STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

DEPARTMENT OF CHEMISTRY

11 May 1971

FROM: John D. Baldeschwieler

TO: Ken Olsen

I am enclosing an updated version of the projected PSAC agenda for the next few months. The May program is relatively firm but the agenda for the remaining months is still quite flexible. I would appreciate your comments, and in particular, any new items which you feel should be brought before the Committee.

JDB:eb
Encl.

Problem Area	February	March	April	May	June	July	September
1. Annual Report			Critique of First Draft	Critique of Revised Sections			
2. Science & Technology Policy	NSF plans for RANN (Res. Appl. to Nat. Needs) (Bisplinghoff) ——— No PSAC action	[1] Professional Unemployment (David) ——— Set up seminar on input-output modeling [2] Incentives for Industrial Support of Research (Haggerty ltr.) ——— PSAC endorsement	Employment of Scientists & Engineers. Input-output modeling ——— Heffner & Strasser to explore use of Bureau Labor Statistics Models for Scientific manpower issues	Productivity Sub-panel report (A. Bueche, C. Savit) ——— Technological Initiatives (David)	Technology Policy --Panel Report NSF Astronomy Program (York, Gell-Mann)	Foreign trade Tax credit for R&D R&D Criteria (Strasser)	
3. Environment					Rockefeller Commission Report (Westoff) Interagency Group on "Population Research"	Radiation Hazards Criteria for land use (Gell-Mann)	Bio-pesticides (McElroy) Chemical Mutagens
4. Natural Resources & Energy	Weather Modification Proposal (Simon) ——— No PSAC action	Energy Forecasts (Simon) ——— Initiate short-term policy-oriented study on energy goals			Energy Report (McCracken) Fast Breeder (Buchsbaum)		

Problem Area	February	March	April	May	June	July	September
5. Transportation					Transportation R&D		
6. Bio-Medical	Cancer Initiative--Technical & institutional options (David) ——— Prepare for Congressional Hearings	Cancer Initiative (David) ——— Urge Sec. HEW to prepare compromise proposal			Cell Biology--Problems, policy (McElroy)		
7. Urban		Evaluation of Social Programs in DoD (Simon, Kaufman, H.David) ——— No PSAC action	Evaluation of Social Programs NAS Report ——— Revised report due from NAS by May PSAC meeting		Medical-social diseases Narcotics--Dimensions of problem (McElroy) BNDD international aspects	R&D in HUD Urban systems Modeling (Jay W. Forrester)	
8. Education		Education R&D Review of past panel activity (Westheimer) ——— Continue panel activity under Truxal					
9. Other Domestic Problems	Report of Commission on Computers in Society (Oates & Oettinger) ——— No PSAC action				Hijacking Panel Report Malnutrition (Hegsted & Shaffer)		

Problem Area	February	March	April	May	June	July	September
10. International				Report on the U.S. Metric Study, NBS (Branscomb, DeSimone)			
11. Military		[1] Naval Warfare Panel Report (Fletcher) ——— PSAC Endorsement [2] Defense R&D for FY72 (Rechtin) ——— No PSAC action			Naval Warfare Panel Report (Fletcher, Getting)		
12. Space			Space issues (Drew & Friedman) ——— Formation of Space Panel endorsed by PSAC		Space issues (Drew & Friedman)		
13. PSAC-OST Relationships					Appropriations Committee chairman & members (Evans)	House Committee on Science & Astronautics George Miller Davis (Research Sub-committee) Mosher (R-Ohio)	
14. PSAC-OST Management of Federal Science Establishment	Priorities for stimulation of applied research--new initiatives			R&D budget issues (Schultz) Spring Preview of technical issues for FY73 (Goldmuntz)	R&D budget issues--NASA	R&D budget issues--NSF	R&D budget issues--NIH

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

DEPARTMENT OF CHEMISTRY

1 April 1971

FROM: John D. Baldeschwieler

TO: Kenneth Harry Olsen

I am enclosing an updated version of the projected PSAC agenda for the next few months. The April program is relatively firm but the agenda for the remaining months is still quite flexible. I would appreciate your comments, and in particular, any new items which you feel should be brought before the Committee.

JDB:eb
Encl.

Problem Area	January	February	March	April	May	June	July
1. Annual Report	Status Report (Beckler)			Critique of First Draft			
2. Science & Technology Policy		NSF plans for RANN (Res. Appl. to Nat. Needs) (Bisplinghoff) ——— No PSAC action	[1] Professional Unemployment (David) ——— Set up seminar on input-output modeling [2] Incentives for Industrial Support of Research (Haggerty ltr.) ——— PSAC endorsement	Employment of Scientists & Engineers. Input-Output Modeling	Radioastronomy (Gell-Mann) Technology Policy--Panel Report	Productivity Foreign trade Tax credit for R&D	Professional employment
3. Environment					Rockefeller Commission Interagency Group on "Population Research" Birth control steroids--Role of FDA	Radiation Hazards Criteria for land use (Gell-Mann)	Bio-pesticides (McElroy) Chemical Mutagens
4. Natural Resources & Energy	[1] Weather modification--"Stormfury, Seeding of Hurricanes" (Savit) ——— Simon to explore policy questions (contd)	Weather Modification Proposal (Simon) ——— No PSAC action	Energy Forecasts (Simon) ——— Initiate short-term policy-oriented study on energy goals		Energy Report (McCracken) Fast Breeder (Buchsbaum)		

Problem Area	January	February	March	April	May	June	July
4. Natural Resources & Energy	(contd) [2] CTR Report ——— Buchsbaum to draft letter to OMB						
5. Transportation					Transportation R&D		
6. Bio-Medical	Progress in control of cancer ——— Bio-Medical panel to form task group to assist OMB in distribution of increment	Cancer Initiative--Technical & Institutional options (David) ——— Prepare for Congressional Hearings	Cancer Initiative (David) ——— Urge Sec. HEW to prepare compromise proposal			Cell Biology--(McElroy)/ Problems, policy	
7. Urban			Evaluation of Social Programs in DoD (Simon, Kaufman, H.David) ——— No PSAC action	Evaluation of Social Programs NAS Report	Medical-social diseases Narcotics--Dimensions of problem (McElroy) BNDD international aspects	R&D in HUD Urban systems Modeling (Jay W. Forrester)	
8. Education			[1] Education R&D Review of past Panel Activity (Westheimer) ——— Continue Panel activity under Truxal				

Problem Area	January	February	March	April	May	June	July
9. Other Domestic Problems		Report of Commission on Computers in Society (Oates & Oettinger) No PSAC action			Hijacking Panel Report Malnutrition (Hegsted & Shaffer)		
10. International	International Development Institute (Heffner) No PSAC action						
11. Military	NATO (McRae) No PSAC action		[1] Naval Warfare Panel Report (Fletcher) PSAC Endorsement [2] Defense R&D for FY72 (Rechtin) No PSAC action		Naval Warfare Panel Report (Fletcher)		
12. Space					Space issues (Drew & Friedman)		

Problem Area	January	February	March	April	May	June	July
3. PSAC-OST Relationships	NAS-OST-Govt. Relationships (Handler) ——— No PSAC action				Appropriations Committee chairman & members (Evans?)		
4. PSAC-OST Management of Federal Science Establishment	1972 budget wrap-up (Heffner) ——— No PSAC action	Priorities for stimulation of applied research--new initiatives			R&D budget issues (Schultz & Weinberger) R&D budget issues--NASA	R&D budget issues--NSF	R&D budget issues--NIH

STANFORD UNIVERSITY
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DEPARTMENT OF CHEMISTRY

8 March 1971

FROM: John D. Baldeschwieler

TO: K. H. Olsen

I am enclosing an updated version of the projected PSAC agenda for the next few months. The March program is relatively firm but the agenda for the remaining months is still quite flexible. I would appreciate your comments, and, in particular, any new items which you feel should be brought before the Committee.

JDB:eb
Encls.

Problem Area	December	January	February	March	April	May	June
1. Annual Report	Status Report	Status Report (Beckler)			Status Report		
2. Science & Technology Policy			NSF plans for RANN (Res. Appl. to Nat. Needs) (Bisplinghoff) ——— No PSAC Action	Professional Unemployment (David) Incentives for Industrial Support of Research (Haggerty letter)	Radioastronomy (Gell-Mann) Technology Policy--Panel Report	Productivity Foreign trade Tax credit for R&D	Professional employment
3. Environment	NSB Report on "Science & the Environment" ——— No PSAC action				Rockefeller Commission Interagency Group on "Population Research" Birth control steroids--Role of FDA	Radiation Hazards Criteria for land use (Gell-Mann)	Bio-pesticides (McElroy) Chemical Mutagens
4. Natural Resources & Energy	[1]Fusion for power generation ——— Chairman to consider formation of sub-group to study policy & funding [2]Helium reserves ——— Forward Garwin letter to OMB	[1]Weather modification--"Stormfury, Seeding of Hurricanes" (Savit) ——— Simon to explore policy questions [2]CTR Report ——— Buchsbaum to draft ltr. to OMB	Weather Modification Proposal (Simon) ——— No PSAC Action	Energy Forecasts (Simon) Fast Breeder (Buchsbaum)	Energy Report (McCracken)		

Problem Area	December	January	February	March	April	May	June
5. Transportation	ATC Panel summary & transmittal letter ——— Forward with minor editorial changes				Transportation R&D SST Back-up position		
6. Bio-Medical	Transmittal ltr. & exec. summary ——— Transmit with Bennett letter. OST Staff to monitor issues defined by Beckler	Progress in control of cancer ——— Bio-Med. Panel to form task group to assist OMB in distribution of increment	Cancer Initiative--Technical & Institutional options. (David) ——— Prepare for Cong. Hearings	Cancer Initiative (David)	Domestic Affairs Council --National Health Policy	Cell Biology-- (McElroy)/ Problems, policy	
7. Urban				Evaluation of Social Programs (Simon, Kaufman, H.David)	Medical-social diseases Narcotics--Dimensions of problem (McElroy) BNDD international aspects	R&D in HUD Urban systems Modeling (Jay W.Forrester)	
8. Education	Education Panel wrap-up (F. Westheimer) ——— Chairman to decide on new deployment of PSAC resources in education area			Education R&D Review of past Panel Activity (Westheimer) Formation of PSAC panel on "Computers in Education" (Truxal?)	Discuss PSAC panel Activities in [1] Bringing young people into adult roles (cont'd.)		

Problem Area	December	January	February	March	April	May	June
8. Education (Cont'd.)					[2] Educational technology--Computers & TV [3] Evaluation of Social Programs		
9. Other Domestic Problems			Report of Commission on Computers in Society (Oates & Oettinger) No PSAC Action		Hijacking Panel Report Malnutrition (Hegsted & Shaffer)		
0. International		International Development Institute (Heffner) No PSAC Action		PSAC discussion of possible panel activity in this area			
1. Military	Report of BW/CW Panel Endorsed by PSAC with editorial changes suggested by Cairns	NATO (McRae) No PSAC Action		Naval Warfare Panel Report (Fletcher) Defense R&D for FY72 (Foster)		Naval Warfare Panel Report (Fletcher)	
2. Space				Discussion of reconstitution of PSAC Space Panel	Space issues (Drew & Friedman)		

Problem Area	December	January	February	March	April	May	June
13. PSAC-OST Relationships		NAS-OST-Govt. Relationships (Handler) No PSAC Action			Appropriations Committee chairman & members (Evans?)		
14. PSAC-OST Management of Federal Science Establishment		1972 budget wrap-up (Heffner) No PSAC Action	Priorities for stimulation of applied research--new initiatives		R&D budget issues (Schultz & Weinberger) R&D budget issues--NASA	R&D budget issues--NSF	R&D budget issues--NIH

STANFORD UNIVERSITY
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DEPARTMENT OF CHEMISTRY

12 February 1971

Mr. Kenneth Harry Olsen
President
Digital Equipment Corporation
Maynard, Massachusetts 01754

Dear Ken:

I am enclosing an updated version of the projected PSAC agenda for the next few months. The February program is relatively firm but the agenda for the remaining months is still quite flexible. I would appreciate your comments, and, in particular, any new items which you feel should be brought before the Committee.

Ed and the OST Staff are composing a list of potential "new initiatives" in science and technology. It would be very helpful if you could note any ideas you may have on new initiatives, and give them to me at our next meeting.

With many thanks,

John D. Baldeschwieler

JDB:eb
Encls.

