, and it is one of the vital functions the office should have.

Mr. THORNTON. Do you have a comment, Dr. Lambright?

Dr. LAMBRIGHT. I agree 100 percent. I think coordination has to do with balance, and we should think about balance not only with respect to existing agencies, programs and problems, but balance between effort in solving existing problems and those that we know are coming. There has to be some mechanism by which we can identify and get work started on those problems that we can foresee now and get them into the existing system.

I think there is a great danger in the administrative process, generally, when you establish agencies to solve existing problems, to rigidify your problem identification process in terms of the administrative solutions which you have. Because we do something well, therefore, we will solve the next problem in our field, but what about those fields that have not been identified as relevant to existing apparatus?

That is the dilemma you face. You have to identify those new problems, and then you have to get some administrative representation into the system, so that work can begin very quickly on things such as population. Who are the advocates for population research in the bureaucracy right now? Where are they. Chances are they are pretty far down the line and very quiet and very fragmented. Is there some way you can get some clout behind those scattered, fragmented population R. & D. organizations so that you can bring some institutional leverage behind the R. & D. in the field?

MR. THORNTON. This relates back to an observation made by Dr. Smith, which I would like to continue to explore. With regard to the willingness of agencies or groups to cooperate, being dependent to some degree upon size and power of the institution, I personally have long believed that it is not necessary to confuse bigness with badness and I do not think the two terms are synonymous. Yet, I can perceive that if an institution becomes fat and comfortable and secure that it may have less incentive to reach out and to cooperate and to combine efforts with other institutions pursuing similar objectives.

My question is how do you overcome that? You have such institutions. Is it the personality of the Administrators? It is not necessarily true that a big institution is going to have that attitude. Well, the biggest of our agencies is small compared with the overall public interest. Who is going to represent all of us and how do you bring a focus to that? How do you convince a big agency that its security is ultimately dependent upon a perception of national goals in the interest of all of us.

DR. SMITH. One thing, Mr. Chairman, if I may take a crack at it, that is crucial here is a sense of balance and proportion of this new office as it begins to function. How do you tell a big one from a little one? There are always a lot of claimants, many little agencies who want to be big agencies and they will always try to be persuasive.

At times it is going to be in the national interest to pick one of them out and back them. Not everyone deserves to be backed. Some of them deserve to remain small or to disappear.

MR. THORNTON. When you say disappear that brings something to mind and that is the sunset laws. What effect would sunset laws which would terminate the existence of all agencies periodically unless they could justify to Congress the need to be renewed—would that have a useful effect upon an agency in wanting to demonstrate that it was essential and its functions are related to many other areas of Government?

DR. SMITH. That is an intriguing one. I wish I knew the answer. I have a feeling that if everything were subject to a sunset law it would just be too overwhelming for the Congress to try to handle.

MR. THORNTON. Yes.

DR. SMITH. You can have the effect of a sunset law by now looking around and saying, where is the real disaster or problem agency, let's land on that one and take care of it. It might be a tool we should try a bit. I think there is no substitute, whatever law we have, for good sense on the Hill and on the Executive side. [Laughter.]

MR. THORNTON. That is true.

DR. SMITH. Sometimes I think you can persuade a big agency, if you try to make a case to them, you persuade them and hit them over the

head at the same time and you bring them along. At other times you cannot deal with them. You have to try to go to the President or get a dramatic statement from the Congress.

But the main thing is how do we judge the really big ones from those that are second priority? You have to be selective. You have to pick out the really critical ones and work hard on them. You can only make an impact if you are selective and you only share so much energy.

Mr. THORNTON. Thank you very much, Dr. Smith.

Dr. LAMBRIGHT, do you have any comments?

Dr. LAMBRIGHT. With respect to the notion of how to move agencies to think about the public interest rather than agency interest, really gets to the question of how to get them to adapt as priorities change and policies change and as needs are foreseen which are different from what they previously were? I think a practical solution might be, if not the sunset law, perhaps to institutionalize a basis by which we take a hard look at their charters every so many years.

In recent years we have seen the legislation of the National Science Foundation rewritten, for all intents and purposes, from what it was in 1950 to what it should be in 1968. It took a hard look and assessment of what it was doing and the NSF today is different from what it was in pre-1968.

We have ERDA which is quite different from the old AEC. It took rewriting of legislation to do that. These decisions to take a hard look at the charters of agencies and to rewrite them were, I think, a perception on the part of Congress of the need to update agencies to deal with new problems. Mr. Daddario was mainly responsible for the change in NSF legislation. The change did not come from within NSF, you may be sure.

With respect to AEC being changed to ERDA, I think that was, of course, due to the Arabs, the energy crisis and everything that came with it. This was ad hoc and totally uninstitutionalized change. I think it would be very helpful if one could institutionalize on a recurrent basis a hard look at the charters of agencies to see if they are still relevant. We have judicial review for our constitution. We change our country, but the charters of agencies don't seem to change very fast. This is not a sunset law, but it has some of the positive effects of such a law.

Mr. THORNTON. I want to make it clear that I do not advocate sunset laws to be applicable across the board. Lest anyone misunderstand, I would not suggest that social security, for example, should be terminated, but maybe it ought to be looked at and analyzed in terms of whether it is performing the functions that the institution was originally designed to accomplish.

Dr. LAMBRIGHT. Or new functions that have not been imagined yet. We read that there are many scientists who are very worried about climatic changes. And this is one of those gigantic macro problems which may be a real problem or it may be imaginary, but we still ought to think about it, and we ought to do research. So you take a hard look at what is going on in the Federal Government, you see a teeny-weeny program in NSF and one here and a fairly large program in weather technology within NASA which has very little to do with climate. Could you change that program in NASA a little bit to relate to this new problem which the agency might not have thought of?

That is coordination. Who is going to do that? It has to come from outside the agency.

Mr. THORNTON. What a tremendous undertaking that problem is, because we have done so many varied things that have the potential of varying our climate. I guess it is our hope that the laws of probability have prevailed and some of the things we have done to warm temperatures may have been canceled by other things we have done that would have the effect of cooling.

Dr. LAMBRIGHT. A lot of these problems are so big that people tend to be scared to deal with them. They would rather deal with something manageable, for example. That is certainly the way the academic community works. Population research among academics is not a glamorous field, because it seems too big and too mushy.

Dr. SMITH. It is much easier to think about minute nuts and bolts, how many rolls of toilet paper should go here or there, or to think about grand global strategy.

Dr. LAMBRIGHT. If you think coordination is tough in Government, you should try it at a university, to get political scientists to talk to economists, for example.

Mr. THORNTON. Dr. Smith, I would like to ask if you would be agreeable to respond to written questions that may be submitted to you. Your testimony has been most interesting and helpful. I feel confident that staff does have some questions they would like to ask, but we are in the situation once again of having to report to the floor of the House. So with thanks to both of you I will declare the hearing adjourned.

[Whereupon, at 12:20 p.m., the subcommittee was adjourned to reconvene at 10 a.m. on Friday, July 23, 1976.]

INTERAGENCY COORDINATION OF FEDERAL SCIENTIFIC RESEARCH AND DEVELOPMENT

Special Oversight Hearings

FRIDAY, JULY 23, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL
SCIENTIFIC PLANNING AND ANALYSIS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Ray Thornton, chairman of the subcommittee, presiding.

Mr. THORNTON. The hearing will come to order.

This morning we continue our hearings on the coordination of Federal research and development. We are privileged to hear from a series of distinguished witnesses, the first of whom, Dr. Charles V. Kidd, has an outstanding career both nationally and internationally, having served on a number of delegations to the United Nations, UNESCO, and other international conferences on education, science, and technology; and who is presently the executive secretary and director of the Council on Federal Relations of the Association of American Universities.

Dr. Kidd, your more complete biographical data will be included in the record.

We have received your prepared statement, and without objection that will be included verbatim in the record.

[A biographical sketch of Dr. Kidd is as follows:]

DR. CHARLES V. KIDD

Dr. Kidd is the Executive Secretary and the Director of the Council on Federal Relations of the Association of American Universities. He was formerly the Executive Secretary of the Federal Council for Science and Technology (Office of Science and Technology, Executive Office of the President), concerned with the coordination of the scientific and technological programs of Federal agencies.

From 1949 to 1964 he was Chief of the Office of Research Planning at the National Institutes of Health and its Associate Director for International Activities. He was earlier an economist with the Council of Economic Advisers, and Executive Secretary of the President's Scientific Research Board.

He received the Rockefeller Public Service Award in 1955 and the Distinguished Service Award of the Department of Health, Education and Welfare in 1964. He is the author of numerous articles on science policy and of the book, *American Universities and Federal Research*, Harvard University Press, 1960.

He has served as member and chairman of a number of United States delegations to UN, UNESCO and OAS international conferences on education, science and technology, and has been a consultant to these organizations. He has also been a consultant to a number of private foundations, including the Ford Foundation, Education and World Affairs, and National Foundation for Infantile Paralysis, and has lectured at a number of universities on matters relating to education, manpower, migration, medical research, and science and technology.

Dr. Kidd was educated at Princeton (A.B. in history in 1935; M.A. in economics in 1937); and Harvard (Ph.D. in public administration in 1957).

I would like now for you to proceed in such manner as you choose, to give us your testimony.

**STATEMENT OF DR. CHARLES V. KIDD, EXECUTIVE SECRETARY,
ASSOCIATION OF AMERICAN UNIVERSITIES, AND FORMER EX-
ECUTIVE SECRETARY, FEDERAL COUNCIL ON SCIENCE AND
TECHNOLOGY**

Dr. KIDD. Thank you, Mr. Chairman.

I would like to run over this prepared statement and summarize it, so we will have some time for discussion.

Mr. THORNTON. Very well.

Dr. KIDD. I was executive secretary of the Federal Council on Science and Technology from 1964 through 1969.

A great deal has changed since, but I think there are some elements of relative permanence in these programs.

The first thing that impressed me, Mr. Chairman, is that there are multiple channels for coordination in the Federal Government. An interagency committee, including the new Council, is only one. There is a maze of relationships among the executive agencies, and a multitude of coordinating jobs are accomplished through those channels.

Then I would like to stress that there is an imperative need for effective communication between the Executive Office and the agencies in connection with matters of science and technology, and a need for a forum where the agencies can get together and at least have a semi-structured atmosphere. In my judgment the new Council can serve effectively as a channel of communication and as a forum. A lot of work of exchange of information and actual coordination depends simply on getting people together so they know each other and so work can proceed at the actual working level.

As a practical matter I think the work of an interagency council or committee is in practice affected by the relative power of the agencies concerned. By and large, a large and powerful agency will have numerous channels of access to OMB, to the Office of the President, and to the Domestic Council. It will rely generally relatively less on an interagency committee; whereas a smaller and weaker agency, having more tenuous relationships with the Executive Office, will tend to be more active in interagency affairs.

I will move now if I may to the question of overlapping and duplication. Although it may be a heretical view, in my judgment this is not a very important function, if you take it literally.

Many Federal agencies have to conduct research in fields of interest to other agencies. All these agencies have statutory responsibilities which they are very reluctant to relinquish unless they are assured their specific interests will be adequately met, and often they cannot

be adequately met unless the agency itself conducts the research. And there are numerous examples—energy, oceanography, atmospheric sciences; material sciences—where research is conducted by a number of departments.

Mr. THORNTON. If I may interrupt as we go along, if I understand the thrust of your testimony it may be that you are saying that sometimes there may sometimes be an apparent duplication of research, when in fact the purposes, goals, objectives, of the research may be quite different, and the appearance of duplication is perhaps not really reflective of the real situation, related to the question at which the research is directed.

Dr. KIDD. That is certainly true.

Take the atmospheric sciences: The Department of Interior wants to know the effect of evaporation from open reservoirs, the Navy has an interest in the atmosphere, NASA has to work on the upper atmosphere. There are areas of this kind all over the Government.

So the work is, I think, more realistically stated in these terms: In a situation which inherently requires people in different agencies to work in the same scientific area, how is the work most appropriately divided among the agencies? How are cooperation and communication at the working level best sustained?

I think the main task of a coordinating agency is to assure adequate exchange of information and appropriate division of work. That often involves thorny and controversial problems, but it is more working out the problem than avoiding the duplication itself.

Mr. THORNTON. Yes.

Dr. KIDD. A further consideration is that this question of coordination among scientific problems is a never-ending one. It is, I say in my testimony, like the stages of man.

Initially you have research conducted in a given agency. Then for political or scientific or any number of reasons research can proliferate in a given area. We have examples of that in, for example, energy, the environment, the atmospheric sciences and oceanography. They have gone beyond the stage of research concentrated in one field, but it is all over the Government. That is what I call an adolescent phase. It is turbulent, you have conflicts that are difficult to resolve. But it is often not appropriate to consolidate those efforts. It is only when the general political, financial and scientific situation reaches the point that it is desirable to consolidate, as in the cases I pointed out, that you pull those activities together.

Therefore, in my judgment the fact that you always have certain activities in this adolescent phase is not an indication of inadequate coordination. It is simply that we have not reached the decision to pull those activities together into a single activity.

Now, the establishment of a new administrative entity in the sense marks the maturation of a function. I pointed out areas in which that has happened. It is useful to note, I think, as far as coordination is concerned, establishment of a new organization typically does not solve the problem of coordination, it just shifts the administrative context in which a solution is sought. The formation of a new organization does not automatically strip all agencies of all R. & D. related to the field of new organization. Similar problems of coordination remain.

Mr. THORNTON. One question that remains, if you are going to continue the parallel to the stages of man, is what resources, are there for determining when an agency has outlived its usefulness?

Dr. KIDD. That is the final stage.

As you know, the longevity of these organizations is really remarkable.

Mr. THORNTON. It is.

Dr. KIDD. They do go out of existence and are merged, as the old NACA was folded into NASA; AEC has disappeared. I think it is generally more a mutation to a new form of organization rather than abolition of functions; it is renaming, redesignating, reorganizing functions.

Mr. THORNTON. Certainly there should be an effort made to salvage the good research and continue those portions of the programs which do a necessary and excellent task.

Dr. KIDD. I think that has happened.

I would like to speak for a while about the uses, utility, and limitations of the interagency committee, or Council, itself, as a means of dealing with questions of R. & D. administration.

"Policy and Planning," for example, occurs in the charge to the new Council. Those are very broad words. Let me note some of the meanings of "policies" and "planning." First, the task of analysis of the state of R. & D. in various fields. In many instances in the past the first step has been to recognize research and development in a given area does occur in a number of places in the government, in a rather independent and uncoordinated fashion.

Typically a group is named, with a secretary, and a report is given which often brings together the research in an organized way and results in a logical grouping of R. & D. efforts in a way that had not been exposed earlier.

Those analyses under the auspices of interagency coordination depend very heavily on the caliber of the staff who do it. I think that is characteristic of all interagency committees, a very high degree of dependence on the staff which does the work.

Then there is a question of drawing up recommendations, and after that the stage of action—doing something about recommendations.

In my experience in interagency effort is best at the first line of activity, that is, analysis; somewhat less effective in making recommendations, and least effective when you reach the point of action. An interagency committee is not a very effective vehicle for securing action.

But I would not play down, at all, the need for and utility of an analysis of the forum function and of framing recommendations. I think this is the area in which these groups are relatively good, and they are needed activities. But one serious question that I think often arises is whether that sort of analysis, preparation of recommendations in a given area, is a proper activity in the Executive Office of the President, because often these efforts become quite technical and quite detailed. They often do not deal with the kind of broad policy questions one naturally thinks of in connection with the grand task of coordination of the gigantic Federal R. & D. activities.

I think there are inherent reasons for this limitation on the effectiveness of these committees, and that these limitations do not reflect the capacity of the people involved in any way, but are rather the result of fairly deep-seated considerations.

One of those is that in any significant area of R. & D. there are complicated political, economic and social questions which far transcend the technical questions.

In the past, say under the Federal Council of Sciences and Technology, the people who participated in these discussions and were named by agency heads to be members were typically technical people, with neither the experience nor the place in the organization to deal with the wider issues. Whether that will be characteristic of the new Council remains to be seen.

There is another limitation on the work of an interagency Council. That is, the Secretary or Administrator of a Federal agency is generally the person who sets the priorities for that agency, in conjunction with the Executive Office, particularly the Office of OMB.

The scientific people on his staff, and the scientific people from other agencies, can get together and make recommendations which seem to them technically sound. But when they return to their departments their recommendations may not parallel the recommendations as seen from the top of the agency, and in that case generally the wishes of the Administrator or the Secretary prevail and the planning effort is subordinated.