Problem Area	December	January	February	March	April	May	June
1. Annual Report	Status Report	Status Report (Beckler)		Status Report	Status Report		
2. Science & Technology Policy			NSF plans for RANN (Res. Appl. to Nat. Needs) (Bisplinghoff & McElroy)	Technology Policy--Panel Report R&D Criteria Paper	Radioastronomy (Gell-Mann)	Productivity Foreign trade Tax credit for R&D	Professional employment
3. Environment	NSB Report on "Science & the Environment" ——— No PSAC action			Rockefeller Commission Interagency Group on "Population Research" Birth control steroids--Role of FDA	Radiation Hazards Criteria for land use (Gell-Mann)	Bio-pesticides (McElroy) Chemical Mutagens	
4. Natural Resources & Energy	[1]Fusion for power generation ——— Chairman to consider formation of subgroup to study policy & funding [2]Helium reserves ——— Forward Garwin letter to OMB	[1]Weather modification--"Stormfury, Seeding of Hurricanes" (Savit) ——— Simon to explore policy questions [2]CTR Report ——— Buchsbaum to draft letter to OMB	Weather Modification Proposal (Simon)	Energy Report (McCracken)			

Problem Area	December	January	February	March	April	May	June
5. Transportation	ATC Panel summary & transmittal letter ——— Forward with minor editorial changes			Transportation R&D SST Back-up position			
6. Bio-Medical	Transmittal ltr. & exec. summary ——— Transmit with Bennett letter. OST Staff to minitor issues defined by Beckler	Progress in control of cancer ——— Bio-Med. panel to form task group to assist OMB in distribution of increment	Cancer Initiative--Technical & Institutional options (David) Proposal for Health Research Advisory Group (David)	Domestic Affairs Council --National Health Policy	Cell biology-- (McElroy)/ Problems, policy		
7. Urban			Social Science evaluation (NAS)	Medical-social diseases Narcotics--Dimensions of problem (McElroy) BNDD international aspects	R&D in HuD Urban systems Modeling		
8. Education	Education Panel wrap-up (F. Westheimer) ——— Chairman to decide on new deployment of PSAC resources in Education area			Formation of PSAC panel on "Computers in Education"	Discuss PSAC panel Activities in [1]Bringing young people into adult roles (cont'd.)		

Problem Area	December	January	February	March	April	May	June
8. Education (cont'd.)					[2] Educational technology--Computers & TV [3] Evaluation of Social Programs		
9. Other Domestic Problems			Report of Commission on Computers in Society (Oates & Oettinger)	Hijacking Panel Report Malnutrition (Hegsted & Shaffer)			
10. International		International Development Institute (Heffner) ——— No PSAC action	International Development Institute NAS (Shapie)	PSAC discussion of possible panel activity in this area			
11. Military	Report of BW/CW Panel ——— Endorsed by PSAC with editorial changes suggested by Cairns	NATO (McRae) ——— No PSAC action	(SALT)	ACDA S&T capability New ABM ideas Laser technology	Naval Warfare Panel Report (Fletcher)	Naval Warfare Panel Report (Fletcher)	
12. Space				Space issues (Drew) Reconstitution of PSAC Space Panel			

Problem Area	December	January	February	March	April	May	June
13. PSAC-OST Relationships		NAS-OST-Govt. Relationships (Handler) ——— No PSAC action			Appropriations Committee chairman & members--Evans?		
14. PSAC-OST Management of Federal Science Establishment		1972 budget wrap-up (Heffner) ——— No PSAC action	Priorities for stimulation of applied research--new initiatives R&D budget issues (Shultz & Weinberger)	R&D budget issues--NASA	R&D budget issues--NSF	R&D budget issues--NIH	

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DEPARTMENT OF CHEMISTRY

JUN 14

8 June 1971

FROM: John D. Baldeschwieler

TO: Mr. Kenneth Harry Olsen

I am enclosing an updated version of the projected PSAC agenda for the next few months. The June program is relatively firm but the agenda for the remaining months is still quite flexible. I would appreciate your comments, and in particular, any new items which you feel should be brought before the Committee.

JDB:eb
Encl.

Problem Area	March	April	May	June	July	September	October
1. Annual Report		Critique of First Draft	Critique of Revised Sections				
2. Science & Technology Policy	[1] Professional Unemployment (David) ——— Set up seminar on input-output modeling [2] Incentives for Industrial Support of Research (Haggerty ltr.) ——— PSAC endorsement	Employment of Scientists & Engineers. Input-output modeling ——— Heffner & Strasser to explore use of Bureau Labor Statistics Models for Scientific manpower issues	Productivity Sub-panel report (A. Bueche, C. Savit) ——— Refer to Haggerty Panel	Technological Initiatives (David) Employment of Scientists & Engineers (David)	Technology Policy Panel Report (Haggerty) NSF Astronomy Program (York, Gell-Mann) Procurement Policies (Comm. on Gvt. Procurement)		
3. Environment						Rockefeller Commission Report (Westoff) Interagency Group on "Population Research" Radiation Hazards Criteria for land use (Gell-Mann)	Bio-pesticides (McElroy) Chemical Mutagens
4. Natural Resources & Energy	Energy Forecasts (Simon) ——— Initiate short-term policy-oriented study on energy goals			Energy Message (David)			

Problem Area	March	April	May	June	July	September	October
5. Transportation				SST Environmental Research Program (Cannon)			
6. Bio-Medical	Cancer Initiative (David) ——— Urge Sec. HEW to prepare compromise proposal						
7. Urban	Evaluation of Social Programs in DoD (Simon, Kauffman, H. David) ——— No PSAC action	Evaluation of Social Programs NAS Report ——— Revised report due from NAS by May PSAC meeting		Narcotics (David)	Medical-social diseases	R&D in HUD Urban systems Modeling (Jay W. Forrester)	
8. Education	Education R&D Review of past panel activity (Westheimer) ——— Continue panel activity under Truxal			NAS Nuclear Physics Panel report (Bromley) Science & Engineering PhD utilization (NSF-Falk)			
9. Other Domestic Problems						Hijacking Panel Report Malnutrition (Hegsted & Shaffer)	

Problem Area	March	April	May	June	July	September	October
10. International			Report on the U.S. Metric Study, NBS (Branscomb, DeSimone)	International trade High technology products (Peterson)			
11. Military	[1] Naval Warfare Panel Report (Fletcher) ——— PSAC endorsement [2] Defense R&D for FY72 (Rechtin) ——— No PSAC action				Naval Warfare Panel Report (Fletcher, Getting)		
12. Space		Space issues (Drew & Friedman) ——— Formation of Space Panel endorsed by PSAC			Space issues (Drew & Friedman)		
13. PSAC-OST Relationships						Appropriations Committee chairman & members (Evans)	House Committee Science & Astronautics George Miller Davis (Research Sub-committee) Mosher (R-Ohio)
14. PSAC-OST Management of Federal Science Establishment			R&D budget issues (Schultz) Spring Preview of technical issues for FY73 (Goldmuntz)	OST Spring Reviews-- Transportation Justice Energy International Co-operation		R&D budget issues--NASA " --NSF " --NIH	

[COMMITTEE PRINT]

SCIENCE, TECHNOLOGY, AND THE ECONOMY

INTERIM REPORT

OF THE

SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT

OF THE

COMMITTEE ON SCIENCE AND ASTRONAUTICS
U.S. HOUSE OF REPRESENTATIVES

NINETY-SECOND CONGRESS

SECOND SESSION

Serial O

FEBRUARY 1972

Printed for the use of the Committee on Science and Astronautics

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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C., February 16, 1972.

Hon. GEORGE P. MILLER,
Chairman, Committee on Science and Astronautics, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am transmitting an interim report of the Subcommittee on Science, Research, and Development on the broad subject of science, technology and the economy.

The Subcommittee has held hearings on the interrelationships between science, technology, and the economy with the initial goal of satisfying the following questions: 1. what total resources should the United States invest in research and development in both the public and private sectors? 2. what are the optimum ways of making these investments?

In pursuing these lines of inquiry, the Subcommittee heard testimony from representatives of American business, academia, government and labor. Although our study is not yet completed, we have identified certain key areas within the broad realm of science, technology and the economy which we feel are deserving of a more thorough investigation. We plan to continue our study in further hearings this Spring.

I should like to point out that the Subcommittee views science and technology as essential inputs in our Nation's economy. Our ultimate goal in making these investigations is to discern the most judicious manner of allocating our scientific and technological resources, in order to solve domestic problems facing the country and assure a healthy balance of trade with other nations.

Sincerely yours,

JOHN W. DAVIS,
Chairman, Subcommittee on Science, Research, and Development.

CONTENTS

I. INTRODUCTION

Objectives

The Subcommittee on Science, Research and Development has embarked upon a detailed study of the relationships between science, technology and the economy. The objective of this study is to answer two important questions: First, what total resources should the United States invest in research and development in both the public and private sectors, and second, what are the optimum ways for making these investments?

This interim report reviews the progress of the study and identifies those legislative issues which the subcommittee feels deserve further careful consideration by the Congress. Basic principles which have emerged to date during the subcommittee study are set forth for further scrutiny by the full Committee and the Congress as a whole.

A major justification for large-scale support of science and technology and the related research and development activities is economic. If financial resources can produce greater return through alternative investments, then one can expect, with few exceptions, that these alternative investments will in fact be made.

Background

The Committee on Science and Astronautics has carefully explored a number of issues relating science, technology and the economy during the past decade. These include geographical distribution of Federal R&D funds, management of information and knowledge, fire research and safety, reallocation of Federal science resources, centralization of Federal science activities, applied science and technological progress, national science policy, conversion of research and educational programs from military to civilian activities, basic research and national goals, and others. It is especially pertinent to describe in more detail three of these efforts.

Basic Research and National Goals

In December 1963 at the initiative of Chairman Miller, the Committee on Science and Astronautics entered into a pioneering contract with the National Academy of Sciences—National Research Council for a comprehensive study designed to throw into bold relief some of the more serious phases of policy which the Government must consider in its decisions to support or otherwise foster research in America. The first assignment under this contract was to prepare an advisory report in reply to two fundamental questions of national policy for science:

> 1. What level of Federal support is needed to maintain for the United States a position of leadership through basic research in the advancement of science and technology and their economic, cultural and military applications?

2. What judgment can be reached on the balance of support now being given by the Federal Government to various fields of scientific endeavor, and on adjustments that should be considered, either within existing levels of overall support or under conditions of increased or decreased overall support.

The NAS–NRC responded by assigning the questions to its Committee on Science and Public Policy which appointed an ad hoc panel, chaired by Dr. George B. Kistiakowsky of Harvard University. Dr. Kistiakowsky previously had been one of the first science advisers to the President attached to the White House. The report of the Kistiakowsky committee [1] has since become a landmark document of national policy.

It is important to note that the first question regarding the level of Federal support for research included the economic aspect specifically. To repeat:

> What level of Federal support is needed to maintain for the United States a position of leadership through basic research in the advancement of science and technology and their *economic*, cultural and military applications.

One of the panelists, Prof. Harvey Brooks of Harvard University stated that there is now general acceptance among economists of the importance of technological innovation in economic growth. Brooks then developed his argument that there appear to be strong economic reasons for Federal support of research, and especially basic research. The following excerpt contains several themes which this Subcommittee anticipates will receive fresh attention in the near future. Brooks wrote:

> There is now general acceptance among economists of the importance of technological innovation in economic growth. To an increasing extent such innovation depends upon the results of basic science, although the degree to which this is true is difficult to quantify. To an increasing degree also there is a disposition to regard organized research and development as an investment in new knowledge equivalent in some sense to the investment in fixed capital. Indeed, most capital investments incorporate some measure of technological innovation. According to some economists the rise in capital-to-labor ratio accounts for only a small part of increases in productivity; about 50 percent is ascribed to other factors lumped under the general heading of "technical progress," which probably incorporates about equal parts of research and education as well as such factors as managerial and marketing innovations. There is also general agreement that in a market economy the allocation of resources to the advance and spread of knowledge will tend to be less than the optimum required for maximum efficient long-term growth of the economic system as a whole. Moreover, the further removed research is from ultimate practical application the less likely it is to be supported in a market economy without either direct public subvention or private support induced by special tax incentives, which is also a form of public support. Thus, there appear to be strong economic reasons for Federal support of research, and especially basic research.

[1] Basic Research and National Goals. A report to the House Committee on Science and Astronautics by the National Academy of Sciences. Washington, D.C.: U.S. Government Printing Office, 1965.

Another panelist, H. W. Bode of the Bell Telephone Laboratories, noted that "it is unthinkable to maintain leadership in technology without maintaining an indigenous supporting basic science." It takes trained people of the highest order, said Bode, to apply modern science to our sophisticated technology. Such people will be available only if we have vigorous basic research of our own.

The panel concluded that this nation must improve the connection between basic and applied science. What emerged from their considered thought was a preponderant opinion that the primary justification for Government support of basic research lies, aside from education, in the expectation of payoff. To this end the panelists suggested a new educational pattern for applied science in which the universities, and the industrial and Government laboratories form joint entities devoted to graduate education in the applied sciences.

Applied Science and Technological Progress

A second undertaking of the NAS–NRC Committee on Science and Public Policy sponsored by the Committee on Science and Astronautics led to appointment of a panel on applied science and technological progress. This Panel, chaired by Professor Harvey Brooks, was charged with looking into the special problems of effective applications of the resources of science to advances in technology. Responding to the eight questions posed to them, the Brooks panel arrived at 15 conclusions and recommendations organized into four groups.[2] These bear reiteration for they illustrate past advice Congress has received about science, technology and the economy.

Group I. With respect to the nature and strategy of applied research:

1. The interaction between science and technology is complex.
2. A broad spectrum of scientific disciplines and technical skills is required.
3. The transfer of technology from the laboratory to a producing or operating organization which builds, sells or uses it, is a vital and often underestimated step in technological innovation.
4. Goals in applied research are reached only by reducing them to a series of researchable, relevant components, but this is a dynamic process, subject to continual review as new results emerge.

Group II. With respect to the environment and institutions of applied research:

1. Successful and relevant applied research is most often carried out by coherent institutions.
2. Communications barriers imposed by security or other requirements reduce the productivity of applied research.
3. Applied research organizations should interact with universities wherever possible.

[2] Applied Science and Technological Progress. A report to the House Committee on Science and Astronautics by the National Academy of Sciences. Washington, D.C.: U.S. Government Printing Office, 1967.

Group III. With respect to the individuals who conduct applied research:

1. Applied research requires personal mobility.
2. The university plays a crucial role in the education of people for applied research.
3. The technical entrepreneur is frequently the catalyst of progress.

Group IV. With respect to the role of the Federal Government in applied research:

1. The applied research establishment of the Federal Government should be examined for redeployment in the light of changing national needs.
2. Patents play a vital role in utilizing the results of applied research.
3. Studies of the history and sociology of applied science are important.
4. When possible, forecast technological progress.
5. Concern with the environment must be a growing Federal responsibility.

* * * * *

While a few of these individual conclusions now seem dated, most have been useful inputs for the Subcommittee.

One of the panelists was Robert A. Charpie, then president of the Electronics Division, Union Carbide Corporation, who also in 1967 led the preparation of a report on technological innovation for the Department of Commerce.[3]

As a member of the Brooks panel, Charpie underscored the importance of technological innovation to economic growth. He wrote:

> Technological innovation is the driving force behind economic growth in the United States. In this context, "innovation" means that process by which a new idea is successfully translated into economic impact within our society by providing better products and simultaneously creating new jobs in the manufacturing and application of those products. . . .[4]

It is increasingly important, he continued, if the nation is to continue the sustained growth in the per capita gross national product that has characterized the economy in the 20th century, that we encourage productivity gain through successful technological innovation. This increase in productivity is necessary if national problems are to be resolved:

> . . . We must remember, however, that the resources for successful large-scale social innovations, whether the objective is the practical abolition of poverty, the elimination of air and water pollution, the development of new concepts of urban living and mass transit in this country, or simpler things like highway beautification, must originate from a more rapid upward growth in the real gross national product if we are to successfully solve *all* of these problems in the coming decades.

* * * * *

[3] "Technological innovation: its environment and management." A report of the Panel on Invention and Innovation, Commerce Technical Advisory Board, U.S. Dept. of Commerce, Washington, D.C.: U.S. Government Printing Office, 1967. ("The *Charpie report*".)
[4] Supra [2].

> Productivity increases hinge on technological innovation and make possible an increase in real disposable income proportional to the increase in productivity, if demand is sufficient. . . . innovations are required in order for the economy to sustain the vigorous growth required to provide the resources to support the social programs which this Nation has set as its goals. Under these circumstances, it seems logical to me for the Federal, State and local governments to become active endorsers, supporters, and encouragers of the technological innovation process wherever it occurs in our society.

National Science Policy Hearings

In 1970, the subcommittee held extensive hearings on National Science Policy. The hearing record [5] of almost 1,000 pages contains much valuable information relating to how our nation can utilize science and technology most effectively in attaining national goals including economic growth.

This record documents various opportunities for science and technology to solve national problems directly or to furnish the necessary resources for solving those problems by non-technological means. One of the witnesses, Dr. Patrick Haggerty, Chairman of the Board of Texas Instruments, Inc., stated:

> Problems in pollution, opportunities in health care, improvements in meeting our transportation needs, improvements in the quality of education—all are the kind of areas to which science and technology can make large contributions. Our commercial balance of payments has depended for years upon technologically-intensive products, and our technological advantage in the area of international trade seems to be eroding. The need for sustaining high annual rates of productivity increase in the sectors of our economy which now have them and improving productivity sharply in those sectors of our economy where it is lagging certainly calls for the application of increasing quantities and sophistication of technology.

The hearings registered considerable concern over the present capabilities of the Nation to maintain continued economic strength in the face of declining Federal support for science and technology. Dr. James R. Killian, Chairman of the Board of the Massachusetts Institute of Technology, commented on the increasing urgency to maintain a high level of productivity in American industry through science. He said:

> Both in industry and in our engineering schools I hear increasing expressions of concern that the United States is neglecting applied research bearing on productivity and that the United States may come to find itself at a great disadvantage. Some engineers are even forecasting grave danger to our balance of trade because of inadequate research in sophisticated fields of automation and computer technology.

[5] National Science Policy Hearings, Committee on Science and Astronautics. Washington, D.C.: U.S. Government Printing Office, 1970.

Dr. Raymond Bowers of Cornell University noted that if the steady erosion of our ability to compete in world markets continues, and the Government does not appropriate sufficient funds to maintain the viability of the scientific enterprise, there may be only one alternative:

> . . . (Government) should at least seek arrangements with countries such as Japan, Germany, and even the Soviet Union, so that we may purchase from them the high technology devices that we will need for our domestic and national purposes.

Dr. Reuben F. Mettler, president of TRW, Inc., and chairman of the President's 1970 Task Force on Science Policy, supported further prompt inquiry into the relationship of science, technology and the economy, saying:

> Science policy should give high priority to gaining a better understanding of the role of science and technology in economic growth, regionally, nationally, and internationally; to those aspects of national policy which create incentives for technological innovation, and the application of new inventions, particularly in the hands of the entrepreneur, to stimulating the expanded application of technology in socially desirable directions; and to other contributions of science and technology to economic growth.

National Science Policy Report

The subcommittee carefully distilled the information presented during these hearings and issued a report entitled "Toward a Science Policy for the United States".[6] Among other things, that report recommended:

> In consideration of the close reliance of trade, national and international, upon scientific and technological development, the Department of Commerce should report to the Congress annually on technological trends and needs in relation to the economic health of the Nation.

In amplifying upon this recommendation, the report further stated:

> The science policy hearings held by the subcommittee were replete with discussion of the close relationship between science and commerce, particularly for the future. Testimony emphasized the increasing reliance of American economic well-being upon the continued innovations and produced by research, basic and applied. We have no reason to doubt the truth and force of this statement, and we were especially struck by the following allegations:
>
> The economic well-being of the country from the technological point of view is just as involved—perhaps more so—on an international basis as on a national one. This stems from the fact that the United States faces serious technological challenges from abroad, particularly Germany, Japan, France, and the Soviet Union, each of which has made comprehensive scientific strides in the past decade.

[6] Toward a Science Policy for the United States. A report to the House Committee on Science and Astronautics. Washington, D.C.: U.S. Government Printing Office, 1970.

> Economic growth can no longer be considered the chief preserve of the consumption industries. Resources, American and global, are too vulnerable to extinction, if subjected to unrestrained exploitation, to permit this. Emphasis, therefore, must increase on the so-called service industries or upon "high-technology" production, both of which make use of larger numbers of people and fewer carloads of materials.

International Aspects

The economic effects of science and technology have become increasingly international in character during the past decade. Multinational corporations have all but erased national boundaries in their production and distribution of manufactured commodities. Research and development activities within such corporations often are centered in one country, with the resulting knowledge being exploited almost immediately in another.

The nearly instantaneous exchange of information through scientific and technical literature encourages the rapid transfer of technology across national boundaries. This technology critically affects the viability of the developed nations in world commerce, and can result in undesirable trade relationships if it is not managed and exploited properly. Thus we cannot avoid the fact that the knowledge resulting from research and development activities, and the controls exercised over that knowledge and its exploitation, are vital to the economic well-being of our country and the other nations of the world.

Academic Analysis

Analysis of the relationship of science, technology and the economy has become an important subject in applied economics. The quantitative effects of support for research and development on the economy are hard to analyze. Economists generally use indirect methods for their analyses, although there is disagreement within the profession on methodology.

There are also articulate spokesmen for the thesis that the success of research and development programs should not be gauged by their ability to increase the gross national product, because the GNP does not adequately measure the quality of life.

Economic Policy and Support for Science and Technology

In recent years, monetary policy has been a key element in establishing overall United States economic policy. An econometric model of the economy predicted that a carefully metered money supply coupled to a free market process would result in a gross national product adequate for balancing the Fiscal Year 1972 federal budget. This monetarist game plan failed to attain its goal, and the country has embarked on a New Economic Policy. The New Economic Policy acknowledges that powerful stimuli are needed in order to attain the socially desirable economic growth rates. To avoid undue inflation, a concomitant "incomes policy" has been implemented in the form of an initial price and wage freeze, followed by price and wage control boards.

The "free market" approach to the economy has carried over into national policy regarding the support of research, development and

science education. The free market model for support of research and development called for government support for basic research only because the private sector of the economy failed to fund it. It implied an end to subsidized science education as violating the free market approach. Specific implementation of this policy in the past has resulted in impounding many millions of dollars appropriated by the Congress for scientific and technological activities.

The New Economic Policy, on the other hand, recognizes the importance of Science and Technology in both the domestic economy and the U.S. position in international trade. National policy seems to be changing in such a manner that it recognizes the importance of research and development to increased industrial productivity. Since research and development expenditures are relatively easy to control through federal actions, their influence on productivity can be especially attractive in the context of overall economic policy.

The free market model for support of research and development has not worked as well as desired when applied to basic science and science education activities. There now seems to be a wider recognition that in order to accomplish the long-term objectives for this nation which are intimately intertwined with science and technology, adequate support must be found for those institutions which provide the science education and perform much of the needed basic research.

Hearings on Science, Technology and the Economy

Early in 1971 planning got under way for full-scale subcommittee hearings on science, technology and the economy. The first round of these hearings was held on July 27, 28, and 29, 1971. The six witnesses represented important sectors of U.S. society, and the hearings established for the record their views on this vital subject. The initial hearings not only brought ideas and proposals into the open for wide debate and scrutiny—they laid the ground rules for further examination of specific problem areas which will be outlined in subsequent parts of this report.

II. RECENT SUBCOMMITTEE ACTIVITY ON SCIENCE, TECHNOLOGY, AND THE ECONOMY

1971 Hearings on Science, Technology, and the Economy

The Subcommittee on Science, Research, and Development held hearings on July 27, 28, and 29, 1971, on the subject, "Science, Technology, and the Economy." The following witnesses, representing the Administration, an academic institution, a major labor organization, a national manufacturers association, and an industrial research laboratory appeared:

July 27, 1971:

The Honorable Maurice Stans, Secretary of Commerce of the United States;

Dr. John R. Pierce, executive director, Research, Communications Science Division, Bell Telephone Laboratories (formerly, a member of the President's Science Advisory Committee; Vice Chairman of the Committee on Public Engineering Policy, National Academy of Engineering; on the Council of the NAE; and presently, a member of the Council of the National Academy of Sciences);

July 28, 1971:

Andrew J. Biemiller, legislative director, AFL–CIO (formerly, a Member of Congress from the State of Ohio, 1945–1950), accompanied by Nathaniel Goldfinger, research director, AFL–CIO;

Dr. Richard R. Nelson, Department of Economics, Yale University, and consultant to the Office of Science and Technology, Executive Office of the President;

July 29, 1971:

Dr. Murray L. Weidenbaum, Assistant Secretary of the Treasury for Economic Policy (former Professor and Chairman of the Department of Economics, Washington University, St. Louis, Mo., who has since returned to Washington University); and

Dr. Willard M. Bright, president, the Kendall Co. and Chairman of the Science/Technology Committee on the National Association of Manufacturers, appearing on behalf of the NAM.

Secretary of Commerce Stans concentrated on the role of technological development as it relates to the economic development and the international commercial relationships of the United States. He recognized that the trade position of a nation is affected by a number of economic and institutional factors, all of which should be considered. Of these factors, technological development is "the major element which we can influence decisively for the long run."

After examining in detail aspects of the deterioration in the trade position of the United States vis-a-vis Western Europe, Japan, and other parts of the world, Secretary Stans set forth certain objectives

for governmental action with respect to technological development. These included facilitating and stimulating the use of both existing and new technology, and the development of the latter as well. He then presented several program options as means by which the sought-after objectives might be attained. Secretary Stans stressed that these options were not mutually exclusive nor were they the only possible courses of action, and he noted that they were under study in the Department of Commerce and elsewhere in the Administration.