Also, realistically the structure of Congress for appropriations has an effect, because plans which may go up in fairly coordinated fashion from the executive branch are considered by different appropriations' subcommittees, and often the budgets are knocked askew in the course of the budget appropriation process.

Another inherent limitation is that generally—

Mr. THORNTON. Would you be willing to suggest perhaps sometimes a skewed budget might be set straight?

Dr. KIDD. Oh, yes. That often happens. I think that is a reflection of another fact, that is, the recommendation out of the agency might not make sense when looked at in broader context. It is just that these technical plans are very fragile things.

Mr. THORNTON. I was trying to suggest that it can operate both ways.

Dr. KIDD. It certainly can.

Finally, there are a lot of practical matters that limit the breadth of the matters with which an interagency committee can deal effectively. One of these is that the process of forming the budget is perhaps the most powerful procedure within the executive branch for coordination. The resolution of many policy questions depends on exposing and discussing matters which are closely held in the Executive Office. That is, the inner workings of the formation of the President's budget.

The Director of the new Office of Science and Technology Policy may be close, and will have to be close, to this process, if he is to be fully effective. But relatively little of that process will probably be divulged to members of the new Council, I would guess.

Another limitation is that many policy questions involve tough decisions which help or harm individual agencies which are members of the Council, and the representatives from these agencies will probably be unwilling to discuss their positions frankly in a Council meeting. Other agencies tend to feel it is improper to sit in judgment on a peer in a meeting of that sort.

Also, in the context of an interagency meeting, the agencies are constrained to protect their bureaucratic flanks. They are selected ex officio as representatives of an agency. They are representatives of their department and, properly defenders of their interest. Often the members can rise above their bureaucratic limitations, but often they cannot.

It is often the case that representatives with little interest or competence in a given matter attend the meetings, and his has a tendency to inhibit those who have a sharp interest in an important matter under discussion.

There are also practical problems of sustaining the level of generality and significance of the agenda. Some members find they are hard-pressed to deal with internal agency problems that are more significant to them than some Council members.

A further limitation on the scope of the work of a Council of this kind is that the Chairman will often for good reasons choose not to bring many important policy issues to the Council. He may prefer to deal with them by telephoning people, calling together small ad hoc groups. The members of these small groups may be members of the Council, but often it is convenient to convene them not in the context of a Council meeting. It is helpful simply to get together to talk about issues where they do not have to represent in public the position of the agency where they work.

Now, this sounds like a rather negative assessment of what a Council can do. But it seems to me it is more productive to look quite realistically at the scope and the limitations of an interagency committee as a device for coordination, and to bear in mind that there are numerous other channels.

There is another broad area of activity which relates not to substantive issues, but to ways and means of getting the search done. I refer to such crosscutting matters as patent policy, personnel policy in Federal laboratories, laboratory administration, storage, and retrieval of scientific information.

These have a great deal to do with effectiveness not only of the Federal but the total national R. & D. effort. And an interagency committee can be quite effective in those areas, including to some degree the operation of the very large direct Federal laboratory operation.

Now, to summarize: The utility of a council is high in gathering information and comparing analyses. They prepare the indispensable background for the preparation of recommendations.

The fact the Council is an interagency group advisory to the Director need not be a real limitation on its utility in my judgment, because the work of such a group will depend more on the substance of what it does than on whether it is labeled "advisory" or whatever.

There is a wide and continuing area of interagency R. & D. issues, even though most problems are found within single agencies.

The forum function is extremely important. And much coordination, particularly of a technical character, can take place simply through drawing together technical people from the agencies.

These remarks, Mr. Chairman, do not exhaust the intricate and interesting problems associated with the new Coordinating Council. And I have not dealt with the broader problems of coordination going beyond the activities of a council.

Mr. Chairman, I appreciate the opportunity to testify. I would be glad to answer any questions you may have.

[The complete prepared statement of Dr. Kidd follows:]

COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL SCIENTIFIC PLANNING AND ANALYSIS, HOUSE OF REPRESENTATIVES

TESTIMONY ON COORDINATION OF RESEARCH AND DEVELOPMENT ACTIVITIES
IN THE FEDERAL GOVERNMENT

Mr. Chairman and members of the Committee, my name is Charles Kidd and I am Executive Secretary of the Association of American Universities. From 1964 to 1969, as I was reminded by the excellent history of the Federal Council on Science and Technology prepared by the Science Policy Research Division of the Congressional Research Service, I was the Executive Secretary of that Council.

While much has changed since 1969, I believe that there are some constants with respect to coordination of the research and development programs of the Federal government that remain relevant. Let me list some of them.

I. MULTIPLE CHANNELS OF COORDINATION

First, it is helpful to assume, as this Committee apparently does, that the channel for coordination of Federal R&D activities will not be solely the new Federal Coordinating Council for Science, Engineering and Technology. There are many devices for coordination. Many important policy questions are resolved within the departments and agencies, and wide areas of research and development are coordinated within the agencies. The National Science Foundation originates policy proposals and recommendations concerning the support of basic research and education in the sciences, and provides studies, information, and advice relevant to general policy decisions. Studies by the National Academy of Sciences, a quasi-Governmental agency, contribute significantly to the formation of policy, and the National Academy of Engineering plays the same role. The former's Committee on Science and Public Policy has been particularly helpful in examining general policy questions, and the entire Academy/National Research Council operation is a major means of providing a mechanism by which the views and judgments of scientists outside the Government are made available to the legislative and executive branches of Government.

The mechanisms for science policy reflect the pluralistic character of most political processes in the United States. This character militates against a neat division of functions, and it results in a sharing of functions. This has the effect of diffusing power. In science policy, the continuing task is to sustain the most effective balance between diffusion and centralization. Diffusion is an effective way of insuring that all relevant factors and potential consequences are considered in reaching decisions, but diffusion can delay decisions and make them less clear cut. Centralization, on the other hand, tends to produce timely and crisp decisions, but at the risk of neglecting important views, relevant considerations and important side effects. At this time, the extremely diffuse character of the process for arriving at science policy needs to be balanced by strengthening the formal central machinery and procedures, as is done by the establishment of the new Federal Coordinating Council for Science, Engineering and Technology.

IV. OVERLAPPING AND DUPLICATION

The new Council will be composed of responsible representatives of Federal agencies. This means that the Council can potentially serve well as a two-way

channel of communication between the President and his office and the Federal agencies. It should also serve as a forum for discussion of problems of common interest to the agencies. The Council members can identify and deal with common problems encountered in carrying out the scientific and technological activities of the Federal agencies, both in Federal laboratories and under grant and contract. The problems relate both to substantive areas of science and technology, extending across agency lines, and also to activities supporting scientific and technological activities, such as personnel policy, or storage and retrieval of scientific information.

It would be possible to set up separate groups, each reporting to the President, for dealing with scientific and technological areas which cut across agency lines. However, the proliferation of such groups would raise two difficult problems. First, the number of groups reporting to the President would be increased. Second, coordination among fields is inherently necessary because they draw upon common limited resources and their combined independent actions produce important consequences which no one agency can deal with. Therefore, if a coordinating authority did not exist to coordinate such separate coordinating groups, it would either have to exist informally or be created formally.

The utility of having such an effective channel of communication is often underestimated because this in fact leads the agencies themselves to divide work rationally.

III. THE BIG AGENCIES AND SMALL AGENCIES

There are significant differences between large and small agencies so far as their attitudes towards coordination are concerned, but these differences stem from a common principle—bureaucratic self-interest.

The interest of large agencies is primarily to ensure that a central coordinating body does not interfere with what they wish to do. Accordingly, they tend to participate in a way designed to ensure that the coordinating activity does them no harm. Generally, they have such ease of access to the White House and the Executive Office that they can deal with matters involving coordination through a number of channels. On the other hand, the smaller agencies tend to look upon a central coordinating body as a major channel of access to the Executive Office.

IV. OVERLAPPING AND DUPLICATION

The statutory charge to the new Coordinating Committee to eliminate unwarranted duplication deserves mention. Although it may be an heretical view, in my judgment this is not a very important function if one takes it literally.

Many Federal agencies must conduct or support research in fields of interest to other agencies. Their statutory responsibilities are such that they can entrust the necessary research to others only if they can be assured that their specific needs will be adequately met. Often agencies must approach a field of science with a specialized purpose which makes it difficult to entrust the research to other agencies. For example, I had occasion to review research in the atmospheric sciences a few years ago. Twelve different agencies then administered sixteen major programs in the atmospheric sciences. Superficially, this sounds like duplication, but the division of effort was actually rational. For example, the Department of Agriculture needed to know the characteristics of thunderstorms in connection with protection against forest fires. The National Bureau of Standards studied the absorption and refraction of radio waves in the lower atmosphere. The Department of Interior needed to know more about the factors affecting evaporation from open reservoirs.

From this example, which could be replicated many times in other fields, it can be seen that to view the problem as being primarily the avoidance of "overlapping and duplication" oversimplifies the matter. The problem is more realistically stated in these terms: In a situation inherently requiring that people in different agencies work in the same scientific area, how is work most appropriately divided among agencies, and how are communication and cooperation at the working level best sustained? A central task of the Coordinating Committee will be to solve these problems. This is an important operating problem that exists whether the total investment in a given field is constant, increasing, or decreasing.

Actually, the set of problems represented by atmospheric and oceanographic research are now coordinated by the National Oceanographic and Atmospheric Administration in the Department of Commerce. This is an example of a field

which has reached a stage of significance requiring a new administrative structure. We have here an example of transfer of a coordinating function from the Executive Office to an operating agency, and the more that this can be done, the better.

V. THE UNENDING PROBLEM OF COORDINATION

I would like to say a few words about coordination as a continuing activity. It is often assumed that if one could only establish an optimum structure for coordination, the problem would be solved. Of course, this is not the case because the substance of the task of coordination keeps changing.

There is a general pattern of evolution of areas requiring coordination that is somewhat analogous to the stages of man. An area of science and technology is often confined initially to—or strongly concentrated in—a single Federal agency. This is akin to childhood. Then for any one of a number of reasons, a field of science and technology may become urgent, popular or both. Then related activities will spring up in a number of agencies. They will tend to vie for missions and funds. Interagency rivalries can become intense. Jurisdictional conflicts become common. This is akin to a turbulent adolescence. This is the stage at which interagency coordination is generally undertaken, and the mechanism is usually an interagency committee.

Since science and technology are dynamic forces which produce change and since new problems of society continue to emerge, there are always areas of science and technology in the adolescent stage. They have grown beyond the bounds of a single agency, but they have not yet matured to the stage warranting a regrouping of functions in an agency which pulls the diverse strings together.

The establishment of a new administrative entity in a sense marks the maturation of a function. This has happened in such fields as energy research and development and oceanography and atmospheric science. It will no doubt happen in other fields as combination of political forces and scientific and technological developments make a new organization logical or expedient. So far as coordination is concerned, the establishment of a new organization typically does not solve the problems, but rather shifts the administrative context within which a solution is sought. For example, formation of a new organization does not automatically strip all agencies of all R&D related to the field of the new organization, so problems of coordination remain. They are merely shifted out of the Executive Office.

VI. THE USES OF INTERAGENCY COMMITTEES

The new Coordinating Council is by statute directed to "recommend policies and other measures designed to provide more effective planning . . . of Federal scientific, engineering and technological programs". The words "policies and planning" are so broad as to have only the most vague operational meaning.

Without treating the subject in a completely organized way, some of the meaning of policies and planning can be outlined. There is first the task of analysis of the state of R&D in various fields. Then there is the question of the *pros* and *cons* of various courses of action if the analysis indicates that something probably should be done. Finally, there is the question of action—decisions as to what will be done. For each of these stages, the effectiveness of an interagency council is affected by the size of the issue under consideration. By and large, as will be pointed out below, the effectiveness of interagency groups is highest in the area of information and analysis, next effective in recommendations and least effective in action. In addition, interagency groups are most effective in dealing with smaller issues and less effective in dealing with large ones.

Interagency committees can effectively review the state of a field. When an area of science and technology is selected for review, the initial approach is usually to set up an interagency committee with a chairman and an executive secretary, and to ask it to determine who is doing what, and at what cost. Studies of these matters typically lead to publications which for the first time draw together information on federally supported and conducted research in the selected fields. The process of pulling together such a report often has as a useful byproduct the closer collaboration among agencies, more precise definition of fields and a new functional grouping of areas of activity for analytical purposes. The primary function of these studies is to indicate ways of operating programs more

effectively and to provide a basis for policy decisions. The effectiveness of these efforts will be heavily dependent upon the adequacy of leadership and staff assistance from the Office of Science and Technology Policy and from the agencies.

The actual process of coordination at the working level depends critically upon communication and good working relationship among technical people. Some problems are solvable by fiat from above, such as establishing the general areas within which agencies will and will not conduct or support research. However, such general decisions almost always leave detailed questions to be resolved at the working level. The committees of the new Coordinating Council will serve primarily to resolve problems at the working level.

Interagency committees can also evaluate programs and indicate appropriate lines of development. The evaluation may be scientific, administrative or budgetary, or any combination of the three. In terms of science, evaluation usually involves an assessment of the probability of a productive outcome in a given scientific or technological endeavor in relation to the resources expended and in terms of feasible alternatives. There is also the question of relevance. That is, the probability that a successful scientific outcome of an undertaking will yield results helpful in resolving an operational problem within a reasonable time. Fields may be assessed in terms of purpose other than scientific. For example, the atmospheric sciences may be reviewed in terms of their implications for crop production, for hurricane protection or for safety at sea. A field may be looked at in administrative terms, to query the existing division of effort among agencies to probe and improve the use of resources, to assess the current and prospective manpower situation, or to weigh the efficiency of the existing division of effort between different types of laboratories.

In short, there is no practical alternative to administration by interagency cooperation at the working level when (a) parts of an emerging area of science or technology are found in a number of agencies by reason of their relevance to the work of the agencies and (b) the full circumstances relating to the emerging area are not such that the current work done in agencies should be removed from their purview and placed in a newly-created organization. The practical problem is therefore how to make interagency cooperation at this level more effective when no practical administrative alternative exists.

However, there are limits to what an interagency council can be expected to do. In general, the broader the problem, the more it affects important agency missions and the greater the amount of money involved, the less can an interagency group make decisions.

A first reason for this is because of the complexity and breadth of the considerations affecting science and technology, the evaluations of the committees of the Federal Council are not automatically accepted, even when the evaluation relates solely to scientific matters. These evaluations often have implications for the missions of agencies, for the welfare and income of various groups and for the size and location of various research enterprises. In such circumstances, the recommendations of the interagency committees are only one of many factors entering into a decision.

A second reason why the recommendations of interagency groups are sometimes not accepted is that the committees represent functions which are competitive with other functions within the various departments. Priorities as assessed within agencies are not always consistent with the priorities as seen by interagency committees. Given the responsibility of Cabinet officers and heads of major agencies, transferring from them to an interagency committee the important authority to set departmental priorities cannot be the usual way of operation. The general priorities set by major officials responsible directly to the President must be accepted as a general rule by an interagency committee. Any other course is a vote by subordinates of no confidence in their superiors whom the President holds responsible for the operation of the government.

A third limitation on the effectiveness of interagency planning is generated by the structure of the congressional appropriation committees. Budgets which may be usefully constructed for interagency activities in the executive branch are typically considered by a number of appropriations subcommittees and committees. They assess budgets primarily from the agency standpoint and sometimes make appropriations which complicate efforts to construct a coordinated program.

A fourth limitation on the effectiveness of interagency coordination arises from the fact that most R&D is conducted within a single department. However,

being in a single department does not automatically solve problems of coordination. It simply submerges them. Concentration on problems of interagency coordination leaves untouched the much more significant problems of intra-departmental coordination. I simply mention this as an inherent limitation on an approach which assumes that interagency coordination is more significant than intra-agency coordination.

Finally, there are many matters having to do with the realities of the operation of Federal agencies, their relationships with each other, and their interaction with the Executive Office of the President which have a cumulative tendency to limit the effectiveness of a Coordinating Council.

1. As has been pointed out, many policy questions arise within individual departments, and these cannot be effectively discussed by a Coordinating Council.

2. The resolution of many policy questions depends on exposing and discussing matters which are closely held in the Executive Office—for example, the inner workings of the preparation of the President's budget. While the Director of the Office of Science and Technology Policy may be close to this process, relatively little will be divulged to an interagency Council.

3. Many policy questions will involve tough decisions which help or harm individual agencies which are members of the Council. The agencies primarily affected by the decision will probably be unwilling to discuss their positions frankly in a Council meeting. Other agencies tend to feel it improper to sit in judgment on a peer in an open meeting.