Dr. Pierce focused on how the Government can by proper support of science and technology improve the lives and welfare of the American people. His principal contention was a long-held view that large Federal expenditures for defense and space research have "inadvertently" alienated engineering education from the civilian economy. This factor has contributed to our difficulties in maintaining a technological lead in our international trade relations. He recommended that Governmental action be both informed and pragmatic in approach.

Mr. Biemiller contended that the present and future technological strength of the United States was being undermined and adversely affected by (1) the accelerating export of technology now going on which also exports production, services and jobs; (2) the current United States policies which encourage the export of American technology, investment and jobs, while foreign governments act to achieve the opposite effect; and (3) the freedom of multinational corporations to vitally affect the present and future economic policies of the Nation. He disputed the argument that a service economy is an appropriate goal for the United States and called for more direct Government intervention through the establishment of a centralized agency to supervise and regulate international trade.

Dr. Nelson's statement concerned three main topics: (1) the relationship of R & D and economic growth; (2) issues of science policy, with particular reference to the government's responsibilities with respect to academic science, support of R & D to meet public sector needs, and its role in support of technologies for private sector use; and (3) the dangers inherent in the "big push" program approach as a means of advancing technology. His central theme was that we need a national policy in support of technology. Such a policy would require the reappraisal of present programs and the development of new criteria and machinery for implementing technological objectives.

The guiding concept of a civilian technology policy, he said, "ought to be an active general Federal program of supporting research aimed at improving basic technological understanding, experimental development and testing of radically new concepts and designs, and provision of research and informational facilities for general use." Such a policy should be defined in terms of supporting particular kinds of activities rather than particular industries. In searching for answers, Dr. Nelson warned against planning "scientific wars" on particular problems.

Dr. Weidenbaum expressed concern that the very liberal funding policy for research and development of the past decade has now been replaced with a policy of too little support. He felt the long-run effects of this change will adversely affect our national posture. He maintained that public and private investment in research and development has been one of the major sources of growth in output and

productivity. Many of the high technology industries which have a high ratio of R & D to sales also have the largest surplus of exports over imports. Research and development is thus vital to our international position as well as our domestic well-being.

Dr. Weidenbaum advocated a "relatively steady trend of funding for research." As a means to increase the availability of private funds for R & D and to encourage investment, he favored liberalized provisions in the tax structure. Finally, he believed more research is needed on the research and development process, including not only the work but the impacts of problems arising from the work.

Dr. Bright pointed to the steadily increasing rate of R & D spending by industry of its own funds in contrast to the fluctuating spending by the Government, and advocated establishing relevant national goals and priorities as the basis of policy. These goals should be oriented toward pluralism, that is, they should insure that multiple approaches will be used for important problems, and toward gradualism, so as to avoid sudden, precipitate shifts in support. He thought some form of government-industrial partnership should be considered "to help take advantage of our technological gains and maintain a high level of domestic industrial activity."

Highlights of the Hearings

It might be expected that with a subject as broad as "Science, Technology, and the Economy", different witnesses would approach it from different viewpoints. This is indeed what the record shows. Nevertheless, from their prepared statements, oral testimony, and answers to questions posed by the Subcommittee members, it is possible to summarize the opinions of the witnesses on the following main topics:

First, their responses to the two questions posed by Chairman Davis at the start of the hearings: (1) What total resources should we as a Nation invest in research and development, both in the public and private sectors? and (2) What are the optimum ways for making these investments?

Next, in dealing with the overall subject of the hearings different witnesses presented testimony concerning unfavorable aspects of the domestic and international economic position of the United States and how this situation came about. Understanding of and some agreement on what is wrong are necessary prerequisites to the consideration of corrective actions.

Total Resources That the Nation Should Invest in Research and Development

No one ventured a set amount. Nor did anyone suggest that the present level was too high. Dr. Nelson called attention to limitations in the use of the Gross National Product as a measure of what technical advance and R and D can do for a nation, considering that it cannot measure quality improvement adequately. Because of these limitations, he expressed the view that "it is dangerous to guide public R and D decisions by the impact on GNP, or worse to somehow set up a component of R and D which is aimed at GNP increase and which is viewed as separate from other R and D aimed at more specifically defined human wants like better housing, health, education, transportation, etc."

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With respect to determining an optimum level of total spending for R & D, Dr. Nelson stated frankly that he did not know how to calculate, "nor do I think anyone else knows how [to calculate] the appropriate fraction of GNP to be spending on R and D." He went even further to state, that since R and D covers many different activities, conducted for a variety of purposes, and employing a variety of resources, "the aggregate R and D total should be built up out of sensible separate decisions on the components." He did admit that some totals were worth watching—that for academic science, for example, but in general "it [is] not very useful to think about an optimal level of overall R and D spending."

Dr. Weidenbaum expressed a personal belief that the level of general support for research and development should be raised. Discussing support for research and development separately, he suggested that in general, "the level of Federal expenditures for research be set in terms of providing a fairly constant real level of support for the overall activity, allowing for the future inroads of inflation and for a reasonable expansion in the numbers of qualified research personnel." Concerning scientific development, he favored government encouragement and support of private sector activity.

Secretary Stans pointed out that while the U.S. total expenditure for R & D was higher than any other country in the world, other countries, notably Western Germany and Japan, were spending relatively more than the U.S. on civilian R & D. Dr. Weidenbaum said that some economists hold the view that the U.S. may be underinvesting in some civilian areas of R & D, but because there is little guidance as to where new or increased R & D spending should be directed, perhaps the wisest course may be "a diversified approach not limited to narrow segments of the economy but covering the private sector as well as the public sector."

With respect to public and private spending, Dr. Pierce doubted that corporations were spending enough for research. Dr. Bright pointed to the steadily increasing rate of R & D spending by industry of its own funds and in accordance with specific plans. He contrasted it to the fluctuating pattern of Federal spending, not in accordance with predetermined goals but as a reaction to external events.

The Optimum Ways for Making Investments in Research and Development

Secretary Stans did not speak to this question directly, except as it relates to the program options he outlined as possible means to enhance technological development.

Dr. Weidenbaum said what was needed was a "relatively steady trend of funding for research—steady in 'real' terms to protect research budgets against the inroads of inflation." He emphasized that the trend should be steady because wide and rapid gyrations either up or down are wasteful and disruptive of genuine progress. Dr. Bright also spoke in favor of steady funding according to predetermined goals.

With respect to research and product and process development performed by the private sector, Dr. Weidenbaum favored governmental aid through several alternatives, emphasizing support for substantive

areas of R & D application, rather than for particular groups of institutions or organizations. Providing a favorable tax structure is a commonly used method.

Dr. Pierce thought that research was most effective when it was linked to an agency with a problem. He stressed that actions be based on "informed concern". He advocated a pragmatic approach, taking into account different situations.

> . . . People have made all sorts of proposals; direct support of research and development; faster depreciation; investment tax credits; taxing corporations partly or wholly on value added rather than on income; tax incentives to industry for the conduct or the support of research. One should not prescribe one medicine for all diseases or symptoms. The Government must be informed and pragmatic in its approach.

Dr. Bright recommended that the government increase its support of fundamental research while allowing industry to maintain its role in product-oriented research and development. Like Dr. Pierce, he advised that the government's support policy be oriented to pluralism, to ensure that a variety of solutions can be tried for important problems, and gradualism, to avoid economic crunches caused by sudden drops.

Dr. Nelson raised important questions concerning governmental policies for support of R and D in both the public and the private sectors. He strongly advocated a policy of assuring a "reasonable level of support for academic science and graduate education without capricious jerks," and also thought that a larger portion of basic research must be directed to problem-oriented activity. With respect to government support of R and D for defense and other public sector needs, he suggested that the whole system of contracting be reappraised, along with consideration of the key question of whether a company heavily involved in government contracts is a private company and whether new legal or institutional forms are needed. Still another aspect brought into question is the use of the "big push" technique in buying defense research. Dr. Nelson expressed the opinion that:

> A large scale R and D attack is likely to be a costly and risky way to try to achieve goals if major technological advances are needed and the underlying scientific and technological knowledge is not strong enough to illuminate the paths. In these circumstances it may not make sense to specify these social goals as goals of science and technology policy, at least to the extent that goal setting involves a commitment to try to achieve that goal within a reasonably short time horizon. If experience be a guide such goal setting does seem to carry a commitment to the marshalling of resources to the problem and usually to premature commitment to a limited set of paths. Achievement of the goal may come more quickly, and almost certainly more economically, if the "war" or "campaign" metaphor can be avoided, and if R and D is allowed to probe at the problem and a wide range of possible solutions experimentally and sequentially rather than being pushed.

Dr. Nelson believed also that governmental policies in support of technologies for private sector use are in need of reappraisal, with a clearer policy of which sectors should receive attention. The areas warranting active public programs are those (1) where private markets do not adequately reflect social value; (2) where the underlying private industry is weak technologically, or (3) where technological research and experimentation of a quite basic kind holds considerable promise of unlocking major new possibilities. Finally, he advised against keying a civilian technology policy "to trying to bolster up sick or sluggish industries."

Dimensions of the U.S. International Economic Problem

In order to understand how science and technology relate to the American economy, and particularly to the international commercial relationships of the United States, it is important to see what the international economic position is at present. Through a series of tables, graphs, and explanatory analyses, Secretary of Commerce Stans presented a disturbing picture.

Balance of trade.—This important indicator of the competitive position of products in the world market shows that the United States overall position has deteriorated to the point where it is expected that a trade deficit will be registered for the first time since 1893. Different categories of products have different individual trade balances. For example, both raw materials and low technology manufacturers have incurred trade deficits, agricultural products have shown small but fluctuating surpluses, while trade in high technology manufactures has consistently resulted in sizable stable surpluses.

Comparative productivity.—Secretary Stans explained that from 1870 to 1950 the U.S. rate of productivity growth exceeded Europe by 60 percent and Japan by 70 percent. Starting in 1950, the situation was reversed, and annual U.S. productivity growth is now approximately 1.7 percent compared to 4.5 percent for Europe and 10.6 percent for Japan.

Comparative productivity and labor index.—A comparison of the output per man-hour in manufacturing, using a base of 100 for 1967, shows that from 1960 to 1970 the U.S. output went from 80 to 108, while that of Japan rose from 52 to 151. Furthermore, while lesser but still considerable increases were found for the U.K., France, West Germany, and Canada, all were in excess of that of the United States. The significant fact is that in 1960, the United States led the above countries in productivity in manufacturing, but in 1970 it was behind all the others on the same scale.

Comparative investment of fixed assets.—Secretary Stans presented data showing that the United States is spending less in terms of its GNP on fixed assets (durable equipment and nonresidential structures for business purposes) than any of its major competitors in Western Europe and Japan. Comparable percentages of GNP to fixed assets for 1969 were: U.S., 10.7 percent; U.K., 13.5; France, 18.4; West Germany, 19.1; and Japan, 29.6.

Patent activity.—Comparative data concerning applications to the U.S. Patent Office during the 1960's show a steadily increasing percentage of foreign applications, rising from 25.4 percent of the total for 1961 to 44.9 percent for 1969.

Civilian R & D.—A final indicator is a comparison of total spending for civilian R & D (public and private) in the U.S. with comparable spending by two leading trade competitors. Although the dollar total of U.S. spending ($13 billion for 1968) was more than three times that of either West Germany or Japan, when the capitalized value of purchased foreign technology is added, the U.S. spent only 1.6 percent of its GNP for civilian technology while West Germany and Japan spent 3.6 and 3 percent respectively.

Factors Cited as Contributing to the U.S. International Economic Problem

The witnesses offered a variety of contributing factors. Secretary Stans' reply was perhaps the most comprehensive:

> No single answer fully explains why we are now facing these problems. Our international trade position is affected by a variety of economic and institutional factors such as: inflation at home and abroad; foreign exchange rates; trade promotion; tariffs; quotas and other import restrictions; nontariff trade barriers; export credit; domestic wage levels, and technological development.

Of these factors, Secretary Stans believes that altering the level of technological development is the major element which we can influence in the long run.

Mr. Biemiller maintained that the present and future technological strength of the United States was being undermined and adversely affected by three developments: (1) the export of American technology which is going on through licensing and patent agreements, joint ventures with foreign producers, and the building of production facilities in foreign countries, resulting in the concomitant export of production, services and jobs; (2) the encouragement of the export of technology, investment and jobs by the United States Government, while other governments pursue policies to encourage the entry of technology, the promotion of production and full employment at home; and (3) lack of attention by the Government to the activities of the multinational corporations whose managers are making foreign economic policy decisions to further their own interests.