4. In the context of an interagency meeting, agencies are constrained to protect their bureaucratic flanks. They are selected on a *ex officio* basis, and hence are representatives of their departments and are properly the defenders of their interests.

5. The membership of the Council is fixed by law and it will probably not be possible to convene meetings of the Council which exclude some member agencies. Accordingly, the meeting will probably often include representatives with little interest or competence in any single policy matter that may be under discussion. Their presence will tend to inhibit those who are primarily concerned with the matter under discussion.

6. The Council will probably meet regularly and it will probably consider many matters that are not of primary significance to all of the members. Some of the members will probably find that they are hard pressed to find time to deal with internal agency problems that are more significant to them than some issues of the Council agenda. Accordingly, it will probably prove difficult to ensure that all of the members, rather than alternates, will be present when important policy matters are discussed.

7. The Chairman of the Council will often, for good reason, choose not to bring many important policy issues to the Council. It will then be difficult to halt a trend in the agenda, attendance and level of activity to the second level. The significance of matters discussed by the Council will affect the rank of those who attend meetings if alternates are permitted—a matter not settled by law. Whether members or alternates attend (if alternates are permitted) will reflect the weight which the members from different agencies place upon the Council as a source of information and potential power, and upon the significance of the agenda items to them.

8. In practice, when the Director of the new Office wants help on significant policy matters from the agencies, he will probably tend to hand-pick specific individuals on the basis of their personal effectiveness rather than to rely on the Council as a body. A few phone calls may suffice, or people from the agencies may be drawn together in hand-picked groups. These may be formal task forces or simply informal meetings. In this context, individuals can speak without representing or committing their agencies. This way of selecting people to work on policy questions that are significant to the President would not amount to "bypassing" the Council but would rather constitute recognition of the fact that discussion and effective design and presentation of policy issues for the President involves delicate issues. Many members of the Council may well participate frequently in significant policy discussions, but I would judge that this would generally not be in the context of the Council or in their capacity as members of the Council.

In summary, the interdepartmental groups are generally more effective in ensuring more efficient use of funds at a given level than they are in developing or expanding activities or in contributing to decisions on the distribution of im-

portant missions among agencies. Other means, generally involving direct dealing by the agencies concerned with the Executive Office of the President, are usually involved when major decisions are made. However, it should be noted that these limitations on the effectiveness of interagency committees do not supply to some of their most important functions—providing information, analysis and better communication. Often interagency groups, such as the new Council, provide this indispensable staff work even though they do not make executive decisions on broad questions.

Often the interagency committee device is criticized as being ineffective. This charge has to be examined carefully and in terms of what can be realistically expected from these groups. Basically, what they can be expected to do is to cope with the problems of the adolescent stage at the operating level. They cannot realistically be expected to deal with major questions of allocation of functions among agencies, proposals for major reorganizations or major changes in budgetary levels.

VII. THE QUALITY OF THE FEDERAL LABORATORIES

Coordination of science and technology is often considered only in relation to substantive issues. However, it should be remembered that the Federal government operates a large scientific establishment. It employs about 75,000 scientists and engineers and the operating budgets for the federal laboratories total about \$5.2 billion per year. The effectiveness of this Federal scientific establishment is a major determinant of the efficacy of the entire national scientific and technological effort. The scientific quality of the work in Federal laboratories is the primary determinant of effectiveness, and not how well it is coordinated, important though this is. The taxpayer would get much more for his money from a scientifically superb but poorly coordinated effort than he would from a perfectly coordinated aggregation of mediocrities. Fortunately, this choice does not have to be made, but the point is made because the significance of actions designed to assure quality is often underemphasized.

The personnel and other administrative policies and the general environment of the laboratories have a great deal to do with their productivity. The new Coordinating Council could productively review again and make recommendations affecting the efficiency of the Federal R&D establishment. For this reason, it would seem prudent for the new Federal Coordinating Committee to give high priority to the statutory directive to achieve more effective utilization of the scientific, engineering and technological resources and facilities of federal agencies, including the elimination of unwarranted duplication. (Sec. 401 (e) (3)).

VIII. RECAPITULATION OF THE VALUES OF A COORDINATING COUNCIL

The limits to the utility of a Coordinating Council as stated above are meant not to be negative but to be realistic. To balance the picture, the positive utility of the work of such a Council can be recapitulated.

(a) The gathering of information and analysis of fields of R&D is an important and often indispensable background for executive decisions made elsewhere.

(b) The fact that the Council is an interagency group advisory to the Director need not be a real limitation on its utility.

(c) There is a wide and continuing array of interagency R&D issues, even though most problems are found within single agencies.

(d) The forum function is extremely important. Discussion of problems in the Council should generally stimulate a wider range of ideas than would result from bilateral discussions between the Director and individual agencies. Conversely, the Council should be a useful means of conveying information and views from the President and his Executive Office to the agencies.

(e) As a product of discussions in the Council and of the work of council committees, it should be possible to provide advice which is in fact a decision when a consensus can be reached. This is generally possible except when basic differences exist among the agencies. There is a wide field for such operating decisions.

(f) Interagency work on means of sustaining the quality of Federal laboratories can be important.

IX. CONCLUSION

These remarks do not exhaust the intricate and interesting problems associated with the new Coordinating Council. They simply review some of the potentialities and limitations of the interagency council approach to the administration of the vast and important Federal programs in science engineering and technology.

Mr. Chairman, I appreciate the opportunity to appear before the Committee. I would be glad to answer any questions which you may have, either on the potential functions of the Coordinating Council or on the broader issues of coordination in the Executive Branch and Congress.

Mr. THORNTON. I want to thank you very much for your excellent presentation and summary. It is a very thoughtful and detailed paper, which is of great value to our committee.

I was impressed not only with the analysis and clarity of delineation of problems that your paper contained, but also with its thoughtfulness and its observations of some facts which might occasionally be overlooked, as for example where you suggested that placing all research and development in a single department or agency does not automatically solve problems of coordination, it simply submerges those problems. It means they must be worked out, or many of them must be worked out, at perhaps a lower level of management decision than would have been the case had the conflict, the requirement of coordination, be allowed to bubble to the top of an agency and to be worked out in a Coordinating Council.

Do you have further thoughts on that?

Dr. KIDD. Yes. There are extensive problems of research coordination within given agencies of research and development. For example, in the Department of Health, Education and Welfare you have the research programs of the National Institutes of Health, and there there is a very difficult controversial question of the extent to which the National Institutes of Health should go beyond research and work on the application of research findings to problems of disease.

I think all over the Government this question of the relationship between research and its application to practical problems will become more acute as time goes on.

Also, within HEW there is the problem of the coordination of the work of the Food and Drug Administration with that of the National Institutes of Health. And the environmental work in the Department of Health, Education, and Welfare with NIH generate very difficult problems, which are for the most part handled within the Department itself.

And that is true throughout the Government.

Mr. THORNTON. You mentioned a consideration, which was emphasized in our hearings yesterday, that there was a difference in the attitudes between the small agencies and the larger agencies with regard to the coordinating group, that the small agencies were happy to have a coordinating group, in that it gave them a channel to communicate with the highest levels of executive decisions, while the larger agencies were mainly interested in protecting their own present channels.

Dr. KIDD. I think by and large that is the case.

The smaller agencies do find any activity that links them to the Executive Office of the President to be useful, and a council is one of these channels; therefore they welcome the activity.

In my observation the larger agencies often have as their primary interest seeing that no harm is done to them.

Mr. THORNTON. Is there any suggestion you might make as to ways of interesting the larger agencies in working for greater cooperation within a council?

Dr. KIDD. I think it is a question of agenda—what the council deals with. The greater the degree to which the problems can be addressed to a consumer or a point of action, the better. I think a report or study in the abstract generally ends up on the shelf, whereas if there is an agency, or part of Government, or OMB, or the Domestic Council, or a committee of Congress, that says, "I would like this thing looked into because I would like to do something about it," then, I think the work is more effective and there is more willing participation by the agencies. If they feel something tangible will come from the effort, they will invest resources. Advance expression of interest by an individual or group which can probably get something done is a great help.

Mr. THORNTON. I also like your observation, which rather than try to find in the testimony I will paraphrase, that if it were necessary to make a choice between a coordinating council or group composed of great expertise, and even brilliance, but not too well coordinated, and one which was mediocre in talent but extremely well coordinated, the obvious choice would be for the former.

Dr. KIDD. Yes. I think you can do more harm through stupidity than you can through confusion.

Mr. THORNTON. I believe you said that was not necessarily the choice.

Dr. KIDD. Fortunately that is not the choice.

Mr. THORNTON. I guess where I am hitting with that is back to your observation that duplication and overlapping is not necessarily harmful. Not only, as we discussed at the time I interrupted your testimony, is there—

Dr. KIDD. Yes—

Mr. THORNTON [continuing]. The possibility of different objectives and the appearance of duplication, where in fact it may not be duplicative, but also is there not the possibility of many areas in which some redundancy of research may be very desirable in.

Dr. KIDD. Yes; that is right. I remember Lee DuBridge said one time if a child is lost in the woods sending out 20 people to find the child is not duplication.

Mr. THORNTON. Yes.

Dr. KIDD. And if you don't know what you are hunting for, having a number of people hunting for it—and that is what research is—may not be duplication.

Mr. HOLMFELD. Who said that, sir?

Dr. KIDD. Lee DuBridge.

That is not to say there is not duplication; that is, people working unknowingly on the same problem to no good end. I am sure there is some of that.

Mr. THORNTON. Inadvertent, mistaken duplication, which is a different thing.

Dr. KIDD. That is correct. I am sure that exists and that primary means of dealing with that is fully communication; because people

generally do not want to waste their time doing something someone else is doing. Scientists, like everyone else, have a given life span, just so much time to work, and they don't want to spend it being scooped by someone else.

You have bureaucratic organizations, of course, where things get a certain momentum and just keep on going, and those, of course, are to be dealt with.

Mr. THORNTON. Dr. Holmfeld.

Dr. HOLMFELD. Thank you, Mr. Chairman.

Over the life of the Council the Council has on several occasions pulled together policy statements in various fields—patents, other areas. It is not clear how useful or effective that has been and whether or not the Council should continue to have a significant role in writing and drafting and getting agreement on, and eventually promulgating, policy statements in this field.

What is your experience along that line?

Dr. KIDD. It seems to me it would be sound for the Council to undertake that sort of thing in areas that are very carefully selected.

The President's patent policy, it seems to me, had a useful influence, drawn up under the auspices of the Federal Council.

Dave Beckler is the expert on that question.

I think that in the patent area the policy statement there was useful.

On another occasion we worked on a policy statement for President Johnson, dealing with, in effect, geographical diffusion of R. & D., and that had some practical consequences. Agencies at that time did as a result of the policy take specific steps to geographically diversify their R. & D. efforts.

Incidentally, I think that was the right policy then and the wrong policy now; so things change.

But in specific areas of that kind I see no reason that the Council should not undertake a policy statement. But they should be very carefully selected so that they relate to areas about which something will be done, where it will have some positive effect, rather than simply being a series of words.

Dr. HOLMFELD. Should the Council, in your view, primarily make that determination themselves? Or should they wait until OMB and the Director of the new office, or even perhaps the President, comes to them and says, "Would you undertake so and so?"

Dr. KIDD. Realistically I think it is generally a mixture of the two. Often you get discussions within the Council that can then be picked up by the Chairman. It may appear to be the initiative of the Chairman, although it comes from the Council members themselves.

Other times someone may see an area in which they wish the Council to work on an initiative which could come from the outside. I would say it would be a mixed situation.

Dr. HOLMFELD. The Chairman asked the Library of Congress to do a historical study. The study notes that when President Eisenhower established the Council he and Dr. Killian said the Federal Council should be able to call on both the President's Scientific Advisory Committee and the National Academy of Sciences for advice, and that seems to imply that the Council was to be involved in policymaking in a major way.

Then as you read the total history, the Council has not been in a major way useful in that way. Do you know whether the Council has ever gone to the National Academy of Sciences and asked them to do a study?

Dr. KIDD. Not as I recall, not as the Council.

Often there are conversations between the President's science adviser and the President of the Academy, in very close contact. But the Council has not in the past been the vehicle. And for reasons I noted I thought that it will be in the future the channel for that kind of communication.

Dr. HOLMFELD. An approach to this coordination question, which we do not know a lot about, it seems to me, is the technique of designating an agency as the lead agency in the field.

Does the Council play a role in that? Is that done independently by the OMB? How effective has it been in comparison with the Council-Committee technique?

Dr. KIDD. Often they are merged. That is, an agency conducting the predominant part of the R. & D. in a given field of interest to a number of agencies is likely to have the staff that they can put to work on these problems, so often you have simultaneously a lead agency whose representative to the Council would be the chairman of a group to work on a given problem. It has often in the past worked out that way.

Now, at times when you have another agency designated, having a clear function, clearly predominant function in a given field, they can act as the locus for a coordinating group, rather than have it under Council auspices. That can work fairly well, too.

As I said, there are some advantages to that, in that it is dangerous, to my mind, to have too many small technical problems floating to the top in the Executive Office. The more these can be pushed into the departments the better.

The problem with that is that agencies are often more willing to participate in an interagency effort originating within the Executive Office than they are in a coordinating effort chaired by a member of a given Executive agency.

Dr. HOLMFELD. One thing that comes strongly forward in the historical study is that the Federal Council has never had the resources that perhaps it should have. For example, the Executive Secretary has many times been the only full-time person there. The Federal Council has never had the very modest budget to enable it to publish its own reports and the reports of its committees.

At times, and I think for the last 2 or 3 years, the Executive Secretary has had other duties, has been a part-time Executive Secretary.

In your view is it desirable that there be a full-time staff there? Is there enough work? Is it going to operate better if there are people there who really devote full time to this work?

Dr. KIDD. I would find it difficult to prejudice that question.

In my judgment the fact the FCST did not have a large budget was not a major problem. The difficulties lie elsewhere, in the kinds of matters that I mentioned in my testimony, much more fundamentally, I think, than in the budget.

When you move from the question of the budget of the Council to the resources available to the Council you have another question,

because the great bulk of the resources available are in the form of staff work done by the agencies.

Now, that is far from a perfect device, too, because the pace of the work, detail, competence, all depend on the resources the agencies are willing to put into the job. Sometimes people have overriding priorities which make that work go very slowly. And if something is urgent I think it would be useful for the new Council to have the resources available, one way or another, to permit the preparation of reports, analyses, whatever is required to go forward expeditiously.

So although the resources of the departments and agencies do in effect expand the resources of the Council, they do so in an unpredictable and not entirely satisfactory way.

Dr. HOLMFELD. One last question, Mr. Chairman.

The question that has come up about the usefulness and propriety of having the Council committees chaired by heads of agencies, or have other people in agencies, who themselves have a very heavy role serve as chairman. Take the lead agency: The oceanography case is one brought to our attention where the head of the lead agency also served as chairman of the Oceanography Committee. The historical study mentions that one time a person from the outside, Harvey Brooks, was brought in to chair a Council committee. In your judgment is there something to be said about the advantages or disadvantages of either approach? Should the thing remain entirely flexible, or should the Chairman of the Council try to get more outsiders involved? What is your philosophy on that?

Dr. KIDD. I think he would be well advised to make a deliberate effort to involve people from outside of the Government in the work of the Council. For one thing, there are people around the country of very high competence and wide and varied experience in matters of interest to the Council, who could probably do a better job than those who might become available as a practical matter from within the agencies.

As I recall Harvey Brooks was brought in as chairman of the committee on long-range planning. That was in my judgment an ill-conceived venture. Nevertheless, Harvey Brooks is extremely intelligent, and in the right context he and others like him could make a large contribution to the work of the Council.

There is a question, of course, when people are brought in from outside, as to the circumstances under which they should be brought in as part of the Council apparatus, contrasted to being consultant to the President's Science Advisory Committee and the Office of Science and Technology, and an analogous procedure, I am sure, will be followed in the new organization.

But even within the limited sphere of the Council I think more use of people from outside Government would be a definite advantage.

Dr. HOLMFELD. Do you care to comment on having the heads of lead agencies chairing the Council committee?

Dr. KIDD. I think that depends on the circumstances. There are times when that is the natural thing to do, when you can get productive work, because of the knowledge and experience of the lead agency. It often happens they do not try to dominate or unduly influence the work.

It depends, again, very substantially on the precise situation that is faced.

Dr. HOLMFELD. Yes.

One suggestion that is raised in the Library of Congress study is that perhaps the difficulty in the past of making the Council as effective as its potential might be is that the Chairman of the Council has also worn other hats. The study says under the new arrangement there are to be up to, I think, four Deputy Directors, and perhaps there might be some sense in considering whether one of the Deputies should be delegated to chair the Council.

Do you have anything to say on that?

Dr. KIDD. That will be up to Guy Stever at the moment, or soon will be, I imagine.

In my experience it would be a mistake to delegate the chairmanship of that group to an Associate Director, or to somebody else.

As I pointed out, these interagency committees are fragile organisms, and they face a number of inherent problems that I noted in becoming effective. One way to overcome that is to have an expression of direct interest by the head of the office in the work of the Council. If that were delegated to an associate, in my judgment the agency would take that as a signal that that is not an area of prime importance and it would have an adverse effect on participation and attendance.

But I am not certain that would be so. It is just that while I was around there I think that would have been the effect.

Mr. HOLMFELD. Thank you, sir.

Thank you, Mr. Chairman.

Mr. THORNTON. Mr. Gallagher.

Mr. GALLAGHER. Would the witness agree if it is not duplication to send 20 men to look for one lost child, would not efficiency be sending out one man to look for 20 lost children?

Dr. KIDD. You could do it that way.

Mr. THORNTON. On that philosophical note, I want to thank you again, Dr. Kidd, for your excellent testimony and for your attendance at our hearing. We do appreciate your coming, and your valuable contribution.

Dr. KIDD. Thank you, Mr. Chairman.

Mr. THORNTON. Our next witness is Mr. David Beckler, assistant to the president of the National Academy of Sciences, former executive officer of the Office of Science and Technology, and a gentleman of distinguished career, including service on the Atomic Energy Commission's industrial development program and many other notable achievements, which will be made part of the official record of these hearings.

[A biographical sketch of Mr. Beckler follows:]

DAVID Z. BECKLER

Since 1973 Mr. Beckler has served as Assistant to the President of the National Academy of Sciences on selected science policy issues. He was the principal staff officer in the establishment of an Academy committee to study the organization of science and technology in the federal government from the standpoint of how scientific and technological expertise can be most effectively applied to the Program management and policy-making processes in the Executive Office of the President.

During the period 1953-1973, Mr. Beckler served in the White House under four Presidents as executive officer of the President's Science Advisory Committee (and its predecessor committee), as the senior executive assistant to all six Presidential science advisors, and as the acting director of the Office of Science and Technology during its final phase.

In 1952 he was appointed assistant director of the Atomic Energy Commission's newly created Office of Industrial Development, leaving that post in 1953 to become executive officer of the Science Advisory Committee to the Office of Defense Mobilization in the Executive Office of the President.

From 1947-1952 Mr. Beckler served on the staff of the Department of Defense's Research and Development Board, where he served as executive director of its Committee on Atomic Energy. During this period, he was attached to the Department of State as a member of its International Science Policy Survey Group, leading to the establishment of an office of international scientific affairs and the science attaché system within the Department.

Mr. Beckler entered the U.S. Government service in 1942 as a technical aide in the Foreign Liaison Office of the Office of Scientific Research and Development, participating in the exchange of scientific and technical information between the United States and its wartime allies. Following the war, he served as deputy technical historian for Joint Task Force I, which conducted the Bikini nuclear weapons tests.

Mr. Beckler was graduated in chemical engineering from the University of Rochester in 1939. He holds a J.D. degree from the George Washington University Law School, is a member of the District of Columbia Bar, and is a registered patent attorney. Prior to World War II, he was associated with the patent law firm of Pennie, Davis, Marvin & Edmonds, Washington, D.C.

Mr. THORNTON. Mr. Beckler, it is a privilege to have you appear before us. We have received and had an opportunity to review your prepared testimony, which is a most excellent statement.

I would like without objection to make your prepared statement part of the record of these hearings, and ask you to proceed to summarize it, or highlight it in such manner as you may choose.

STATEMENT OF DAVID Z. BECKLER, ASSISTANT TO THE PRESIDENT, NATIONAL ACADEMY OF SCIENCES, AND FORMER EXECUTIVE OFFICER, PRESIDENT'S SCIENCE ADVISORY COMMITTEE

Mr. BECKLER. Thank you, Mr. Chairman.

I want to point out in the first instance that I am here in a personal capacity, although I am associated with the National Academy of Sciences. However, I speak from the vantage point of some 20 years in the White House working with the various forms of Presidential science advisory mechanisms. I have had the privilege and pleasure of serving all six President's science advisers as senior staff assistant; have been executive officer of the President's Science Advisory Committee for the 20 years of its existence, and have worked closely with all the executive secretaries of the Federal Council for Science and Technology.

Mr. THORNTON. We understand that. As I was trying to make clear, your record is one that has made you a vast repository, really, of experience. And we are eager to share those experiences, and do understand you are not coming to us to represent an organization's view, but to share this background that you have.

Mr. BECKLER. Thank you.

Shortly after the reconstitution of the President's advisory mechanism in 1957, after the Soviet Sputnik, Dr. Killian set up a panel under Dr. Emanuel Piore, to look at the question of how to strengthen our capabilities for the development of national science policies. It was

the Piore report that proposed the establishment of a Federal Council for Science and Technology. This history is well documented in the excellent background report being prepared for the committee. I will not spell out its details, except to say that the Piore Committee emphasized that the Council should be an instrument of Government to bring to the special assistant to the President for Science and Technology, in an organized way, the advice and assistance of policy officials of the major R. & D. departments and agencies.

In fact, as a consequence of that report, the posts of assistant secretary for Science and Technology, or equivalent, were established as the highest policy level in agencies specializing in research and development.

The only precedent at that time was the post of Director of Defense Research and Engineering, in the Pentagon, and the Secretaries in the Army, Navy, and Air Force, which had been the result of recommendations of an earlier report.

The Executive order establishing the Council emphasized the policy functions of the Council. Although it described a number of functional objectives, such as more effective planning and administration of Federal scientific and technological programs, it, importantly, did not direct the Council to carry out those functions per se.

What it did direct the Council to do was to recommend policies and other measures to achieve those objectives.

On the other hand, with few exceptions, the Federal Council has not served as a policy development mechanism for the President or the science adviser, nor has it been an effective channel to communicate and implement Presidential policies affecting the R. & D. functions of the departments and agencies. Rather, it has mainly concentrated on the coordination of technical programs in a number of scientific and technical problem areas where the problems and interests cut across several departments and agencies.

Even in the area of technical program coordination the Council has enjoyed only limited success. I do not mean to imply that the Council has not been a highly useful mechanism in providing a forum for policy level officials, as emphasized by Dr. Kidd. But in my view the forum function does not justify the activity of the Council, for reasons that I will dwell on shortly, particularly since the circumstances under which it has operated in the past have not attracted high-level policy people to Council meetings. Very often the exchange of information at the Council has been among the second- and third-tier people.

The reasons why that has been so do not flow from failures of leadership or intellectual quality. They are much more organic, having to do with the basic concept and function of the Council and the White House science and technology mechanism.

This is the main thrust of my statement, namely, that the deficiencies of the Federal Council in the past have been intimately related to the organizational and policy environment in which it has operated. The work of the Council is inherently part of a broader scheme of policy, program development and funding involving the White House and the Executive Office of the President. Its operations necessarily reflect the decentralized departmental and agency structure, and the executive branch-congressional relationships.

There are major constraints on the ability to effectuate Presidential level, topdown coordination of R. & D. policies and programs that intersect the interests of several Federal departments and agencies. We have a pluralistic form of government, and there is considerable delegation of responsibility and authority. This is one of our great strengths, and has resulted in new initiatives that might otherwise not have been taken. There is a certain amount of competitiveness which is healthy, if it is, in a sense, properly orchestrated or managed.

If I had to make a tradeoff between tight topdown management and this more loose type of decentralized activity, that I would opt for the latter rather than the former. There is less probability of error, and more self-renewal, in such a system. We have seen in other governments attempts at tight planning and direction, which have resulted in less-than-effective results.

Mr. THORNTON. You are saying organization and efficiency are not the primary goal to be sought?

Mr. BECKLER. That is correct. When the focus is on coordination one can somehow become totally preoccupied with the process and mechanisms and instruments for coordination, forgetting the substance of what is being coordinated.

The strongest Presidential leverage for policy and program coordination is the budget process. In fact, the budget is the tangible expression of our national science policies. There are some major policies that do not require budgetary implementation; but by and large the Federal budget reflects governmental policies and priorities in its allocation of resources, and, from the departmental and agency point of view, it is a policy document.

Yet, the budget is a composite of individual agency budgets negotiated within a total envelope of Federal expenditures. There is a great deal of discretion left to the departments and agencies in how they allocate their resources internally.

And there has been—it varies, of course, with time—reluctance by OMB to take initiatives, to suggest new program directions, and even to make tradeoffs that they feel should more properly be the responsibility of the departmental or agency head.

Mr. THORNTON. In that connection, our next witness will suggest to us—I hope I am not revealing his testimony too much, in advance—that the new Science Adviser position should be delegated some authority, within limited areas, to reallocate or change budget allocations between science functions, to give that office some authority which would command attention among the different agencies.

Do you have any thought with regard to that? Would you like to supply us later with some thoughts as to whether that might be a useful suggestion?

Mr. BECKLER. I will give you my reaction now.

I think the more leverage the Science Adviser has on the budget process, the more effective he will be in affecting the output side. It is one thing to advise, another thing to incorporate the results of the advice in policies and programs.

In my view the best way to bring this about is through the process by which the President develops his annual program and budget. The Science Adviser must not only have his arguments marshaled, but must have established relationships with OMB and other White House

units so that changes can be introduced as the budget is shaped for Presidential decision.

The difficulty with separate funding authority in the Science Adviser is that research and development are not pursued, except in certain areas of basic science, as ends in themselves, but they serve broader needs—transportation, defense, health, and so forth. If he attempts to trade off research and development activities across departments and agencies, he must understand and be perceived to have some cognizance over the ends which are served by R. & D. Since the Science Adviser does not have this breadth of responsibility, he would have limited credibility in recommending that a certain investment be for energy R. & D. than for something else. Thus, broad reallocation authority in the Science Adviser would be incompatible with the general notion of research and development serving ends. We have seen some difficulties on this score in the past.

Dr. Goldmuntz will probably speak on the new technology opportunities and initiatives that President Nixon initiated. Although it did have some positive results, many of the objections to the proposed initiatives were not technical objections but were questions of: Is it a Federal responsibility? Are there other ways to accomplish the same end, for example, through regulatory change? What is the cost-benefit calculation in a broad sense? In other words, there were social and political and economic considerations that needed to be factored in before the total picture and options would be put before the President. This suggests juggling the R. & D. is perhaps not the right end of the stick.

At the same time, I am not opposing the thought.

Mr. THORNTON. You are saying the Science Adviser should be involved in the budgetmaking process?

Mr. BECKLER. Not only OMB, but there are other instruments, such as the Domestic Council, National Security Council, and other units in the Executive Office, that he would have to work with.

Nonetheless, it might be desirable, in my view, to give the science adviser some discretionary authority, say when the agency budgets finally are brought into focus toward the end of the fall. At that time the Science Adviser should take an overview look, as is now done in the OMB R. & D. "cross-cut." In effect, the President should say to the Science Adviser, "I would like to have you give OMB your views on better distribution of funding." The President could give the Science Adviser some leverage, by asking the Science Adviser to suggest reallocations to OMB and to the President up to a certain percentage of the total R. & D. funding.

The purely advisory function of the Science Adviser has not put him in a very strong position, because his advice could be accepted or rejected out of hand without much recourse on his part. I don't know that it is realistic to think in terms of Congress making a special appropriation, because it might represent a precedent for other types of allocation—why science and technology and not in other large programmatic areas—and could raise much broader matters of principle.

I make these suggestions.

Mr. THORNTON. I appreciate the outline. I thought it appropriate to have it come in the testimony at the point where you were discussing the budget.

Mr. BECKLER. Thank you.

Since there is no separate budget for R. & D., and the tradeoffs across agency lines are quite difficult, both conceptually and in practice, it does make the job of coordinating fairly difficult.

Earlier, question was raised about the matter of uniqueness of R. & D. objectives. You have to consider the entire spectrum from basic research to development. As you go toward the development end, the expenditures are very requirement-specific.

Going toward the other end—applied research, exploratory research, basic research—there is increasingly more diffuseness of objectives, and much more possibility for interagency interaction. The reallocations and tradeoffs can more easily, and more appropriately, be made at the more fundamental end than at the development side. If one questions the technical feasibility of, say, a new type of vehicle for the Department of Transportation, the Department might say "Well, if you want us to drop that we would like to take the money and put it elsewhere, don't take it out of our budget. We have many other demands, and would put it in another area of R. & D. or put it outside of R. & D., in order to achieve our mission. We are always resource-short."

For example, when OST first put the energy budget together in 1965, it was very clear that there was enormous imbalance between fossil fuel research and nuclear research, but the fact was it would be very difficult to get more money, at least at that time, in the Department of Interior, for the reasons that there was a very strong Joint Committee on Atomic Energy that was able to muster resources for the Atomic Energy Commission. The Interior Department did not have a committee as concerned about the research function. In addition, there was a very unclear question in that case as to what was the Federal responsibility and what was the responsibility of private industry.

In the atomic energy area the Government has been the primary stakeholder, and has, per se, assumed a public responsibility.

Mr. THORNTON. Let me state that that question has not yet been resolved, as to the responsibility of the private and public sectors. Is there not still a third reason, which was that the public perception, which is often reflected by congressional action and by Executive action, did not yet perceive the need to develop fossil fuel resources, which is now beginning to be recognized?

Mr. BECKLER. Quite true. I merely recited it to point out it was not feasible—even though desirable, we thought—to shift. Furthermore, although it was always possible to find \$50 million in military R. & D. which was, relatively speaking, "slack" in the DOD system, which could be vital money for R. & D. in a smaller agency, as a practical matter one could not transfer \$50 million from a multi-billion-dollar budget.

So there are very practical problems that defy what you might call the theoretical point of view—that you have a number of R. & D. chips and can move them around to optimize the pattern on the board. It is just not that way.

Because R. & D. must be judged in relation to the technical objectives they service, the White House science and technology policy mechanism must have effective working relationships with the various Presidential staff mechanisms on which the President relies for

analysis and advice—the OMB, NCS, Domestic Counsel, the Council of Economic Advisers, and other White House Executive Office units. Beyond that, the science and technology policy office must have a clear mandate on which to exercise its prerogatives as a full partner in the decisionmaking process.

If there is a single message in my statement, it is in that one point.

The answers are not yet in. We have a very good piece of legislation; but the main problem that remains to be dealt with, one that I experienced in the years I was sitting in the White House and that plagues the Science Adviser, is the forces of isolation. If you don't have a piece of the action no one really wants your advice. And the forces of isolation are such that unless you have a mandate that people will accept and recognize, unless they know you have the backing and interest of the President, it is very difficult to intervene in a policy decisionmaking process where other participants feel they have the basic responsibility. This is a crucial question that one has to work on constantly, to maintain effectiveness; because science and technology advising mechanism in the White House is, frankly, an anomaly. It has always been an anomaly.

Except for instances where specialized White House councils have been created, the marine and space councils, a council on environmental quality, these are transitory councils, extraordinary mechanisms. The recognition that science and technology was somehow different from other matters and should have a functional office in the White House was a very profound development, and one where it is necessary to have a continuing process of education; new people and new administrations come in with the same questions—"Why don't we leave the details to the technicians? Why do we need you here?" It is often viewed as an advocacy mechanism rather than a full partner on the team, judging rather than advocating. That is a very important psychological factor.

What is not appreciated is the fact when you look at the total Federal expenditures, and you well know that much of the budget is uncontrollable, when you get down to the hard question of what is there that is flexible in the budget, that you really can change, it's the R. & D. component. In order to accommodate other growing points in the system, not necessarily scientific and technical, but other programs that are important to the President in the short run the large investments in R. & D. are continuously scrutinized as possible sources of funds for other activities. So the R. & D. programs have to be carefully nurtured and justified, or else they will tend to be the most vulnerable.

Because in the past there has not been a strong coupling between the Science and Technology Office in the White House and the decisionmaking process, with certain exceptions, there has been, effectively, no White House customer for the reports of the Federal Council.

I remember coming before the appropriations committees looking at the Office of Science and Technology. A recital of its many reports sometimes evoked a bored response saying "We are not interested in how many reports you have written. We want to know what has changed because you are there."

If you ask that question, as I have asked myself what is really different because we have had a Federal Council, it is very difficult to re-

spond specifically. Some things you can identify, but there is little of seminal importance, except the feeling that somehow it is good for other agency people to get together and exchange views.