When it was pointed out that the encouragement of the development of less-developed countries and the rehabilitation of Europe and Japan through the export of technology was a national policy adopted in the post World War II period, Mr. Biemiller's associate, Mr. Nathaniel Goldfinger responded:

> This was a conscious policy, and it was a policy which we of the labor movement endorsed back in the late 1940's and early 1950's. It has been carried over much too long beyond any reasonable date in terms of rational policy.
>
> What was wise policy in 1948 may well be irrational policy in 1971. This is what we are saying, the world has changed. The world has changed drastically since the days when Europe was an industrial and economic shambles after World War II. That is long past.

Dr. Pierce thought that the overriding concern in the United States since World War II with exploiting science and technology for defense and space efforts has resulted in an insufficient attention to matters relating to our civilian economy, and that the process had

"inadvertently alienated engineering education from the civilian economy."

Dr. Nelson, in suggesting that Government policies with respect to academic science and public and civilian technology require reappraisal and rethinking, appeared to be attributing at least a part of our economic difficulties to misallocation of national resources.

Dr. Weidenbaum expressed the view that the long-run effects of insufficient support for research and development, resulting in unemployment and underutilization of important national resources, can have and have had important effects on economic growth and productivity.

Ways to Improve the International Economic Position of the United States

The witnesses touched on four main points on how to improve America's international economic position:

Need to rethink our policies; reorder priorities; set specific goals.—Secretary Stans voiced a sentiment generally felt when we said, "The magnitude of the problem is such that we cannot rely upon normal forces to maintain our advantage in technology." He indicated that the Administration was giving serious consideration to a wide range of program options.

Dr. Nelson made a case for the reappraisal of the Federal policy for support of R & D across the spectrum—with respect to support of academic science, to meet public sector needs, and in support of technological development for general or private sector use. He said

> I think that the whole structure of sectoral and technology specific programs should be subject to reappraisal. What is needed is the development of criteria and machinery for a national policy in support of technology.

Dr. Weidenbaum thought that if we looked at the ends or goals we wished to attain . . . the decisions are clear. That is, we are going to emphasize key civilian areas to a greater extent than we had . . . and we are going to proportionately be devoting less of our resources to space, to defense, but it doesn't mean absolute decline. It may be a slight raise in defense spending over the years but relatively a lower priority in terms of where the proportion of our funds go."

Dr. Bright expressed the belief that just as industry depends on the setting of relevant goals, so too must the government set specific national goals and establish their priority on a regular basis.

Pluralistic, pragmatic, and gradual approach preferred.—In seeking improvements in the international economic position of theUnited States, the witnesses favored a pluralistic approach. Just as one should not prescribe one medicine for all diseases or symptoms, so should a variety of approaches be used for particular situations. Governmental actions should be based on practical consequences, not on shortsighted, moralistic or vindictive judgments, and the approach should be informed and pragmatic.

Gradualism in dealing with the situation was also advocated. Part of our present problem is due to the precipitate manner in which trade imbalances occurred, without time for industry or labor to make necessary adjustments. Dr. Nelson warned against the dangers of the "big

push" thinking which has characterized spending for defense and space R & D. Such a large scale attack is likely to be a costly and risky way to try to achieve goals when the existent scientific and technological knowledge is not sufficient to bring about needed technological advances.

Need for greater degree of governmental intervention.—All the witnesses favored a greater degree of governmental intervention in dealing with improving our international economic position by the enhancement, utilization, or development of existing or new technology. The particular approaches to be used varied from witness to witness as will be seen below when specific measures are outlined.

Technology not the whole answer.—The enhancement of technological development to better the United States international economic position is only one aspect of the total problem. A number of the witnesses spoke to the need to pay more attention to our domestic wage and price levels, to the control of inflation, and to increasing our productivity in order to stay competitive internationally. (Nelson, Weidenbaum, Bright.)

Specific Proposals for Governmental Action to Improve the United States International Economic Position

Organizational proposals.—The establishment of a single Federal focus for the enhancement, assessment, and forecasting of industrial technology was one of the program options enumerated by Secretary Stans.

Activities of this Office would include: Identification of technology opportunities in various industries; assessment of current technological strengths and weaknesses; forecast of future technological developments; development of specific industrial technology enhancement programs; establishment of mechanisms to guide technology transfer; development of educational and training programs designed to encourage invention and innovation; and acceleration of domestic dissemination of the results of Government-sponsored R & D.

Secretary Stans also placed in the record a preliminary listing of new technological opportunities that might, if properly developed, influence the U.S. economy favorably. The listing included possible projects in the following major areas: energy generation devices; energy transmission; construction and buildings; transportation; mining; ocean utilization; pollution control technology; communications; and disaster control.

Other organizational proposals included:

Establishment of a council to advise Congress on developing national goals and priorities.—Such a council, similar to the Council of Economic Advisers, was suggested by Dr. Bright, who envisioned it as "advisers to the Congress for establishing goals and reviewing them and helping to establish priorities for the two sections of Government involved."

Establishment of a new agency in lieu of the Tariff Commission to deal with international trade.—Mr. Biemiller favored the creation of a new agency with authority from the President to regulate, supervise, and curb the outflows of U.S. technology and capital. Such authority should include decisions on the kind of investment that can be made abroad, the products involved, the country where the investment would be made, and consideration of the effect of the investment on the flow

of trade and on U.S. employment and the national economy. The proposal was made in order to restore decision-making on foreign economic policy to the Government, rather than leave it to the self-interests of the multinational corporations.

Dr. Nelson thought such an agency "would be able to grind into its considerations questions and issues and criteria that go beyond the particular short- and medium-run profitability of the venture from the point of view of the particular company." Dr. Weidenbaum cautioned that an effort to prevent the international movement of technology would in all probability lead to retaliatory actions by other nations. Dr. Bright expressed the opinion that imposing controls on the export of technology has been shown to be both ineffective and potentially destructive to the exporting nation's best interest.[7]

Direct and indirect financial incentives aimed at stimulating the development and utilization of new technology.—As enumerated by Secretary Stans, this program option has many possibilities which should be studied. Examples of direct incentives are loan guarantees, grants, and procurement incentives. Indirect incentives include providing tax incentives for research and development and for capital expenditures such as depreciation allowances, investment credits, credits for incremental R & D, and favorable treatment for individual inventors.

Drs. Weidenbaum and Pierce supported tax incentives to spur R & D but Dr. Nelson thought it was a "bad idea," because already existing projects would continue to be subsidized while the underfunded activities would still get no new support.

The idea of favorable treatment for inventors received general approval. Dr. Pierce suggested making it easier for inventors to set up in business, possibly through liberal treatment of capital gains and perhaps even financial backing. Dr. Bright endorsed additional support for the inventor; he also supported broadening our patent policy in accordance with pending legislation.

Eliminating restrictions against industry by modernizing antitrust legislation.—Present antitrust legislation prevents American industries from engaging in certain kinds of joint ventures and joint research and thereby inhibits spreading the high costs and risks of technological development. Secretary Stans observed that "it may well be time to modernize antitrust laws which evolved to deal with the different problems of an earlier era" and to that end said that studies of the antitrust laws now underway would be completed and submitted to the White House and the Attorney General in the "relatively near future."

Promoting the setting of voluntary standards where appropriate and mandatory ones where absolutely necessary.—Secretary Stans testified that a further aspect of the antitrust laws which needs study is that which inhibits companies from collaborating to set voluntary standards. Other actions which would result in more effective standards include avoiding frequent changes in standards; substituting performance standards for material standards; and preempting State and local standards or promoting uniformity among them.

[7] Legislation is pending in both the House and the Senate to create a United States Foreign Trade and Investment Commission which would seek to stem the outflow of U.S. capital, jobs, technology, and production.

To avoid prejudice to American products, it is extremely important that the United States participate in the international standards-setting negotiations now going on. Legislation to foster United States participation in international trade by promotion and support of representation of United States interests in international voluntary standards activities is pending in the 92nd Congress.

Selected Readings on Science, Technology, and the Economy

In October 1971 the Subcommittee published a committee print entitled "Selected Readings on Science, Technology, and the Economy" [8] which had been prepared at its request by the Economics and Science Policy Research Divisions of Congressional Research Service. The document was intended to collect for the Subcommittee and the Research Management Advisory Panel of the House Committee on Science and Astronautics information on how the President's new economic policy, announced on August 15, 1971, proposed to utilize science and technology. It also contains a compilation of contemporary thought on the general subject of the relationships among science, technology, and the economy.

For this latter purpose, a literature search of writings covering roughly the last decade was made. The final selection consists of some 50 excerpts from individuals or entities both within and outside the Government, as well as a sampling of opinion from foreign individuals and international organizations. Each excerpt is usually preceded by a brief introductory paragraph which identifies the author and places the quoted section in proper context.

The excerpts represent a variety of analysis and opinion on this complex subject. As summarized in the introductory notes:

> Some [of the authors] deal very specifically with research and development as a factor in productivity and in economic growth. Others extend to the interfaces of economic and other activities of society. Some treat research and development or science and technology as an entity, others carefully distinguish between them and assign different economic roles to each.
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> Some confidently see a firm, positive relationship while others find no statistically convincing evidence. So there are many differing views confronting legislators who would set national policies affecting application of science and technology for economic ends.

The range of current thinking is illustrated in the following excerpts from the *Selected Readings*. All are from documents published in 1971.

In testimony at the Subcommittee's hearings on July 29, 1971, Dr. Richard R. Nelson, formerly with RAND Corporation, now Yale University, generalized as follows:

> Many individual studies have been made in recent years in an attempt to quantify the economic effects of R & D. Of course, the underlying assumptions as well as individual num-

[8] Selected Readings on Science, Technology and the Economy. Prepared for the House Committee on Science and Astronautics by the Congressional Research Service. Washington, D.C.: U.S. Government Printing Office, 1971.

bers these studies come up with differ, but the overall results tend to be quite similar. The contribution of R & D to economic growth and productivity appears to be positive, significant, and high.

Professor Harvey Brooks of Harvard University who recently served as chairman of an ad hoc OECD Group on New Concepts in Science Policy discussed the various known ways that knowledge produced by scientific and technological developments affects our economy. He concluded that still *more* knowledge is needed in order to better understand the interactions of these developments with other factors—economic, psychological and sociological—which together are transforming our society.

> Knowledge produced by science and developments in technology constitutes a factor of production. It increases the productivity of labour and capital and opens up a wide range of new possibilities for the use of both man and machinery, with a consequent rapid obsolescence of capital equipment and labour skills. Thus it tends to increase the demand for labour and capital, so that wages and interest rates are pushed upwards simultaneously. This demand is difficult to control because, as mentioned above, both consumers and large firms are becoming more independent of governments. In fact, knowledge favours the internationalization of business because more is known about all countries and because R & D per unit becomes cheaper as scale of operations increase. It also favours the organisation of all kinds of pressure groups trying to get larger shares of national income. Finally, it increases the efficiency of advertising and of political propaganda and thus increases demand in various ways. It should be added that, since the overwhelming part of the new knowledge is produced in the rich countries, it promotes the economic growth of those countries, before it can spread to the poor nations and be adapted to their special situations.
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> It seems that to master all these consequences of knowledge, *more* knowledge is needed. It is urgent that we get a clearer picture than we have today of the complete system of interactions between technical, economic, psychological, and sociological factors that is transforming our societies almost beyond recognition. Thus, an adequate science policy is one of the preconditions for more sophisticated economic policies.

Jean-Jacques Salomon, head of the OECD Science Policy Division and Secretary of the Secretary-General's ad hoc Group on New Concepts of Science Policy, writing in the OECD Observer for August 1971, expressed reservations about certain assumptions concerning the relationships of research and development to the economy.

> There is nothing more significant * * * than the hopes aroused during the 1960's by the idea of a close relationship between the economy and investments in research and development. This relationship turned out to be far more complex and far less linear than originally supposed; moreover, the experience of the OECD countries in the 1960's has shown that the management of a country's scientific and technological resources was far more delicate than had been suspected, and that coordination between economic policy and science policy was easier to advocate in principle than to put into practice.

Still further toward the other end of the spectrum are the views of an American, a British scientist, and a British scientific journal. MIT Professor Lester C. Thurow reported his findings in the March 1971 *Technology Review* that while technological progress is a definite factor in economic growth, he saw no evidence of research expenditures having had a similar effect on the growth of productivity.

> One empirical observation is possible. Measured rates of growth in productivity do not seem to have increased with the acceleration of research expenditures during the World War II or with the acceleration of research expenditures in response to Sputnik. Economic historians are in disagreement as to whether postwar productivity is growing faster than prewar productivity; if there is a difference, it is very slight. No one maintains that there has been any increase in the rate of growth of productivity after the Sputnik jump in research expenditures. There is also no evidence of any gradual acceleration of productivity during the postwar period.