I would say the Council, then, has tended to operate on the basis of self-interest, consensus and compromise, and its proposals have been implemented only to the extent the agencies wished to take advantage of its conclusions. Obviously, it is often desirable to have an external source of recommendations that a departmental member can take into his department and argue with the Secretary that it is also the view of other agencies. I do not discount it.

But there has been little incentive in the past for policy-level members of the Council to participate actively in its plenary sessions, because their time might be more effectively spent in direct dealings with OMB and appropriations and authorizations committees. Consequently, the attendance at the Federal Council meetings has been generally spotty, and the meetings themselves have not been important events. In fact, at times in the past the representation has dropped to the point that it tended to damage the prestige and leadership of the Chairman.

In my view this situation is due to the relatively weak posture and influence of the Presidential Science Advisers in the past, and of the Office of Science and Technology, in influencing the budgetary and policy-formulating mechanics involving civilian R. & D. I do want to make a particular point that in terms of measuring the impact of the past White House science and technology advisory mechanisms the most significant results of the work have been in the military and space areas. What happened—I say this not as a self-serving statement but a statement of fact—as the result of a small group of people providing the basis for the creation of the Space Administration, providing the initiative that established the Arms Control Agency, generating the analysis that led to the biological warfare test ban, and many other things, including guidelines for the post-Apollo space programs—these have been the great accomplishments. But they were areas where the Government has been the customer, of the products of R. & D. In civilian technology, the situation is more complex. The Government is not the customer, and the resulting knowledge must be applied outside of Government, in complicated marketing and institutional structures.

In the civilian technology area, the OST had very great difficulty, because there were many other authoritative experts and responsible officials involved that they were not able to glue all the essential pieces together. The Federal Council was in effect operating in the area of greatest difficulty. Consequently, it is only natural that it sought refuge in what it could do effectively, that is, coordinate fairly well defined scientific and research programs.

This situation should show marked improvement as a result of the enactment of the National Science and Technology Policy, Organization, and Priorities Act of 1976. That act not only established a new Office of Science and Technology, but also a Federal Coordinating Council for Science, Engineering and Technology. In effect, you have the same two mechanisms but with a much stronger mandate. And there is a subtle but, I think, very important distinction, namely, it is legislation that the Congress has initiated.

We in OST were often in an awkward position vis-a-vis the Congress, by virtue of being a creature of a reorganization plan. At times Members of the Congress felt we were really Presidential staff, and that what happened to us was more a matter of Presidential decision rather than congressional intent.

With the new legislation, the situation is now very different. That difference should reflect itself in a much stronger stature and involvement of this new mechanism.

Even more that, we have for the first time a declaration of national policy for science and technology, and a very detailed statement of requirements and processes for its implementation. The act provides the essential structure and agenda for much more effective policy-level coordination.

In my testimony, I have listed a number of the policy-level matters singled out in the legislation for specific attention, such as the necessity for strong public participation, cooperative relationships with State and local governments, creation of policy planning elements, dissemination of information, a Federal procurement policy to encourage use of science and technology to conserve energy and materials; development of cost-benefit principles; support of basic research and education, and so on.

Furthermore, there are functions the Office of Science and Technology must perform where the Coordinating Council would be of great assistance:

Preparation of the science technology report, administrative regulation affecting Federal R. & D. activity, definition of emergency problems of national significance, policies for international cooperation.

These are all very important policy issues, most of which have not in the past been addressed by the Council in a meaningful way.

There is plenty to do. They are not only a "wish list."; they are clear requirements set forth in legislation.

I will pause for a moment on something that has concerned me for a number of years, that despite the fact the Government is spending a vast amount of money for Federal R. & D. through very complicated departmental and agency structure, there has been no continuous examination of R. and D. management and organizational concepts. In any large company, you find a lot of attention given to the structure of their central research laboratories, research functions of subsidiaries tying them to corporate planning, marketing and so forth.

During all the years I was in OST the Office of Management and Budget had only one person spending parttime on science and technology organization questions, largely in response to congressional bills or legislative proposals that would call for a department of science or creation of various research laboratories, something that required an administration position. It was completely an ad hoc fire-drill type of approach.

Consequently, on this important question of how you bring about effective, efficient management within this complex structure, where there is not much direct analogy from industrial experience, and where the public pressures are much different and the benefits are much more elusive, it is timely that we really look at how we can rationalize this structure. In fact that will be a primary job of the new committee established by the bill.

That committee could well call upon the Federal Coordinating Council for assistance.

The Federal Council's role in the coordination of technical programs of the kind that has preoccupied the Council in the past has to be examined by the Council as a policy issue; that is, how can one bring about more effective coordination of detailed technical problems in coherent areas without calling on the Federal Coordinating Council to provide detailed supervision and monitoring.

The coordination policy and the process should be guided by the Federal Coordinating Council, but alternative arrangements must be found to effectuate interagency coordination in areas that are part of the bread-and-butter continuing operations of the Government's departments and agencies.

There are on the other hand at times overriding technical policy questions that require coordinated approaches. The Committee on Inadvertent Modification of the Stratosphere, is a good case of where you have a national policy question. It affects a very large population and a very big industry and the public policy issue is very important. It is being approached on an ad hoc basis, bringing together the most competent people, to analyze what we know and do not know about the matter. In this case the Council has called on the National Academy of Sciences, which is now still preparing its report to IMOS which will constitute an authoritative scientific and technical contribution to their broader consideration of the policy question.

Mr. THORNTON. I believe you suggest that this use of the Federal Coordinating Council by the Science Adviser as a means of mobilizing ad hoc committees is an important consideration?

Mr. BECKLER. That is very important. It is important that the issues be defined clearly, so one can clearly say there is President-level interest in the issue involved.

In my prepared testimony I point out that this is a crucial part of the process, namely, issue definition in consultation with the other elements of the Executive Office of the President, the Domestic Council, and soon, so that they are fully cognizant that there is an issue that the Coordinating Council is being called on to examine, and to ascertain that they will in effect be interested to receive the report and will put it on their agenda for discussion and deliberation.

Having no such commitment in advance, many reports of the President's Science Advisory Committee outside of the national security and outer space areas did not receive systematic examination by the other responsible offices in the Executive Office of the President. The reports were prepared, published, sent around with a nice Presidential note saying "Please take this into consideration in thinking about future plans." But they were not made part of a staff process with option papers noting the second and third order effects, so on, that usually is the way the White House staff operates.

So I would say the Federal Council studies must become part of the normal method of operation and be regarded as serious inputs. That requires careful, advance preparation. In some cases the President may not want a report in a certain area, for a variety of reasons, and if you generate the report it could be counterproductive. I don't know how you deal with that ideologically. As a practical matter, it could have deleterious consequences.

The Coordination Council, itself, should meet only infrequently. I do not see that a council meeting with all the member representatives sitting around a table with the chairman is the place where important action can be taken.

I have been impressed by the method of operation of the National Security Council, which does not meet frequently. It has a very interesting formal study procedure. It carefully defines the issues in advance. The National Security Adviser to the President discusses the issues with the President to be sure he is interested in having them examined. A detailed, study design, is devised and responsibilities are assigned to the agencies in the results.

The Federal Coordinating Council can be used as a mobilization device for the Science Adviser. It is important at times that the Science Adviser engage the efforts the agencies through an interagency mechanism, so that they feel part of it, the policy-decisionmaking process. But its auspices should be used more than its presence.

There may be policy questions involving all departments and agencies supplying R. & D. I think some in the past, such as the issue of the support of basic science although there have been Presidential policies that all such agencies should support basic research related to their missions, this has not been universally recognized. This is a question of general concern to all departments, and is best debated with all present.

In the early days one of the important reports of the FCST was the Astin report on the environment, for Federal employment of scientists and engineers, how to attract and retain them.

The Federal Council was very effective in developing the second generation statement of Federal patent policy, that did have an important impact on legislation. This is another area where all the members had a stake.

But where the problems involve only several members, they should be called together on an ad hoc basis by the chairman to focus the issue, agree on a tight deadline and aim at the type of results which are of interest at the policy level.

These are the main points I want to make.

The Domestic Council has been an instrument of some interest to me. If one reads the original plan for the Domestic Council one finds all the right words there about a mechanism in the Executive Office of the President to help define longer range goals and objectives and policies, and to provide a balance between program and policy development and the budgeting function of OMB. Time and circumstance resulted in the budget function being dominant and the Domestic Council being more of a short-range fire drill kind of operation, at least in earlier times.

I think this imbalance has changed in the present administration. The Domestic Council is the place where the Cabinet officers can come together and deal with such questions as what should be our national transportation policy, which should be influenced by and guide transportation R. & D. Thus, there is a symbolic relationship between the Federal Council and the Domestic Council. The fact the chairman and science adviser is now a statutory member of the Domestic Council strikes me as an opportunity to directly link the Federal Council problems and projects to the broader work of the Domestic Council.

Mr. THORNTON. I can assure you that was the intent.

Mr. BECKLER. I am delighted to hear that.

These are some thoughts that might be of use to you.

[The complete prepared statement of Mr. Beckler follows:]

STATEMENT BY DAVID Z. BECKLER, ASSISTANT TO THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES BEFORE THE COMMITTEE ON SCIENCE AND TECHNOLOGY, HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL SCIENTIFIC PLANNING AND ANALYSIS—JULY 23, 1976

Mr. Chairman and members of the Subcommittee, I am pleased to have this opportunity to present testimony on the coordination of research and development activities in the federal government. I am here in a personal capacity, speaking from the vantage point and perspective of one who has had the privilege and benefit of some twenty years' experience in the White House and Executive Office science and technology advisory mechanisms. From 1953-1973, I served as Executive Officer of the President's Science Advisory Committee and senior staff assistant to all six Presidential Science Advisers. During that period, issues involving the coordination of Federal R & D activities were continuously being raised and addressed. The coordination question was a priority matter on the agenda of the first Presidential Science Adviser and the President's Science Advisory Committee after the Soviet Sputnik precipitated the decision by President Eisenhower to establish the White House science policy structure in 1957. It was a PSAC panel, chaired by Dr. Emanuel Piore, that recommended in December 1958 the establishment of the Federal Council for Science and Technology.

The history of the FCST and prior mechanisms for promoting coordination of R & D within the Executive Branch has been well documented in the extensive report being prepared for the Subcommittee by the Science Policy Research Division of the Congressional Research Service. You asked for my views regarding the effectiveness of the FCST as a mechanism for coordinating Federal R & D and my thoughts about how such coordination can be improved in the future either through the FCST or by other means.

This brief statement is intended to summarize my views and present general observations and conclusions without detailed documentation. I will be pleased to amplify my remarks in response to questions raised during or after my presentation.

The Piore Committee on National Science Policy saw a need for an inter-agency council to promote coordinated policy planning and more effective management of Federal programs in science and technology, in recognition of the large amount of R & D funding channeled through a multiplicity of Federal departments and agencies. In the Committee's view, such a council could be an instrument of government for bringing to the Special Assistant to the President for Science and Technology, in an organized way, the advice and assistance of policy officials in the major R & D agencies.

The Executive Order of 1959 establishing the FCST reflected the Piore committee's emphasis on the policy-level character of the Council. Its members were to be representatives of policy rank named by the Departmental Secretaries. While the Executive Order refers to a number of functional objectives, such as more effective planning and administration of Federal scientific and technological programs, it did not direct the Council to carry out those functions *per se*. Rather, it directed the Council to recommend *policies* and other measures to achieve those objectives.

With few exceptions, the Federal Council for Science and Technology has not served as a policy formulating mechanism for the President or the Science Adviser. Nor has it been an effective channel for communicating and implementing Presidential policies affecting the R & D activities of the departments and agencies.

The FCST has mainly concentrated on R & D program coordination in a number of scientific and technical problem areas involving the R & D activities of several departments and agencies. Even in technical program coordination, the Council has enjoyed only limited success.

I do not intend to imply that the FCST has not been highly useful in providing a forum for the exchange of information among R & D officials in specific program areas. There have undoubtedly been many indirect consequences of

FCST activities on R & D policies and programs. Nonetheless, over the years, there have been relatively few major impacts or consequences of FCST activities.

The reasons for limited effectiveness and influence on the part of FCST are not necessarily failures of leadership or intellectual quality. Rather, its deficiencies are intimately related to the organizational and policy environment in which it has operated. The work of the FCST is inherently part of a broader scheme of policy, program development and funding involving the White House and Executive Office of the President, the decentralized departmental and agency structure and the Executive Branch-Congressional relationships.

There are major constraints on the ability to effectuate top-down coordination of R & D policies and programs that intersect the interests of several Federal departments and agencies. Ours is a pluralistic form of government organization and delegation of authority. It has the great virtue of diversity of ideas and the strength derived from the semi-independence and, at times, competitiveness of the Federal departments and agencies. In this situation, the strongest Presidential leverage for policy and program coordination is the budget process. Yet the Federal budget is a composite of individual agency budgets negotiated within an overall envelope of Federal expenditures, with considerable discretion left to the departments and agencies with regard to internal allocations of resources. There is no separate budget for R & D and trade-offs across agency lines are quite difficult, both conceptually and in practice. Each agency must justify its R & D expenditures in relation to its statutory objectives and in consideration of other non-R & D programs that contribute to those objectives. Although the overall coordination problem could be mitigated by a more functional organization of the departmental and agency structure, efforts in recent years to achieve major reorganization of the Executive Branch have not been successful. Coordination of R & D through the central budgeting process has the further difficulty that the individual agency R & D programs are dealt with by a number of different committees in the Senate and House of Representatives, so that efforts to achieve balanced R & D programs involving several agencies can easily fail due to fragmentation during the Congressional authorization or appropriation process.

Because R & D must be judged in relation to the various technical objectives they serve, the White House science and technology policy mechanism must have effective working relationships with the Presidential staff mechanisms on which the President relies for analysis and advice—the OMB, NSC, Domestic Council, CEA and other White House Executive Office units. Beyond that, the White House science and technology policy office must have a clear mandate on which to exercise its prerogatives as a full partner in the decision making process.

Furthermore, there must be an effective mechanism for defining the priority issues and tasks to be addressed by the Federal Council and for assessing its reports and relating them to a broader framework of Presidential priorities and to economic, social, institutional, fiscal and political considerations. Since there has effectively been no White House customer for the products of the FCST, it has tended to operate on the basis of self interest, consensus and compromise. Its proposals have been self-implementing only to the extent that the agencies wish to take advantage of its conclusions and recommendations.

Consequently, there has been little incentive for the policy-level members of the Council to participate actively in its plenary sessions. From a departmental and agency standpoint, their time can more effectively be spent gaining support for R & D programs within their agency hierarchies, and in strengthening their direct relationships with the OMB and with the relevant Congressional authorization and appropriations committees. As a result, the main thrust of agency participation in the FCST has been at the scientific and technical subcommittee level where there are mutual benefits to be derived from the exchange of information and the development of common approaches.

In my view, the inability of the FCST to deal with interagency policy and program development has been due, in large measure, to the relatively weak posture and influence of the Presidential Science Advisers and the former Office of Science and Technology in budgetary decisionmaking and policy formulation involving civilian R & D. It is noteworthy that the various Presidential Science Advisers were particularly influential in matters affecting military and space R & D, which have accounted for a large fraction of the Federal R & D budget. But these R & D activities have been coordinated outside of the framework of the FCST. The Science Advisers have had substantially less impact in the civilian areas of concern to the FCST, a situation which inevitably has con-

tributed to the lackluster performance of the FCST as a policy level coordinating body.

This situation should show marked improvement as a result of the enactment of the National Science and Technology Policy, Organization, and Priorities Act of 1976. That Act not only establishes a new Office of Science and Technology Policy and a Federal Coordinating Council for Science, Engineering, and Technology; it also sets forth a national policy for science and technology and requirements and procedures for its implementation. In effect, the Act provides the essential structure and agenda for much more effective policy-level coordination.

Among the policy-level matters singled out for specific attention are:

The need for strong participation and cooperative relationships with state and local governments and the private sector.

The creation of policy planning elements to assist the agencies in identifying public problems and objectives and anticipating future concerns to which science and technology can contribute.

The management, dissemination and transfer of scientific and technological information including procedures for systematic interchange of scientific findings among the Federal agencies.

Federal procurement policy to encourage the use of science and technology to foster the frugal use of materials and energy.

Development of criteria, including cost-benefit principles, to identify Applied R & D programs appropriate for Federal funding support.

Assuring the stability of scientific and technological institutions and the support of basic research and education in needed disciplines.

Development of Federal patent policies based on uniform principles.

Efficient management of laboratory facilities and equipment.

In the statement of functions of the Office of Science and Technology Policy, there are elements of policy planning, analysis and advice on which the new office could appropriately call on the assistance of the Federal Coordinating Council for Science, Engineering, and Technology, including:

Assistance in preparing the Science and Technology Report.

Periodic review of Federal statutes and administrative regulations which affect Federal R & D activities.

Policies for international cooperation in S & T.

Identification of current and emerging problems of national significance involving scientific or technical considerations.

I cite these areas of Congressional concern as an indication of the number, scope and diversity of government-wide policy and management needs that, for the most part, have not been dealt with by the FCST.

Nor for that matter, has the overall organization and management of Federal R & D received much attention by the OMB or the former Office of Science and Technology. Organizational and management issues involving Federal R & D have been dealt with on an *ad hoc* basis in response to specific, short-term needs. There has not been a continuing, professional examination of ways to improve the structure and effectiveness of Federal R & D—a lack of attention to management policy that is difficult to explain in view of the vast public expenditure for R & D and the complexity of the Federal R & D organization. Large industrial corporations appear to give much more systematic attention to R & D organization and management than does the Federal government. This matter will, of course, be the subject of in-depth examination by the Federal Science, Engineering, and Technology Survey Committee established by the 1976 Science and Technology Policy Act. The Federal Coordinating Council for Science, Engineering, and Technology could be called upon to provide expert support and assistance to the Survey Committee.

In addition to policy and management issues, it will be necessary for the new Federal Coordinating Council to deal with questions involving the initiation and scientific and technical coordination of research and development programs in priority areas of Presidential level concern, such as the work of the FCST Committee on the Inadvertent Modification of the Stratosphere to which Dr. Stever referred in his testimony earlier this week as a very successful activity.

Beyond the realm of specific program issues of policy level import, there remains a basic need to coordinate agency R & D programs in the manner of the FCST Interagency Committee on Atmospheric Sciences. There are many such R & D areas of overlapping interest where exchange of information among agency representatives would promote more efficient utilization of resources and avoid

needless duplication. I question whether this type of coordination needs to take place at the Presidential level unless high priority R & D programs are involved where there is a Presidentially perceived urgency and broad national interest, such as in energy R & D before the establishment of ERDA. When such need exists, the objectives of the coordination effort should be clearly defined and carefully assessed in relation to policy or program consequences. The progress of the coordination effort and the need for its continuation under the Council should be periodically reviewed. Unless this is done, there will inexorably be an increasing number of technical coordinating subcommittees of indefinite life that will divert the attention and sap the strength of the Council in dealing with policy and management issues involving R & D.

Because there is a genuine need for interagency R & D program coordination in many scientific and technical areas of common concern to several departments and agencies, other mechanisms to facilitate oral and written exchange of R&D program information should be seriously explored. This is a management policy issue that the new Federal Coordinating Council should address, including the feasibility of alternative arrangements and procedures such as the designation of lead agencies for promoting coordination in given areas of R & D.

In my view, the character of problems to be dealt with by the new Federal Coordinating Council and its relationship to the Office of Science and Technology Policy call for new arrangements and methods of work. It would be a mistake to merely continue the activities of the FCST under a different name. There should be a clear break with the past.

The Federal Coordinating Council should be viewed by the Science Adviser as a means for mobilizing the expertise of the Federal departments and agencies on an *ad hoc* basis to deal with specific scientific and technical policy, program and management issues. The Coordinating Council should meet infrequently as a body. Aside from very broad questions affecting all agencies engaged in R & D, only those members directly involved should meet at the request of the Chairman to consider specific issues. For all studies, the issue should be carefully defined in advance. This should be done in consultation with the appropriate White House and Executive Office units to secure their agreement on the need for and importance of the study and willingness to participate in a process for assuring that the study results receive attention and consideration at the Presidential level.

As to the method of conduct of the studies, a variety of techniques should be employed depending on the nature of each specific issue. Where there are strong vested interests on the part of concerned Federal agencies, it may be desirable to undertake the study initially utilizing outside consultant panels or contracts. The agency representatives would then be convened to debate the conclusions and recommendations and to state the reasons for agreement and disagreement including the desirability of alternative approaches. This study technique would recognize the practical difficulties in asking the agencies to present proposals on issues where they have strong vested interests in the initiation of a new R & D program or in the protection of ongoing activities. Where there is an issue of general concern to all agencies calling for their expertise and insights, such as Federal scientific and technical manpower policy, the direct convening of an interagency working group would be more appropriate. In still other situations, a mixture of agency personnel and outside-of-government experts might be more effective both in providing needed outside expertise and objectivity and in securing agency acceptance of study results.

I would hope that the Federal Coordinating Council for Science, Engineering, and Technology would adopt a mixed strategy in undertaking its studies involving a blend of agency personnel, expert consultants and contractors.

The number and nature of policy, management and R & D coordination issues demanding the Council's attention require that the Council have access to full-time staff and some financial resources in addition to that provided by the member agencies. The Act creating the Council does not make separate provisions for Council staff and budget. The Council will need to rely on the Office of Science and Technology Policy for staff support and financial resources. Since the Director of that Office serves as chairman of the Federal Coordinating Council, it is logical that he have adequate resources to pursue the work of the Council with a reasonable degree of independence and flexibility. Clearly, this need should be taken into consideration in setting the staff and funding levels of the Office of Science and Technology Policy.

In conclusion, Mr. Chairman, I would like to emphasize that there is a new "ball game" for the coordination of Federal R & D activities. Whatever the failures or shortcomings of the FCST, there is reason to believe that the National Science and Technology Policy, Organization and Priorities Act of 1976 lends new opportunity, rationale and confidence that the Federal Coordinating Council on Science, Engineering, and Technology can be an invaluable player on the Presidential science advisory team.

Mr. THORNTON. Very, very useful.

I thank you very much for your fine testimony and the excellent summary presented to our subcommittee.

I want to call to the attention of the staff members that we have just heard excellent testimony from a scientist who is also a lawyer. I am very delighted to receive this good testimony.

I am also quite interested in your particular field of expertise in the law, which I believe, without excluding other areas, does include antitrust and patent work, or primarily patent work.

I wonder if we might usefully draw a distinction or rationalize the apparent differences and objectives between coordinating research policy, communication of ideas, making sure the research base remains good and sound, with the need to provide incentives to individuals to get out on the razor's edge of innovation with new inventions and ideas, protect their proprietary rights, and give them the necessary incentive to go forward with developments.

These two objectives should not be in conflict. I think it is necessary to understand how they can be reconciled.

Do you have any observations on that?

Mr. BECKLER. It seems to me if the coordination function is carried out in an enlightened way, it will in effect provide the incentive for the entrepreneur with the idea, encourage him to come forward with his idea.

You can kill things through coordination, but you can also provide incentives through coordination. It is a question of how you carry it out.

I don't think constructive coordination is something that in effect merely tries to put existing pieces of things together.

Mr. THORNTON. You are saying coordination does not necessarily imply destruction of proprietary rights or making everything public?

Mr. BECKLER. Coordination within the private sector is another matter. The question of how industrial research and development takes place, relationships among companies, is quite different from the relationship among the departments and agencies. Within the Government you want the closest possible cooperation and exchange of information. Within industry, you want to maintain a sufficiently competitive situation that there can be a multiplicity of ideas and incentives to exploit them.

Does that get to the heart of your question?

Mr. THORNTON. We are touching the same problem. You are providing good responses.

But I want to zero in on a particular aspect of coordination and policy review which the Federal Council might make, and see whether you agree that this would be useful.

I am trying to suggest it may not be enough to coordinate, certainly not enough merely to act as a forum, although these are useful things.

Might it not be a useful function for the Federal Council to try to identify institutional, private or governmental, institutional barriers against innovation and to come forward with suggestions how those barriers may be reduced?

Patent policy is one such area where there is a need to improve statutory governmental provisions relating to patent policy, in order to provide additional incentives. Certain areas of regulation may also need attention—antitrust enforcement; the laws themselves should not stifle competition or development of ideas. They are designed to promote competition. Yet we have been told the impact of those laws on some ideas toward development to research programs to attack, say, the energy problem, we are told the presence of antitrust laws may be an inhibition against focusing on scientific research. Do you think any positive effort should be given to identification of this kind of problem?

Mr. BECKLER. I do, very much. I am not convinced some of these things should occur under the Federal Coordinating Council. That may be the wrong place for examining the impact of Federal antitrust regulations on R. & D. in the private sector, because there would be two agencies that would be in disagreement; that is, the Department of Commerce and the Department of Justice, in a sense. They have different points of view; at least they had in the past. I think that kind of issue is best handled by the Office of Science and Technology Policy working closely with the Domestic Council, with the Council of Economic Advisers, and drawing on the agencies concerned, and outside groups.

We went through this some time ago. The Justice Department did not take an adamant position but merely said, "show us the evidence that antitrust regulations have suppressed innovation, because we now have files in many instances where in effect we moved in and the result was a multiplicity of sources rather than a single source."

Mr. THORNTON. Of course, the testimony we have received has not been there was a suppression, but that the fear or concern for antitrust action had an impact.

Mr. BECKLER. That is so. It is one of the strong points made by representatives of industry, even though the Department of Justice at the time indicated it did not have a hard and fast rule, that there were circumstances under which it would be possible for companies to cooperate, particularly where you have fragmented industries, not just a few dominant companies; where you have Government involvement or where the cooperative arrangements were open ended and involved as many companies as wished to join. At that time they made it quite clear there were no hard-and-fast rules except under certain prescribed situations where there would be a clear violation. In other cases, they would be willing to provide advisory services.

But the industry point of view is that, "we have to be conservative, since the situation is uncertain and there have been actions taken in the past that suggest this is a pretty risky business, that we better not move too far."

In my opinion there is a certain amount of overreaction, which is not illogical but due to inherent uncertainty and unwillingness to commit in advance until one sees a precise situation. It is an area of fluidity.

On the other hand, I think there are major questions of this kind that could appropriately be addressed by the Federal Coordinating Council, such as the impact of other Federal regulatory actions on innovation in the environmental and pharmaceutical areas. Further, there are many governmental programs where the results of the R. & D. are supposed to go into the market structure, as in health services, transportation, so on. Yet the design and execution of those R. & D. programs has not been part of a transmission-belt concept. It has been an R. & D. concept that if we develop something useful, someone might pick it up.

That has been the subject of a number of studies, and still remains an important deficiency in the way in which the civilian departments and agencies conduct R. & D. The Government agency makes certain decisions on R. & D. as to what would be useful to the public, what industry might be willing to manufacture, and so on, without adequate dialog and involvement with the producer and user right from the beginning, so the process can result in products and services available in the marketplace. This, of course, has many exceptions. But by and large there is not a systems concept that builds in all these factors.

The best example I can think of where these factors were taken into consideration is the civilian nuclear power program of the Atomic Energy Commission. Very early after the war, in the early 1950's, the AEC adapted to an industrial development policy. They eased security restrictions to bring in wider involvement of companies that were not in the Manhattan program. They formulated a conscious plan which included the construction of prototype research reactors, designed in the National Laboratories, demonstration programs, so on with industrial involvement and participation. There was a conscious transition from Government to private hands.

There is a feeling we need much more of a systems concept in framing Federal civilian R. & D. programs.

That is the kind of issue that is clearly of importance to the Federal Coordinating Council.

One other point I make in my testimony relates to a question by Dr. Holmfeld. I believe that the Council should adopt a mixed strategy in doing its studies. The previous Federal Council by and large used only Government experts, and I think there are occasions when it would be good to have a mixture of Government and outside experts. There are times the studies should be undertaken initially by outside experts and then authorized by the members to obtain their reactions and their reasons for accepting or rejecting the conclusions and recommendations. Such a strategy could be particularly effective where: (1) the departments and agencies are apt to argue in their narrow self interest, or (2) a key agency is reluctant to agree to a consensus that might adversely affect its own programs in favor of an activity elsewhere in the Government. Bringing in outside experts who can speak with authority on the substance tends to suppress the natural bureaucratic tendency to compromise and paper over the real issues.

I think the mixed strategy is very good for other reasons. We must remember that for many areas of concern the expertise does not necessarily reside in the Government agencies. Even where best it exists in Federal employees, it may be difficult for them to disengage themselves from their official capacities. We have a large outside resources

of expertise, in universities and industry, that can be mobilized and brought to bear, so one can be sure the ideas are well-conceived and take into consideration a broad range of views.

Mr. THORNTON. Mr. Beckler, I would like to ask if the Staff might have an opportunity to prepare some questions for you to respond to in writing. We are under some time pressures.

Mr. BECKLER. Certainly.

Thank you for this opportunity, Mr. Chairman.

Mr. THORNTON. Thank you very much for your excellent testimony.

We will now hear from Dr. Goldmuntz, President of Economics and Sciences Planning, Inc.

We are very pleased to have you with us. We have had an opportunity to review your prepared statement. Your biographical data and prepared testimony will be made part of the record.

[A biographical sketch of Dr. Goldmuntz follows:]

DR. LAWRENCE A. GOLDMUNTZ

PRINCIPAL INTERESTS

Public policy and its relationships to technology and the economy; application of advanced technology in engineering development.

EXPERIENCE

1973-present: President, Economics and Science Planning, Inc., consultants. Research on the economic and technological impact of Federal regulation; railroad reorganization; automotive safety; air quality and emissions control; urban mass transportation.

1971-72: Assistant Director for Civilian Technology, Office of Science and Technology, Executive Office of the President; Executive Secretary to the Federal Council for Science and Technology; Chairman, ad hoc committee on Cumulative Regulatory Effects on the Cost of Automotive Transportation.

1968-71: Consultant, Office of the Assistant Secretary of Transportation (Research and Technology); Chairman, Metroliner Steering Committee; Executive Secretary, Air Traffic Control Advisory Committee.

1953-68: President, TRG, Inc., (1953-1965); General Manager, TRG Division, Control Data Corporation (1965-1968); Supervised large-scale programs: shipboard sonar; space and terrestrial laser range-finding systems; airborne anti-submarine warfare systems; satellite communication ground station development; electronic countermeasures.

1951-53: Engineer, Nuclear Development Associates.

1949-51: Engineer, General Precision Laboratory.

B.E.E., 1947; M.E.E., 1948; Ph.D., 1950, Yale University.

Born June 10, 1922, New York, New York.

Member: Sigma Xi; American Physical Society; Institute of Electrical and Electronic Engineers; American Institute of Aeronautics and Astronautics.

Mr. THORNTON. I would ask you to proceed now in the manner you choose, hopefully to summarize your testimony so we may have the opportunity to explore that testimony with some questions and answers.

Dr. GOLDMUNTZ. I will be glad to.

STATEMENT OF DR. LAWRENCE A. GOLDMUNTZ, PRESIDENT, ECONOMICS AND SCIENCE PLANNING, INC., WASHINGTON, D.C., AND FORMER EXECUTIVE SECRETARY, FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

I am delighted to appear before you, Mr. Chairman.

Two previous witnesses covered this subject amply, and very well. I will add a few points, if I may.

I was Executive Secretary of the Federal Council from February 1971 to October 1972. During that period the Federal Council operated in its normal mode, and also in an unusual mode, the New Technologies Opportunity Program.

As we all know, most of the coordination of Federal R. & D. does not occur by means of the Federal Council. It could not possibly accomplish this job since Federal R. & D. will total \$23 billion in 1977.

The agencies are intelligent and cooperative, and work together, even without prompting. There are many interagency agreements, some known and some unknown by the Executive Office. Some work effectively, some do not. For example, NIOSH is working in support of OSHA, and those agreements are superb, and everybody is very satisfied with the result. The interagency agreement on microwave landing system, has, however, not worked well.

The first thing to do is to organize Federal R. & D. so as to minimize the coordination requirement. We do that by the very organization of Federal R. & D., by disbursing to the mission-oriented agencies the relevant R. & D. responsibility. Nevertheless the requirement for coordination has increased in recent years.

We have criticized R. & D. for being too compartmentalized. You find an agency like ERDA reacting to criticism that their research may be too narrow, and immediately that administration has to coordinate with EPA, HEW, the Nuclear Regulatory Commission.

Even if agencies did not have to interact, you have common disciplines running through each agency. It is important to recognize that, and to evaluate the Federal investment in these common disciplines.

I recall we organized a Federal Council Committee on Forecast Modeling, because we were forecasting in many agencies. We were worried about the quality control and investment in the models, and wanted to see if there was a possibility of exchanging information between agencies and limiting investment, or establishing common quality control techniques.

OMB perennially surfaced the issue of interagency cooperation and interaction. They are probably the prime source of interagency cooperation especially from the point of view of spending money efficiently.