On the other hand, he does see technical progress which he considers separate from research, as accounting for 3.2% out of a 4.7% economic growth.

> * * * Thus, on the supply side of the economy, technical progress will account for 3.2 percentage points out of a 4.7 percent economic growth. Technical progress is all pervasive. It is the basic ingredient that makes economic growth possible.
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> But as to research: while it may seem almost axiomatic that more research and development activities should lead to more technical progress, it is difficult to postulate this axiom on the basis of American history since 1940. More research expenditures do not seem to lead to more technical progress. The question remains, why not? The answer is unknown.

In a similar vein, an editorial in *Nature* in September, 1971 referred to a recent address of Sir Alec Cairncross, President of the British Association for the Advancement of Science, in which he declared that postwar British governments may have been misguided in supposing that investment in scientific research would ensure prosperity and competitiveness with advanced economies such as that of the United States. The writer expressed a qualified agreement with Sir Alec's opinion:

> . . . It is . . . unfortunately true that much of what has been written in the past, and many government policies on research and development, have been based on the assumption that it might be possible to win extremely quick economic returns from investments in research and development, and to that extent Sir Alec's declaration, reactionary though it

> may have seemed to some, is entirely well grounded. . . . But it would be a great misfortune for everybody if Sir Alec Cairncross's complaints that people have expected too much too quickly of scientific research and development should confuse the issue of what connection there may be in the long run between research and development on the one hand and prosperity and amenity on the other.

Analysis of the opinions indicates that while it is difficult to show positively that particular investments in technological development always result in increased identifiable economic or social benefits, a consensus exists that in general this is the case. There is even more general agreement that technological developments are contributing factors in promoting national economic growth and social satisfaction, technologically caused pollution and other negative effects notwithstanding.

Though specific cause-and-effect relationships are even harder to determine and the time lags are longer, there is also consensus that basic and exploratory research is a vital input to this total process.

Subcommittee Meeting With Research Management Advisory Panel

The Subcommittee met on October 15th with its Research Management Advisory Panel in order to review plans for further exploration of the relationships between Science, Technology and the Economy. The members of the Panel are: James B. Fisk, President, Bell Telephone Laboratories, Inc.: James M. Gavin, Chairman of the Board, Arthur D. Little, Inc.; Samuel Lenher, Vice President and Adviser on Manufacturing and Engineering, E. I. duPont de Nemours and Co.; Wilfred J. McNeil, President, Tax Foundation, Inc.; Don Price, Dean, John F. Kennedy School of Government, Harvard University; C. Guy Suits, Vice President and Director of Research, General Electric Corporation (Retired); Jerome B. Wiesner, President, Massachusetts Institute of Technology; Executive Director is Michael Michaelis. During this meeting several of the subjects raised in the course of the hearings before the Subcommittee were further explored.

International Trade and Competition.—The difficulties experienced by American products abroad due to competition of foreign-made products was noted by the Panel. This competition arises both in pricing and in advanced technology. While the price advantage accruing to foreign competitors is still due in some measure to lower labor costs abroad, the higher productivity enjoyed by foreign competitors is increasingly due to technological advances. Advances in technology also allow foreign competitors to meet and beat American products in the marketplace on the basis of developments which equal or surpass the state of the art in the United States.

The members of the Panel felt strongly that the technological advantages enjoyed in the international market by a number of the advanced countries stem in no small part from a close, cooperative relationship between industry and Government. These close relationships are in marked contrast to the government-industry relationship in the United States which frequently is of an adversary nature. In

Japan, for example, the Ministry for Technology and Industry (MITI) works closely with industry in coordinating planning, including planning of research, development, and product development. Similarly, in France a government agency, Le Commissariat du Plan, often referred to as "Le Plan", performs a similar function. In the United States, on the other hand, the regulatory agencies and the tax and anti-trust laws have served in many cases to make government and industry adversaries. A notable exception in the case of the United States is agriculture where the Agricultural Research Service through the extension services and the land-grant colleges have worked closely with the farmer.

The Multi-National Enterprise.—In the over-all picture of the technology competition between nations, the multi-national corporations are playing an increasingly important role. By establishing branch plants in other countries for the production of their products, these firms successfully avoid the problems and restrictions associated with the transfer of patents and licensing. At the same time the workers, engineers and managers in the host country obtain training in and understanding of the advanced state of the art in the field in which the mother corporation is engaged. Such knowledge is quickly transferred to other firms in the host country through personnel movements. The panel members noted that these processes and their long-range effects are just beginning to be recognized and that policy-makers in the governments of the countries affected do not really know how to deal with the phenomenon.

Effects of the Anti-Trust Laws.—The anti-trust laws in the United States were singled out for discussion by the Panel members. In the context of the competition being experienced by American firms in the international market, it was felt that the anti-trust laws in their present form tend to inhibit technological advances by preventing firms from cooperating in research, development and product development. Panel members observed that while the problems arising from cooperation between firms are less severe in the field of basic research, they become prohibitive in the area of product development because of fears that such cooperation may be found to have an adverse effect on competition.

It is in the area of product development, however, that the other technologically advanced nations are making rapid advances through government-industry cooperation and cooperation between firms. The Panel members felt that the traditional U.S. view of the anti-trust laws is deeply ingrained in the thinking of governmental leaders. But the situation today requires new attitudes toward anti-trust legislation and consideration should be given to changes applicable to the research, development, and product development area.

Civil Technology Management.—The shift in priorities away from space and defense research and development has led to suggestions that the country's capabilities in manpower organizations and facilities be focused on civil technologies. Some Panel members observed that there is a gap between the government's management capability in the civil fields as compared with the military and space fields. There is not within such governmental departments as, for example, the Department of Housing and Urban Development or the Department of Transportation, a strong tradition and experience in the

management of large, long-term technological enterprises. This suggests that any major refocusing of governmental resources on civil related research and development must take into account the need to strengthen the management capability as well.

Taking a somewhat broader view, this problem raises the question of how to develop knowledge and how to apply it. The processes by which knowledge is developed and used are not well understood and the obstacles are not well-defined. Further study of this aspect was recommended.

Conversion Research and Education

The nation has witnessed a substantial shift in national priorities resulting from the completion of the research and development effort leading to the landings on the moon and a reduction in defense related R & D. This has been reflected in shifts in budgetary support away from the industrial and government organizations engaged in research and development and has in turn produced a relatively high degree of unemployment of engineers and scientists. The unemployment has been compounded by the financial difficulties of the country's universities and colleges which have reduced their hiring of young faculty members.

In the summer of 1971 the Subcommittee held hearings on Conversion Research and Education. Hearings were held in Washington and in several of the localities which have been affected by unemployment of engineers and scientists with particular severity. The subcommittee took the view that scientists and engineers constitute a unique national asset of highly trained manpower which can provide solutions to problems having high national priority, not only in research and development for space and military purposes but also for the new fields of high national priority such as environmental protection and urban improvement.

The subcommittee's concern has been both with the current problems created by the unemployment and underemployment of talented scientists and engineers and with the longer range problem of how to avoid and deal with repetitions of this condition. The hearings provided evidence that whereas modest government programs to provide assistance in job-finding and retraining can be of help, the major problem lies in the establishment of jobs. The individuals in the talent pool have the basic training and skills necessary for work in their respective professions and feel that they can apply them to those problems to which industry and government wish to give priority.

On a longer range perspective, the subcommittee considered the fluctuations in oversupply and undersupply of highly trained manpower. The desirability of matching the supply of such manpower with future demands of the national economy was considered, but it was recognized that forecasting in this area is very difficult. The health of the national economy rests in no small measure on a wise science policy. The supply and utilization of engineers and scientists forms a major component of the nation's science policy, and the subcommittee will continue its scrutiny of this subject.

III. LEGISLATIVE ISSUES IDENTIFIED

1. Utilization of New Knowledge

It is generally agreed that economic growth is due in part to advancing technology, which results from the utilization of new knowledge. "Technological" knowledge is only a portion of that which is reflected in economic growth; managerial knowledge, for example, can also be very important.

It is also clear that utilization of technological knowledge in the economy does not necessarily increase productivity or gross national product. This is due in part to the phenomenon of substitution of new products for old. These new products may be cheaper or better, but may not increase the total measured national wealth.

Technological innovation, defined as the first application of science and technology in a new way and with commercial success, is one of the more important aspects of economic growth. National policy should more directly recognize the importance of technological innovation, and adjust the legal and regulatory structure to encourage it. This encouragement can include ways of making risk capital more easily available to innovators and revising patent policy to more adequately reward the innovator.

The failure of private institutions to make risk capital available for innovations developed outside the pale of large industrial corporations is widely recognized. Proposals have been made for appropriate governmental actions to encourage venture capitalists to support technological innovations, especially in the context of small business activities.

An important element is the patent philosophy set out in the United States Constitution. This philosophy is based on a clause in Article 1, Section 8, which gives Congress powers "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." It is the basis for the incentive system on which innovators and research and development teams often depend. At the present time patent applications which meet the standards set by Congress and which are granted by the Patent Office provide a 17-year, nonrenewable monopoly for the patent's developer—in return for public disclosure of the details of the innovation. Anything which tends to counteract the effects of the patent philosophy is thus—to some degree—a deterrent to innovative trade mechanisms. Since other factors, however, such as the public interest, must also be taken into consideration, competing legal systems which attempt to balance the rights of individuals versus those of the public in the economic field have emerged. The most obvious counter-system consists of the Antitrust Laws, which will be commented upon later.

A still further element in the utilization of new knowledge involves the growing concept of technology assessment. The activity which has developed on technology assessment over the past few years is

extensive [9] and the Subcommittee's involvement therein is well known. It is sufficient to point out here that, so far as the Congressional effort to foster technology assessment methodology is concerned, emphasis has been strongly placed on ways of providing *information* to the Congress with regard to new and developing technologies and not *advice* on how to handle them. The pending legislation in this field describes technology assessment as "a new and effective means for securing competent unbiased information concerning the effects, physical, economic, social and political, of the applications of technology, and that such information be utilized whenever appropriate as one element in the legislative assessment of matters pending before the Congress." For the most part this would involve situations in which the Congress is asked either to support or regulate programs with a highly technological content. It is *not* intended that assessments of this kind be utilized to impede the progress of innovation or to negate the adversary system of the Congressional hearing.

2. Government Role in Civilian Research and Development

Since the second World War the Federal Government has attained a preeminent position in support of research and development in this country. This has been accomplished mainly because of the national emphasis on defense and space. The civilian federal agencies have lagged behind in developing the managerial techniques for the support of research and development, and in the allocation of funds for R & D projects important to their missions. Further scrutiny of the role of R & D in civilian federal agencies has been proposed with the objective of more adequately coordinating this support in order to maximize its social and economic effects.

The role of the Federal Government is not limited to direct support of R & D through federal agencies. Stimulation of R & D through federal policies is also extremely important.

The role of the Federal Government in support of research and development in defense and space activities has been twofold. It has been purchaser of specific levels of effort of R & D activities, and also the purchaser of products which have required intensive R & D programs. In the latter case, recovery of the costs of the research is often made through overhead payments to industrial concerns.

It is appropriate to reassess the role of the federal, state and local governments in their direct support of R & D and in their purchases of technological products.

It seems clear that the present distribution of national resources for these purposes can be improved. This improvement should be aimed at maximizing the efficient use of resources as well as the returns on the national investment.

So far as patents are concerned, the government's role operates in two basic ways. One of these is as a stimulator of research and development through the patent system.

A second facet involves the handling of patents resulting from activity which the government itself sponsors and pays for. Except in instances where specific patent directions have been written into individual pieces of legislation, the government's patent policy is now generally determined by Presidential Order and reviewed regularly by

[9] "Technology Assessment, Annotated Bibliography," report to the Committee on Science and Astronautics. Washington, D.C., U.S. Government Printing Office, 1970.

the Committee on Government Patent Policy of the Federal Council for Science and Technology. The first Presidential Order setting forth the relative rights of parties involved and procedures to be followed was issued by President Kennedy in October, 1963. Following annual review of the results of this policy, a revised Presidential Order was issued by President Nixon on August 23, 1971. For the most part, the policy as originally enunciated and as revised is a flexible one which endeavors to protect both the public and the inventor through adaptive administrative processes.

Other nations utilize varying patent protection schemes—which may or may not be similar to the systems which have grown up in the United States. Germany and Japan, for example, operate with a close relationship between the national government and industry as a means of competing for a large share of international markets. France employs a system which very heavily depends upon government planning and sanction. In Britain, the government-inventor-exploiter system has vacillated back and forth since the end of World War II. At times the government has taken the lead in sponsoring research, and at other times it has been disposed to leave the matter almost entirely up to industry. In the Netherlands, a unique research system is in existence known as the Central Technical Organization (TNO). Fundamentally, the TNO makes joint use of both government and industrial funds, personnel and laboratories through programs aimed at achieving a particular technological goal.