We organized a Federal Council spring review, being particularly interested in the problems of coordination as a result of one spring review, a number of important ad hoc committees were organized which we felt were necessary to address issues that had surfaced. There was an ad hoc committee on Ecological Research, one on RANN coordination, and one on energy research and development goals. These were short-lived committees organized to address a particular concern. We had good cooperation from the agencies; I think the results were worthwhile.

One should realize that an FCST committee has no authority. It cannot commit an agency or any branch of the Executive Office. It is a committee organized to provide policy options, a consensus among agencies, to allow the Federal programs to proceed. It illuminates an outlines issues. It cannot decide anything. Sometimes this process works well.

Sometimes an agency of Government will come to the FCST and say, "We cannot structure a proper set of options without the sponsorship of the Executive Office by means of FCST. Establish a committee to examine this particular issue to help structure the Federal role in this technology."

Other times when the staff of the FCST felt it was important to structure an area, agencies felt it was an intrusion, and were not anxious to cooperate. You will have that all the time. Some efforts at coordination come up from the agencies, some from the Executive Office of the President. They will not always agree.

The response of the agencies and the Executive Office itself to the new technology opportunity program was much more positive than to many other efforts. The reason for this response was first of all that the President wanted it, and second there was to be money and an opportunity for more responsibility. We worked very hard and achieved excellent cooperation.

I feel guilty about the amount of work that went into the new technology opportunities effort because not as much came out of it as was expected. But at least that program provided insight into how one can motivate the Federal Establishment.

One of the things it would be advisable to do is to provide the Science Adviser, or the process backing the Science Adviser, with authority to do something as a result of interagency reviews. The more clearly that authority is understood by individuals in Government, the Congress, the agencies, the more certain you are to get a thorough study, with a lot of ferment and ideas.

The coordinative process should bring in outside people.

I think that is very important. I am not sure I know why, but when I joined the FCST it did not seem to be the usual practice to bring in outside experts to help in the coordinative process. I think we began to break down that artificiality, and I think it is very important in the future to recognize that experts, outside the Government, can be extremely helpful.

There has been another limit on the ability of the Federal Council to operate as effectively as we might like. That is, the short lifetime of the Executive Secretary. There were five Executive Secretaries in 9 years. That is not enough time in that position. If it had not been for Mr. Beckler I could not have done my job. He was the institutional memory in that office, and the only one. Somehow we must make these jobs sufficiently attractive to hold people for the necessary period of time to become proficient in their job. This cannot be done when the Executive Secretary of the Federal Council has an average lifetime of 2 years in the job.

Mr. THORNTON. I think this argument might be applicable to other positions. [Laughter.]

Dr. GOLDMUNTZ. I am in favor of a 4- or 5-year term for Members of Congress. With respect to additional authority for the Science Adviser, I would like to make a few comments. It is not just to enhance his ability to do a coordinating job; it is also to enhance his ability to evaluate the R. & D. programs that are going on in the agencies of government, and to interact with these programs. I don't believe it is possible for him to evaluate and make decisions about every R. & D.

program. However, we know that when you diffuse science responsibility throughout the agencies of government not every decision in each agency is correct. Some are terribly wrong.

It is very frustrating to have an Executive Office that is supposed to overview Federal R. & D., discover something badly out of kilter, and only have a weak tool to correct it; that is, persuasion. This is particularly the case, if the Science Adviser is not close to the President or the budget process. You might rely on the hope that the Science Adviser can always be close to the President but you cannot be assured of this relationship. Even your recent legislation cannot assure a close relationship.

I would like to see the Science Adviser enabled to operate even when his personal relationship with the rest of the Executive Office is not superb. It is weak to rely only on personal relationships. It is important, but if the Science Adviser has not been able to develop such a relationship what can he do?

I was frustrated in my last few months with the Council because it was obvious that the personal relationship was not there, the office was not held in high esteem, and it was impossible, or difficult, to do many things that were deemed important.

I would like to see a change in the institutional arrangement, so that in the circumstance where the Science Adviser's relationship with the rest of the Executive Office is not as good or influential as one might like, he has some options to interact with science programs going on in the rest of Government. He should not control them, but he should have an ability to interact. If he can interact with the budget before it reaches Congress, marvelous; but he might not be able to do it, for the budget takes a long time to develop. Putting the budget together is a huge job, just to get it together, get it printed, get it out. It is terribly difficult to get a minor change at the last moment which may be very important from a scientific point of view.

If the Science Adviser tries to interfere in the budget process just before the budget is printed, he has a terrible time—you have tens of billions of dollars to put together, and you come up with a \$10 million item.

Perhaps he should have the authority to, in a minor way, interact with the process after the budget has been approved by the President or the Congress.

Thank you.

[The complete prepared statement of Dr. Goldmuntz follows:]

TESTIMONY BY DR. LAWRENCE A. GOLDMUNTZ, PRESIDENT, ECONOMICS & SCIENCE PLANNING, INC., WASHINGTON, D.C.—AT HEARING BEFORE THE SUBCOMMITTEE ON DOMESTIC AND INTERNATIONAL SCIENTIFIC PLANNING AND ANALYSIS OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY IN WASHINGTON, D.C., FRIDAY, JULY 23, 1976

Mr. Chairman, my name is Lawrence Goldmuntz. It is a pleasure to appear before you to discuss the coordination of Federal R&D activities. I was Executive Secretary of the Federal Council for Science and Technology from February 1971 to October 1972. During six months of this period the FCST had technical responsibility for developing the New Technology Opportunities Program. This was an attempt to define civil technology projects that would be appropriate for additional Federal support and that would stimulate social or economic development. In view of the excellent report on the Federal Council that has been prepared

for this committee by the Congressional Research Service, there is no need to review the history of the FCST. However, it might be helpful to present some residual impressions concerning coordination of Federal R&D by means of the Federal Council.

It is fortunate that most of the enormous Federal R&D program (\$23 billion in 1977) does not require coordination at the executive level. Even the small amount of coordination that is needed can overwhelm the capabilities of a scientific staff that is necessarily small since it is located in the Executive Office of the President. It is therefore essential to organize the Federal R&D structure so as to minimize the need for coordination. As you know, this has been done. DOD, NASA, HEW, DOT, HUD, etc., all have R&D efforts supportive of their own mission.

However, it is not possible to organize Federal R&D in such a way that there is no interaction or overlap between programs. In fact, a criticism of too many programs and R&D projects is that there has been insufficient concern with side effects. The response to that criticism increases the requirement for coordination. For example, energy programs interact with environmental, land-use, health, economic and foreign policy issues. Because of the intimate interaction with environmental and health issues, the Energy Research and Development Agency has established an Administration for Environment and Safety. Its efforts have now to be coordinated with EPA, HEW, and NRC.

Even if the missions of the agencies of government did not overlap or interact—there would be a need for coordination. Certain disciplines are common to many R&D missions. It is efficient to exchange information about these disciplines. For example, an FCST Committee on Forecasting Models was organized to determine the scope of Federal modelling activities and to understand whether there was a need for and mechanism to provide some quality control of the various models being generated.

Therefore, even with an efficient organization of Federal R&D, there is still interaction and overlap between R&D efforts and then there is always some commonality at the discipline level, all of which requires coordinative effort.

A great deal of coordination can, must and does occur without prompting or oversight from the Executive level. There are a large number and variety of interagency agreements concerning R&D programs or facilities or personnel that are developed by individual agencies with only occasional prompting from the Executive Office. Agreements can range from a joint FAA, NASA, DoD microwave landing system program to R&D support for OSHA in the Department of Labor by the National Institute of Occupational Safety and Health in HEW. A spur to the development of such interagency cooperation can and does occur at annual agency budget reviews with OMB where duplication or coordination of agency effort is a perennial topic.

Coordination of agency technical efforts was specifically a focus of the FCST spring reviews. OMB was invited to observe. Partially as a result of these spring reviews, a variety of interagency committees such as the Ad Hoc Committee on Ecological Research, the Committee on RANN Coordination and the Committee on Energy Research and Development Goals were organized to coordinate a government wide approach to these technical issues. These coordinating committees were intended to be short lived, to address specific issues of immediate concern, to determine whether the Federal program addressed the emerging issues adequately, to determine whether there was duplication between agencies and perhaps to suggest the redirection of the efforts of certain agencies.

An FCST committee has no authority. It cannot commit an agency or any executive office such as OMB or CEQ. An FCST committee can illuminate issues and can attempt to find consensus among the agencies. The Executive Office personnel, who may be observers or represented on an FCST committee in addition to their technical responsibilities to the committee, sometimes have to remind a committee that their purpose is to outline policy options and that policy is made elsewhere.

Some FCST committees were organized at the request of the mission oriented agencies since it was felt that without Executive Office participation, the coordination effort would fail and the budget process could not respond to an otherwise legitimate effort at scoping the problem and assigning responsibilities in a preliminary manner. Some FCST efforts were reluctantly accepted by the agencies with a feeling that either nothing would come of the effort or that the effort represented executive level intrusion into agency affairs.

The agency response to the New Technology Opportunities Program was much more enthusiastic than to any FCST endeavor. The request came from the President. There was gold at the end of the rainbow. Outside experts were called in to help formulate and evaluate programs. At the very least there was a lesson in motivation to be learned from the New Technology Opportunities Program. However, the time frame was too short for solid achievement and the reality was less than the promise.

The FCST seemed, during my tenure, to be only a partially effective instrument to achieve coordination and cooperation among R&D agencies. First of all there were five executive secretaries in nine years. Even the best of us require a certain amount of time to learn our job. It is safe to conclude that the FCST has to attract a competent staff that is sufficiently motivated to stay with the responsibility.

Second, it should be made explicit that the FCST can utilize experts outside the government to help in the coordination and program formulation process, either in an advisory capacity to the FCST or directly within the FCST coordinating committees.

Third, the FCST has to be perceived to have some authority before it can attract a qualified staff or the attention of the mission oriented agencies. In a stable environment where personnel have matured together in the organization, the trusted staff to the chief executive does have authority. This authority is derived from the staff's recognized influence with the boss. The Executive Office of the President doesn't have sufficient durability to develop these relationships. The agencies recognize this organizational defect. It should be possible to provide the President's Science Adviser, who is the Chairman of the FCST with some funding prerogative to give him the authority he requires to be effective.

This could take a number of forms. Perhaps he could have authority over some funds for longer range research or a quick reaction capability that he could commit for a limited period until a mission oriented agency adopted or finally rejected his initiative. Perhaps he should have the authority to reprogram a small percentage of each mission agency's R&D budget up to some maximum amount, after it has been approved by Congress. These funds could be applied to an alternate suggested use either within that agency or in another agency. This mechanism could also provide a quick reaction capability, or the opportunity to restore balance to an agency's R&D program or the opportunity to support a program of broad Federal interest that is more logically accomplished in one agency than in another. Such authority goes beyond enabling the Science Adviser to accomplish a better job of coordination. Such authority not only permits that, but also permits the Science Adviser to make some evaluations of Federal R&D programs and to act on these evaluations. Such authority goes beyond the usual inclination of the Congress and the mission agencies. But the Congress faces a dilemma; is there sufficient uneasiness with the productivity and responsiveness of Federal R&D to provide, perhaps only in the civil sector, some reprogramming authority to the Science Adviser? Will such an authority improve matters? I believe so.

Mr. THORNTON. I thank you very much for your good written presentation and excellent summary.

You said a function of the FCST has been to provide policy options, but, you said, you, or the committee, had to be reminded that they could not set policy but only offer policy options.

I put that together mentally with the testimony on Wednesday of Dr. Lambright that the agencies sitting on these committees too often, I believe he said something like, tend toward finding the lowest common denominators. Decisions may be agreeable and workable, but they may not be very meaningful.

How do you handle that? How can you be sure these committees do not overlook the power they were given to spell out the choice of options in real and precise language, and not simply come to a loose agreement on the things that are obviously agreeable?

Dr. GOLDMUNTZ. I think that is the responsibility of the representative on each committee from the Executive Office. He should make sure all options are explored, exposed, and recorded, even if they represent minority opinions. He also should make sure that the committee is not a mutual back-scratching operation—I will give you \$5 million to do your pet job if you give me \$3 million to do my favorite job.

That is why you want a member of the committee representing the Science Adviser who must be competent, knows the field, and knows how people work and how committees operate. You have to have a committee which is competent, so as to avoid these traps. I can think of nothing else, other than the native intelligence of the participants on the committee.

Mr. THORNTON. Are there any goads, sticks, or carrots, available either to the Congress or the executive branch, that might encourage this?

Dr. GOLDMUNTZ. No report is automatically accepted by the Coordinating Council or the Federal Council. The report must go to the Council, and the President's Science Adviser must approve it before it is published. This is a fairly good control. There have been a number of requests for a redo of a report, where the technical quality was insufficient, or the options not clearly delineated.

Mr. THORNTON. At the bottom of page 3 of your prepared testimony the last sentence indicates that some FCST efforts were reluctantly accepted by the agencies, with the feeling that either nothing would come of the effort, that it would be harmless, or that the effort represented Executive-level intrusion into agency affairs.

I run into all kinds of problems as to how you get this Nation's public policy carried over to agency decisions. Is this attitude one that has some depth? Is it one you run across occasionally? How do you translate Executive-level intrusion into agency affairs into a flowing through of a public policy consideration by agency members?

Dr. GOLDMUNTZ. The last paragraph on page 3 talks about a spectrum of responses by the agencies to requests from the Federal Council, some positive, some negative.

In retrospect the agencies were at times correct, they could have handled some problems themselves, and did not need the Council. I did not find the agencies unresponsive to a real, legitimate need. I found the agencies extraordinarily cooperative, most of the time.

With respect to the new technology opportunities program, some of the agencies were much more skeptical than I that anything would come out of it, and I think they turned out to be more correct than I was. Nevertheless they worked very hard, and assigned some of their best people.

Mr. THORNTON. This is getting away from science policy, but I feel a little that Harry Truman was right. Even if the general is right as to the military consequences, the President is still boss, and that is the only way public policy can be transmitted.

Dr. GOLDMUNTZ. That is I think particularly true in the evaluative function of the Science Adviser. That is why I strongly suggest giving him more authority; because there are times when the Science Adviser will meet with an agency head and say "Can't we agree this should be done?" And the agency may, in the person of the Assistant

Secretary for Research and Development, agree and still it does not get accomplished. You can even put money in the budget, and still it does not get accomplished.

While we certainly do not want a science czar, some central direction of scientific effort, neither do we want a science adviser to be powerless. We have not given him the authority I believe he requires, to identify areas where more work or a changed emphasis would be helpful, and the authority to see that it gets accomplished.

Mr. THORNTON. I completely concur in your last statement. I certainly don't think we should have a czar. Nor do I think the President is ultimate boss in this society. The ultimate boss is the people, and only insofar as those of us in Government, whether in bureaus or in Congress or in the executive branch, only insofar as we are responsive to the goals of our society are we performing our function. That is getting rather far afield, and I do not mean to do that. But I was concerned because of this being one of the reactions that has been identified. It seems to me a wrong for an agency to ever get the impression that a proper inquiry from a properly constituted body was an intrusion into their activities.

Dr. GOLDMUNTZ. I did not mean to imply that agencies would resist inquiry from the FCST. They might resist a decision by the FCST to organize a coordinating committee it might be appropriate for the agency to outline their objections. If the Science Adviser then decides nonetheless it is important, I am sure he would get the agencies' cooperation. It is proper for the agency, if it feels that way, to express skepticism as to whether it is a worthwhile effort. You want the agencies' cooperation once the Science Adviser has heard them out.

But at times I think the Science Adviser would like to do something in a substantive way as a result of evaluation, that he has a hard time getting done. I would like to see him have some authority in that regard; if one agency cannot do it, do it in another, but don't let one agency block something.

Mr. THORNTON. I want to ask you if you would respond to written questions by the staff.

Dr. GOLDMUNTZ. Surely.

Mr. THORNTON. I do want to again express my appreciation for your most thoughtful testimony and good responses to the questions we have asked.

We are under some time limitation.

I want to introduce for the record Mrs. Pecora, secretary to the FCST Executive Director, who has been in our audience every day of the hearing and who has provided a good deal of assistance in the preparation of the Library of Congress study.

We are very pleased that you are here.

And Mrs. Bates, it is a pleasure to have you sitting in here, having made the great contribution that you have made to the course of these hearings.

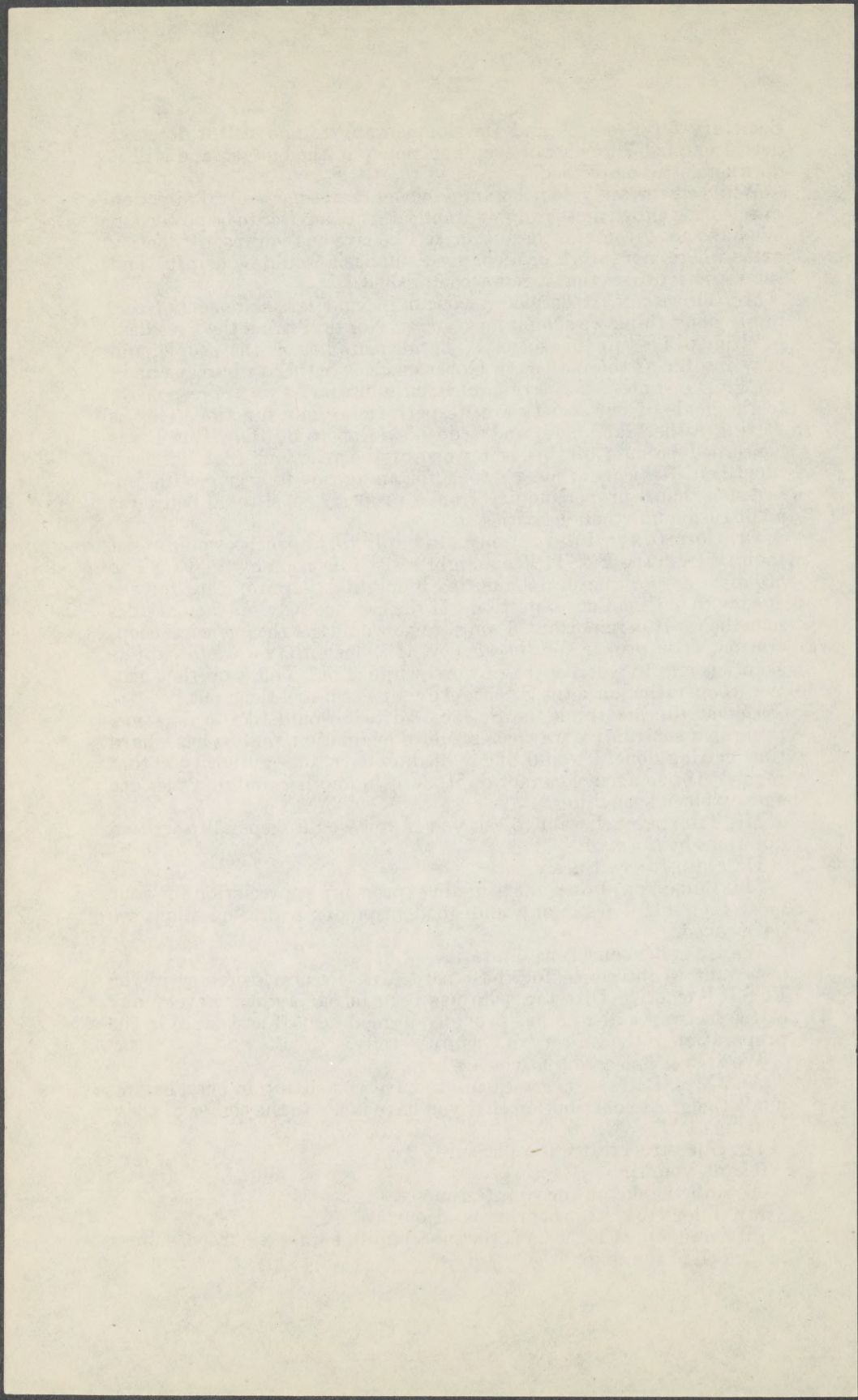
Dr. GOLDMUNTZ. It was a pleasure.

Thank you, sir.

Again I thank you for your testimony.

Mr. THORNTON. This hearing is adjourned.

[Whereupon, at 11:50 a.m., the subcommittee was adjourned, subject to the call of the chair.]

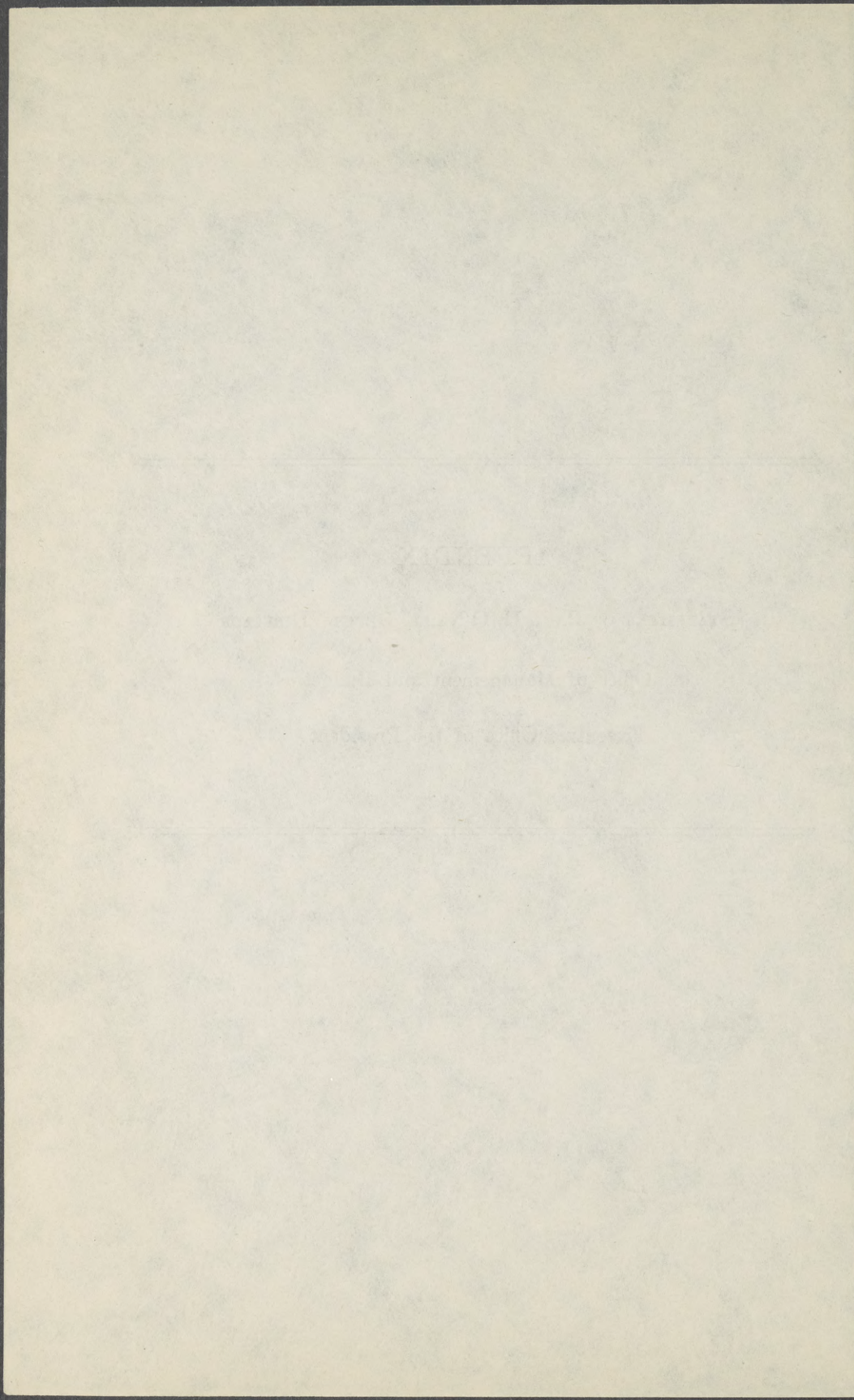


APPENDIX

STATEMENT OF PAUL H. O'NEILL, DEPUTY DIRECTOR

Office of Management and Budget

Executive Office of the President





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

AUG 2 1976

Honorable Ray Thornton, Chairman
Subcommittee on Domestic and
International Scientific
Planning and Analysis
The Committee on Science and Technology
2319 Rayburn House Office Building
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

This letter provides information on OMB's activities and role in coordinating research and development activities of the Federal Government in connection with the recent hearings of your subcommittee on this subject.

The Office of Management and Budget uses a number of means to achieve coordination and consistency in the R&D activities of all the Federal agencies including the Department of Defense. Before discussing these mechanisms, however, a few background points should be made concerning OMB's ability to coordinate the R&D efforts of the Federal Government.

- OMB is a relatively small Federal agency and there is a high degree of communication and cooperation between personnel at the staff and management levels of the organization. This pattern of communication and cooperation characterizes the working relationships of staff who work on related programs (within Program Divisions) as well as the relationships between staff who work in very different program areas and in different Program Divisions.
- The organization and working style of OMB (which depends highly on cooperation between and among groups) permits the ready identification and handling of R&D issues which may require coordinated effort among examiners and agencies.

- In many cases interrelated R&D programs are grouped under Program Associate Directors (PAD). For example, the PAD for Natural Resources, Energy and Science (NRES), has responsibility for the programs of EPA and ERDA; the PAD for Human Resources has responsibility for the medical research programs of VA and HEW; and, the PAD for National Security and International Affairs has responsibility for the research programs of the Department of Defense.
- Under the PAD for NRES, there is also, through the Science and Energy Technology Division (SET), a focus for dealing with general science issues which cut across all agencies such as the overall level of Federal support of basic research. This Division also provides a focal point for OMB dealings with the Science Adviser and assists in bringing together staff resources in OMB to work with the Science Adviser on key issues.

The mechanisms available to OMB to assist in coordinating Federal agency R&D efforts can be organized into four broad categories: budgetary review mechanisms, Government-wide functional or managerial mechanisms, working with other organizations, and ad hoc task forces pulled together to solve specific problems. Each of these are discussed below.

Budgetary Review Mechanisms

In developing the President's Budget, OMB staff review agency budget submissions and identify issues that require further review, analysis and resolution. As part of this review, agency R&D requests are examined and evaluated in light of their relevance and appropriateness to agency missions and in terms of their relationship to R&D programs of other agencies. Attention is also given to issues which result from or are in response to external events and developments.

1. During the entire process of developing the President's budget, OMB staff continually analyze policy, managerial

and financial aspects of programs. As part of this review, budget examiners check with each other to determine whether or not overlap or duplication or gaps would result from agency R&D proposals. In addition, in those cases where R&D is intended to develop information needed for agency program decisions, checks are made to see whether or not other agencies have had similar or related research underway or completed to answer these information needs.

2. Crosscut reviews of Federal R&D programs are also undertaken in the budget process. In these reviews, broad Government-wide issues are identified and considered. In addition, the proposed and planned total Federal agency dollar investment in R&D for the current and future years is considered.
3. Throughout the budgetary process, and particularly at the Director's Review sessions, staff from the Office of the President's Science Adviser participate. These staff bring their specialized perspective on R&D to the budget review sessions, which typically focus on a single agency's program.

This year, staff of the recently created Office of Science and Technology Policy are expected to participate in the budgetary review process.

4. While the budget decisions are being made, staff of the individual agencies cooperate with OMB staff in preparing a Special Analysis of R&D programs, which is published as part of the budget documents. This Special Analysis summarizes long term trends and new budgetary initiatives, describes the 11 largest Federal R&D programs, and summarizes R&D spending by function and agency. Although the special analysis is not used directly as

a decision-making document, its preparation serves as a means of reviewing the net effect of agency budgetary decisions on the overall Federal effort in R&D. Its publication also provides interested observers with summary information on trends and policy developments in Federal R&D support.

5. Throughout the fiscal year, and particularly during the fall budget review process, there is regular tracking and reporting to the Director on the status of the Federal Government's R&D efforts in areas of special concern.

Government-Wide Functional or Managerial Mechanisms

In addition to its budgetary role, OMB assists in coordinating R&D through its Government-wide management responsibilities. Some of the mechanisms available are outlined below.

1. The Office of Federal Procurement Policy is charged with the development of Federal Government procurement policies. As this office further implements its responsibilities, the R&D practices and procedures of the Federal agencies will be affected. The recent release of OMB Circular A-109 dealing with Major Systems Acquisition is an example of the kind of policy directive which is likely to result from the OFPP's efforts.
2. In cooperation with OMB Program Divisions, the Organizational and Special Studies Division (OSS) of OMB analyzes and makes recommendations on Government reorganization. In conducting their studies of Government organization and suggesting possible reorganization steps, this group is often involved in areas which can affect and influence the R&D activities of the Federal agencies. For example, staff from OSS played a major role in recommending the initial organizational structures of the NRC and ERDA. In doing this, the details of ERDA's cooperative and supporting role (under the Energy Reorganization Act of 1974) in conducting research for the NRC were developed.

Working with Other Organizations to Achieve Coordination of Federal Agency R&D

An important part of OMB's coordinating role is to work with other organizations in: developing issues which impact on or have R&D components; defining R&D needs; learning of potential or real areas of overlap or duplication; and defining needed analytical studies which can be of use in resolving R&D issues. These organizations can be found: within the Executive Office itself (e.g., the Domestic Council, the Council on Environmental Quality); among the Federal agencies (e.g., NSF, FCST); and among the various Federal advisory bodies and study groups (e.g., the National Academy of Science). In those cases where major budgetary issues have been involved, OMB staff have participated as observers and advisers in the work of the Federal Council on Science and Technology and its various working committees. OMB expects that the new OSTP will take an active role in examining and helping to coordinate Federal R&D efforts, and OMB will cooperate fully with the Office in its work.

Ad Hoc Task Forces and Other Special Coordinating Mechanisms

OMB is, on many occasions, called upon to be involved in the structuring of interagency programs responsive to near-term policy needs and objectives. These interagency programs often have R&D components. Typically, these efforts involve the creation of ad hoc task forces that study issues and report their findings and recommendations. A sample of the kinds of ad hoc efforts mounted by the Executive Branch, and in which OMB has participated, includes:

1. Health and Environmental Effects of Energy Related Pollutants

- In 1974, OMB created two special interagency task forces (chaired by staff selected from two Federal agencies) to examine and define the health and environmental R&D needs and recommend program priorities for R&D on energy related pollutants.
- As a result of this effort, research priorities were defined and agency roles in this R&D effort were defined.

Funds to support this effort are now appropriated to EPA under the Energy Research and Development Appropriation and then "passed through" to 17 other Federal agencies. OMB staff regularly monitor this research effort and the EPA "pass through" budget requests are examined by the budget examiners for the receiving agencies.

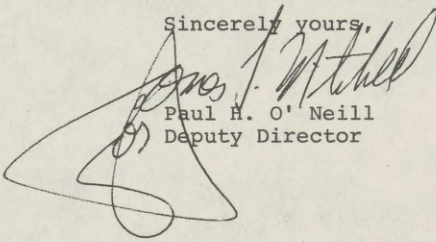
2. Earthquake Prediction and Mitigation Research

- This topic was identified as a potential area for increased funding by the Presidential committees on science and technology (Baker-Ramo Committees).
- OMB interacted with the Science Adviser and other agencies to consider short-term reprogramming of funds to monitor an area of earth uplift in Southern California that is suspected to be an earthquake precursor.
- The President authorized the reprogramming of \$2.6 million in FY 1976 and Transition Quarter funds to monitor the uplift. The reprogramming involved agencies examined in two different divisions of OMB, and examiners cooperated closely to handle the necessary reprogramming actions.
- At the President's direction, the Science Adviser undertook to examine the longer-range situation. Under his guidance, NSF and the Geological Survey are working with the Interior Department, OMB and other agencies to draw up a long-term research program plan. The plan is for consideration in the development of the FY 1978 budget.

- The Science Adviser also created an advisory panel of non-Federal scientists to review the long-term program. OMB participated with NSF, Geological Survey and other agencies in preparing working papers for the panel's initial meeting.
3. FCST Committee on the Inadvertent Modification of the Outer Stratosphere (IMOS)
- At the request of the Science Adviser, OMB staff have participated as observers in the work of the IMOS Committee which is examining the potential effects of fluorocarbons upon the ozone layer.
 - OMB has been kept up to date on the R&D recommendations likely to emerge from the IMOS effort.
 - OMB has also advised IMOS Committee members on the budgetary procedures to be taken into account in formulating any short and long-term R&D programs which IMOS might recommend to the Science Adviser.

I hope this information will prove useful to you and the members of the Subcommittee in understanding the role OMB plays in helping to coordinate the R&D activities of the Federal agencies. I will be glad to provide any additional information you or the other members of the Subcommittee might require.

Sincerely yours,



Paul H. O'Neill
Deputy Director



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