3. Stimulation of Industrial Research and Development

There have been many proposals made for the revision of federal policies in order to stimulate the performance of research and development in industrial laboratories.

Tax credits for increased levels of research in certain industries have been suggested. These tax credits would function in a manner similar to the investment tax credit. They could be based on an absolute level of R & D expenditures or incremental expenditures, either across the board or in particular areas, such as product lines closely related to exports.

A National Industrial Research Agency has been proposed, which would function with regard to industry in a manner similar to the National Science Foundation in its support of R & D in universities. This agency could, for example, make direct grants based on specific proposals, or formula grants based on incremental research activity or incremental capital expenditures for R & D equipment. Guidelines would be developed to assure these expenditures were in the national interest. The independent research and development (IR & D) programs in the Department of Defense, NASA and AEC have been cited as prototypes for civilian "IR & D" programs. Dr. George Kistiakowsky made such a proposal during his testimony on a national science policy before the Subcommittee in 1970.

The scale of many of the new technological programs facing industry is truly gigantic. This results in inordinate demands for capital and operating costs, often beyond the resources of individual corporations. Proposals have been made for industry-wide research institutes, jointly funded by corporations, to pursue appropriate R & D projects. These institutes may or may not have direct government participation and funding.

Here again American antitrust policy and patent policy come to the fore.

The problem rests mainly with the complex elements which are required to bring about the stimulation of new products or processes. In the first phase, an invention must be conceived and reduced to practice in a tangible form. This first phase lies solely within the control of the inventor. The second phase is the "R & D" stage in which engineering skills beyond those possessed by the inventor must be used, feasibility determined and prototypes and field testing undertaken. The third phase is the massive exploitation of the invention in the economic arena. Usually this means that parties having still greater marketing capability become involved—those having expertise in advertising, marketing and business finance.

In all stages tax implications arise and, according to their nature, may encourage or deter completion of the process. So far as antitrust is concerned, problems are not likely to exist in the first two stages of an invention, but are almost always present in the third stage when issues involving compulsory licensing, exclusive or nonexclusive licensing, quality control of the product, etc., are present.

There is presently a diversity of opinion on the relative merits of a liberal patent policy versus restrictive tax and antitrust policies.

4. Technology Utilization

There have been significant Federal programs to assure the transfer of technology developed for defense and space purposes into the civilian economy. These are most advanced in NASA and the Department of Defense. The Department of Agriculture has for a century engaged in the transfer of agricultural technology from the experiment station to the working farmer. The State Technological Services Act of 1965 attempted to follow the pattern of the Agricultural Extension Service and assure the increased utilization of technology in small business enterprises.

State and local governments have increasingly recognized the importance of utilizing existing technology to solve many of their problems. In this case it should be noted that such organizations as the National Science Foundation and the National Academy of Public Administration are currently in the process of aiding State and local governments develop better mechanisms for the proper exploitation of technology in solving their problems. The former is making grants through its Intergovernmental Science Program for such purposes, while the Academy has fostered a number of studies and seminars designed to bring together appropriate personnel from various States to help determine workable advisory organizations.

Legislation has been proposed in the Congress to establish a central focal point for technology utilization in this country. Congressman J. Edward Roush has introduced a bill creating a single, independent agency to take over all of the technology utilization activities now performed by the Federal Government, with the exception of the Agricultural Extension Service.

5. International Transfer of Technology

In recent years the development of the multinational enterprise has had a wide effect in the almost instantaneous transfer of technology across national boundaries from one part of the enterprise to another. Thus we find extremely sophisticated electronic equipment being manufactured or assembled in Singapore or Taiwan, utilizing the current state of the art developed in central research laboratories of the parent American or European firms. The gigantic size of many of these multinational enterprises makes regulation by other than the largest individual nations extremely difficult.

U.S. labor unions view the rise of multinational enterprises with the ability to easily and quickly transfer technology as threats to American jobs in high technology industries. Legislation has been introduced in both House and Senate to attempt to control this transfer of technology.

Some of the less developed countries view the large scale importation of technology as a threat to their economic sovereignty. The Andean Pact nations as a result have incorporated stringent restrictions on the importation of technology into their Andean Investment Code, approved in 1971. They feel that royalties and technical fees are clandestine profits which the developed countries extract unfairly.

Proposals have been submitted to the Congress to create a U.S. International Development Institute (IDI) to replace in part the present Agency for International Development. This IDI would be the conduit for U.S. scientific, technological and managerial know-how to less developed countries. In particular, it would focus U.S. research competence in the sciences to help raise the technological levels of the lower income countries.

There are widespread demands for change in the handling of patents, licensing and royalties. One of the major arguments for a change states that this nation's achievement of a favorable balance of trade is largely dependent upon the United States maintaining its position as a leader in high technology exports. This means not only continued efficient production of high technology items already in demand by other nations but also continued and accelerated research and development in such fields to enable us to be the first to introduce other new or improved high technology goods into the world market.

The United States no longer enjoys the luxury of being the only nation with industrial sophistication. Both the Europeans and the Japanese have the competence to produce high technology goods for export.

However, research and development aimed toward production of high technology often involves a considerable risk of failure and tremendous costs. This is particularly true for innovative research. Companies could, in some areas at least, facilitate this research by taking advantage of the economies of scale and spreading the cost and risk among many interested parties, rather than working individually.

Unfortunately, United States antitrust policy tends to discourage and inhibit joint or cooperative efforts among competing industrial firms in the area of technological development. For example, under the general policy favoring competition, it is often thought that firms which undertake research and development on an individual basis will be more aggressive in their pursuit of new processes and products and will more likely succeed in bringing new goods to market. Thus, the Sherman Act has been construed to require that joint or cooperative research and development activities be kept to a minimum in order to insure meeting the policy objective of full and effective competition.

Beyond Sherman Act scruples, the Supreme Court has held that the antimerger provisions of the Clayton Act are also applicable to joint ventures. Joint ventures also incur the risk of challenge under theories advanced against horizontal, vertical, and conglomerate mergers.

Finally, antitrust law in the area of joint research and development is unclear, uncharted by judicial decisions in litigated cases so that companies contemplating joint research and development may not be able to determine whether they may proceed free of antitrust risk, and this uncertainty in itself may dissuade them from going forward together.

By contrast, the Common Market and Japanese antitrust laws and policies actively encourage joint efforts among competing firms to improve technological development and production efficiency.

In opposition to the foregoing contentions, some officials believe that they are much overdrawn and unsubstantiated. For example, Assistant Attorney General McLaren recently made the following observation: [10]

> As for the alleged need for increased profits to patent owners, we know of no economic or other persuasive evidence that permitting patent owners to engage more freely in restrictive licensing would increase invention or the productivity of the economy. When decisions are made to invest in research and development, so far as we can learn, the outer limits of permissible licensing arrangements receive minimal, if any, consideration.
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> A detailed investigation of the facts underlying this proposition may be in order; however, we believe that no basis even for inference, much less for firm conclusion, presently exists. I understand that the Federal Trade Commission has expressed a willingness to investigate this matter further.

Because of the breach between these economically oriented policies and a growing number of court decisions which have tended to complicate them, some sentiment appears to be rising for new economic theories on which patent, antitrust and tax laws may be based. One authority has commented that "while courts are equipped to deal with a substantial volume of raw economic data relating to the particular facts of the case before it, they obviously are not able to conduct empirical studies from which meaningful economic theory may be inferred . . . much of the available and superficially prestigious 'economic' authority has no foundation in empirical data . . . (Our present) elaborate legislative (anti-trust) scheme has been constructed on the basis of a glibly-stated economic proposition, the validity of which is never examined." [11]

Unlike the suggestion of Mr. McLaren, it was here suggested that the National Science Foundation, as an "impartial" agency, support studies designed to develop such new economic theories.

[10] Testimony before the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Judiciary Committee on S–643, May 11, 1971.

[11] Allen C. Holmes, New York District Attorney, quoted in the *Congressional Record*, April 22, 1971, page S–5413.

6. Productivity and Employment

There is a general feeling that the results of research and development increase productivity. A few months ago Under Secretary of Commerce James Lynn stated that one of the most important factors influencing productivity is technology and he quoted estimates of between one-fourth and three-fourths of productivity growth as being attributable to improvement in technology.

As noted earlier, the constant substitution of new products in our economy makes the assessment of productivity growth extremely difficult and complex. Although this substitution, due in large part to advancing technology, may not be measurable in economic growth or productivity indices, most observers feel that it does increase the level of our material wealth.

The service industries have lagged far behind manufacturing and agriculture in increasing productivity. On the other hand, they have contributed immeasurably to the economic standards of our country and other developed nations and have provided employment for increasingly large parts of our work force. There are demands for increasing productivity in service industries through implementation of technological innovations and advanced methodologies. An obvious example is that of education, perhaps the largest service industry in the U.S. Legislation is currently pending before the Congress to encourage the widespread application of educational technology in our school system.

7. Scientific and Technical Manpower

A necessary condition for developing scientific knowledge and the related technologies is an adequate supply of highly trained scientific and engineering manpower. For most of the period since World War II, this commodity has been in short supply. More recently, because of significant cutbacks in technological activities related to defense and space, there have been undesirable surpluses in certain disciplines.

There is widespread desire for more accurate projections of technical manpower requirements and closer coupling of these projections to the educational system. There is also widespread recognition of the difficulty in predicting technical manpower needs, since the lead time for training scientists is quite long compared to the manpower needs which may be generated by a new industry based on new technologies. These technologies are by their very nature impossible to predict, just as discoveries in science are impossible to forecast.

Because of this difficulty in predicting specific technical manpower requirements, increased emphasis has been laid on training engineers with basic science and mathematical backgrounds. This flexibility of training permits them to more easily adjust from one technical activity to another. It seems feasible that the training process should also emphasize managerial and other nontechnical training as well, since this would permit easier transition of scientists and engineers into government and business positions. Technically trained individuals can make valuable contributions to society and the economy in activities outside the strictly technical arena.

Of current interest is a need for converting relatively large numbers of scientists and engineers to activities outside the traditional defense

and space R&D activities. Proposals are being implemented for utilizing their talents in various ways, including civilian engineering activities and medical technology, and there are increasing demands for broadening these conversion research and education programs.

8. Interaction Between Research and Engineering

For some years it has been recognized that the optimum environment for development activities includes participation by scientists involved in basic research. This has been the policy in some of our nation's foremost industrial laboratories. The basic research scientists not only interact in various ways with the engineers involved in development work, but they are also often recruited from their basic work into more applied concerns of industrial organizations or governmental agencies. Within the Federal Government the Advanced Research Projects Agency has sponsored a number of specific contracts coupling industrial development programs to university research activities. The results of this experiment indicate that, with proper management, this combination of talents can be more effective than the same activities being performed separately.

The National Science Foundation has sponsored systematic studies of the role of research in the overall process leading to technological innovation. The results described in the NSF publication "Technology in Retrospect and Critical Events in Science" point out the need for a better understanding of the interaction between science and technology. Attaining this understanding should make the technological innovation process a more efficient one in attaining societal goals and economic growth.

9. Stimulation of R & D in Foreign Countries

The subcommittee has not at this point undertaken a comprehensive review of the policies followed in other countries in regard to the encouragement of science and technology as a stimulant to economic health and growth. However, in the course of committee work it became clear that there are significant differences between the policies now in effect in the United States and those that have been adopted by a number of our closest competitors. While not all of these policies would be suitable or acceptable for implementation in the United States, they may well provide insights and examples that bear closer scrutiny as this country looks to changes that may be needed in its own policies in the future. Without any claim to comprehensive treatment, following is a summary of some of the pertinent information that has come to the subcommittee's attention.

Canada

Canada does not pursue a policy aimed at extensive coordination of research and development at the national level. Specifically, there is little effort to coordinate research and development between industry and government. A recent report by the Canadian Science Council attributes the decline in technology-based manufacturing industries chiefly to the absence of close cooperation and coordination between government and industry.

The Science Ministry established in June 1970 is a small policy group closely analogous to the U.S. Office of Science and Technology. It does not have control over government funds for research and development, and is understood to concentrate its efforts on attempting

to redirect the Government's past orientation from exclusive concern with research and development in government in-house laboratories and in universities. Within the last few years an "Industrial Research and Development Incentive Act" has been passed providing some financial support of research and development to Canadian industry.

Canada exports little advanced technology, and there are few restrictions or policies applicable to the import of foreign technology.

France

In France, the scope and priorities of Government support for research and development are determined within the framework of a comprehensive science policy and national economic plan. The major areas that receive support are selected on the basis of national interest and a given industry's research and development capability. The support for a selected industry or project may take the form of grants, research contracts, or tax incentives. Typical of the major heavily subsidized projects are the Concorde SST program, carried out by the nationalized sector of the French aerospace industry, and the "Plan Calcul," a program for the development of national capability in computers. Under these programs the Government provides research and development grants to a private sector which agreed to regroup and merge in order to enhance its viability.

The research and development policy closely ties in with the objectives of the 5-year economic plans. Industries which agree to implement these objectives receive special tax incentives by agreements made with the Government. In addition, the French Government has allowed the formation of economic interest groups for the purpose of pooling resources for research and development. These economic interest groups are not subject to corporation taxes as an entity. As a general incentive, companies investing in buildings to be used in research and development activities are entitled to an initial depreciation allowance of 50 percent.

The French Government does not apply restrictions to the import and export of technology.

Germany

The German Government pursues a strong program of encouragement for science and technology. On the federal level the Ministry of Education and Science conducts a "New Technology Program." Funding of this program was tripled between 1970 and 1971 and doubled between 1971 and 1972. The program is aimed at achieving technological advances for German industry and the following areas have been selected for priority attention: chemicals, energy, environmental protection, transportation, and biotechnology. Under the provisions of this program ten percent of the costs of new research and development plant and equipment is paid to industrial firms, and the Government may provide up to one-half of the costs of the associated research and development program. The industry involved retains significant rights to the results. The fields of aviation and computers have been singled out to receive additional support.

Export of technology is encouraged through tax incentives and through planning and management assistance to firms establishing plants abroad. There are very few restrictions on inflow of technology from abroad.

The individual states provide a number of incentives for foreign companies to build modern plants within their jurisdiction, either on a wholly owned or a joint venture basis. These incentives include tax concessions, sites and facilities, and financing aid.

Japan

Japan has long followed a policy of close coordination between the government and private industry. Sectors of industry are selected for special encouragement and support by the Industrial Technology Agency with the advice of industry. Such sectors or industries are subsidized by the government in amounts up to three quarters of total development expenses. The Ministry of International Trade and Industry (MITI) selects the participating firms and coordinates their work. The funding of this work is provided for in the national budget. Projects now being supported include the development of electric automobiles, electronic computers, water desalination, and remote control excavators for submarine oil fields.

Imports of foreign technology into Japan have been encouraged in an effort to advance Japanese industry. Up until 1968 all categories of such imports were subject to government control in order to prevent any adverse effects on the over-all evolution of the economy. Since that year import controls have been removed except in selected fields where Japanese industry is still weak technologically. These fields include aircraft, atomic power, electronic computers, petrochemicals, and space technology.

The Japanese government provides tax incentives for technology exports, but no other direct support. Exports of advanced technologies are subject to approval by MITI and export licenses may be withheld if judged contrary to the national interest. In one case approval for the export of an advanced, electronically controlled knitting machine was withheld because it was judged that wide use of this machine in the United States might adversely affect Japanese textile exports.

Soviet Union

Under the economic system found in the Soviet Union the central government exercises detailed control over all aspects of industry, including research and development. Private industry does not exist and all industry is organized under about 30 "branch" ministries such as the Ministry for Aircraft Industry, the Ministry for Shipbuilding, and the Ministry for Chemical Industry. Individual research and development projects of any magnitude need approval from the Ministry in Moscow and from the State Planning Committee.

This highly centralized form of control has proved ill-suited to the needs for administrative flexibility which is required to take advantage of new ideas and breakthroughs arising from research and development. As a result, the Soviets have taken some modest steps to increase flexibility and take advantage of local initiatives. They have permitted individual plants and enterprises to retain a small percentage of their surpluses for use in research and development initiated locally. They have also, in an attempt to increase productivity throughout the economy, instituted a system of financial incentives. These incentives apply to engineers and scientists and are expected to increase productivity in research and development as well. A major organizational step taken in recent years has been the transfer of a number of research institutes

from the jurisdiction of the Soviet Academy of Sciences to the individual branch ministries in order to effect a closer working relationship. Most observers believe that, with the exception of a few high-priority sectors such as atomic energy, space, and defense, industrial research and development in the Soviet Union still labors under the constraint of an over-centralized, bureaucratic system.

The Multilateral Phase

Any discussion of action being taken by foreign countries in relation to their policies and practices in the technology-economic area should include mention of those operations which are underway on a multilateral basis.

A number of these exist and are in process in one way or another through the operations of the United Nations and its affiliate, the U.N. Economic, Scientific and Cultural Organization (UNESCO), the Council for Europe, Western European Union, the Organization for Economic Cooperation and Development (OECD), the incipient International Institute for Applied Systems Analysis, several of the special NATO committees, and others.

Probably the most important recent action taken by a group of nations in the technology-economic sphere was the October 1971 meeting of the OECD Science Ministers in Paris. This was the first meeting since 1968 of the Science Ministers of the 25 highly industrialized countries which make up the OECD. The theme of the conference officially was "Science and Technology for Society", although in fact it was devoted to ways and means of integrating national science policies with the social and economic policies of the member nations. In this context, particular attention was given to (1) trends and objectives of the science policies of individual countries as they affect national and international economics; (2) innovations underway and the results of such innovations on economic factors; (3) international cooperation in science and technology and what reasonably might be expected from it, socially and economically.

The specific findings and recommendations of the OECD Science Ministerial Meeting, although couched in general terms, are relevant to the issues being discussed in this report.

At the conclusion of the meeting, the OECD Ministers issued a joint communique which was based on the following conviction:

That science and technology will continue to be essential elements in social and economic progress, that science and technology should contribute more fully to the improvement of the quality of life as well as to material well-being, and that the undesirable side effects of technological applications must be controlled.

In addition to the three basic goals outlined above, the ministers defined a number of fields in which work should be undertaken and in which the OECD and national staffs are already engaged. The areas stressed are primarily these:

1. The accumulation of more basic knowledge and its relation to social problems.

2. Changing requirements for scientific and technological manpower.

3. The growing importance of social objectives requiring increased use of social science.

4. The need for closer links between economic, social, scientific and educational policy-making at all levels of government, national and international.

5. More accurate information and the accumulation of better baseline data on which decisions can be made.

6. The stimulation of improvements in the industrial innovation process.

7. Stimulation in the public sector for market incentives which presently are partly or wholly absent.

8. Improved understanding of the research activities and the market mechanisms of multinational firms.

9. The assessment of the adverse and beneficial consequences of technological development.

A number of specific recommendations were also made in two other major areas. One of these was promoting research cooperation between member countries of the OECD; the other included the evolution of science and technology for developing countries.

Further evidence of the fact that technological application is being directly linked with economic activity on an international level was offered during the OECD proceedings. This came about when the Organization's Directorate for Scientific Affairs set up a working group to study what it calls "the levelling-off phenomenon" of research and development efforts by certain leading nations in the field. The working group was charged to pay special attention to France, Germany, Japan, the United Kingdom and the United States in efforts to determine the relative economic consequences of R & D efforts by these nations.

IV. SUBCOMMITTEE VIEWS

The Subcommittee does not have specific legislative recommendations to make at this point in its study. It has, however, synthesized certain basic principles which have emanated from the 1971 hearings on Science, Technology, and the Economy, and earlier subcommittee activities. These principles are put forth now for further consideration by the full Committee and the Congress. It may be that after careful scrutiny they will be used as the basis for specific legislative proposals.

• A balanced approach to the support of science and technology is needed in order to attain those long-term national goals which are dependent on science and technology.

Basic research, the generation of new knowledge, and development, the exploitation of that knowledge, work together closely in the attainment of commercially successful, technologically intensive products. Increasing emphasis rightfully should be placed on industrial research and development activities, for it is in the industrial laboratory that an optimum reward structure exists for effecting commercial utilization of new knowledge.

New ideas for stimulating industrial research and development should be brought forth and closely scrutinized. But it must be kept in mind that the prosperity of high technology industries depends upon basic as well as applied research and development. This prosperity also depends on adequate numbers of highly trained scientists, engineers and technicians. National support for a balanced program of scientific research and science education is just as important as adequate funding for industrial research and development.

• Strong institutions must be nurtured and, where necessary, developed to provide an adequate educational, research, and development base for meeting the scientific and technological challenges facing the nation.

Large-scale science education efforts are no better than the institutions which furnish the instruction and facilities. Present indications of financial instability in our institutions of higher learning are bound to be reflected eventually in inferior education for our scientists, engineers and other students.

At the graduate level, science education and research are indistinguishable, and policies for the support of science education and research are closely intertwined. Continued improvement in governmental policies and organization for the support of research must be made.

The successful commercial exploitation of the products of research requires competent industrial laboratories. These may be found within a given corporation or may be commercial or not-for-profit laboratories doing research for many companies. Many industrial R & D laboratories are facing financial support crises as are some universities.

Because of the large-scale research and development problems faced in some industries, especially with regard to problems of environmental quality, there are new and increased pressures to develop cooperative laboratories for the performance of industrial research. These laboratories could be jointly sponsored by Federal or state governments, as well as industrial corporations. Legal and regulatory changes should be made where necessary to encourage such joint efforts.

- **Consistent support of science and technology by the Federal government must be acknowledged as a matter of public policy, and strengthened and increased where necessary.**

This subcommittee has made earlier recommendations concerning the establishment of a National Institute of Research and Advanced Studies, which would more closely coordinate the nation's efforts in basic research and graduate education in the sciences. Elsewhere, other proposals have been made, such as those to convert the National Aeronautics and Space Administration into a National Science and Technology Agency, which would be assigned the responsibility for coordinating and managing major technological projects in the national interest.

In seeking to strengthen those organizations available for carrying out national technological objectives, a careful balance must be struck between centralized responsibility and decentralized decision-making. This will help assure allocation of national resources in a rational manner to meet high priority objectives, and at the same time prevent the creation of a monolithic and bureaucratic super agency.

Of prime importance is the provision of adequate funds for basic research and science education in the context of current and future technological requirements. New organizations as well as new money may be required to accomplish these goals.

- **Incentives must be offered to encourage innovation and commercial exploitation of new knowledge.**

Other nations have for some time recognized the important role of government in providing incentives for industrial utilization and exploitation of new knowledge. Although basic research is of prime importance to our nation, effective methods must be found to utilize the results of this research in a optimum manner.

Direct government grants, tax advantages, progressive patent policies, and other regulatory and financial incentives have been employed successfully in foreign nations. Careful consideration of these options must take place in the context of the historical American experience in regulating the relationships between government and industry. Success will help assure adequate growth of the domestic economy and a favorable balance of trade.

- **Renewed efforts must be made to utilize technologies developed in noncommercial research and development programs, such as defense and space, for commercial advantage.**

Since World War II, the United States has led the world in its investments in research and development. This apparent advantage has been due primarily to high research and development expenditures in defense and space programs.

These expenditures have had dual advantages because of the valuable lessons learned in managing large technological enterprises and the utilization of much of the new technology for commercial activities. Such transfer of existing technology to purposes other than that for which it was funded is increasingly important. Effective organizations and programs to promote technology utilization can help this nation compete successfully in the world market place and at the same time fulfill its defense obligations and continue the exploration of space for the benefit of all mankind.

- **Equitable means of assigning costs of environmental and social factors to technologically intensive products must be developed and implemented.**

Costs involving environmental protection and social responsibility are increasing rapidly. Presently these costs are not consistently assigned to the products incurring the direct or indirect expenditure by society at large. In many cases, rather than pay these costs the physical or social environment is degraded.

Better methods and institutions for assessing the effects of technology must be developed, and the environmental and social costs should whenever possible be levied directly on the product or service which incurs them. International cooperation and agreement will be a prerequisite for success, and most likely should be considered in the context of international trade and tariff treaties.

- **Particular attention by the Federal Government must be given to developing procedures for identifying and focusing on those research priorities which are critical to the economic well-being of the nation.**

The vital relationship between science and technology on the one hand and national economic health on the other, has been amply demonstrated during the inquiries made thus far by the Subcommittee.

It seems important, however, to emphasize the urgent necessity for the government to find ways to identify and encourage the rapid and efficient growth of research into priority areas. For the most part the country has thought of such research in terms of immediate tangible goals such as improved housing, transportation, health care, education, and agriculture.

While the achievement of such immediate practical goals is indeed of prime importance, solutions to them based on contemporary knowledge may well result in little more than makeshift solutions. Large scale parallel efforts must be directed toward new research and development efforts in those specific categories in which lack of new knowledge is holding back progress in many important areas. Examples of such broad, high priority research areas are energy and materials. These and others which govern our ultimate limitations, are being given a good deal of attention, but little of that attention is being devoted to research and development. More must be devoted to real innovative work—which would conserve existing resources and permit the application of methods and processes presently unknown or unused.

V. FUTURE SUBCOMMITTEE ACTIVITIES

The Subcommittee on Science, Research and Development anticipates further hearings on the subject of Science, Technology, and the Economy during 1972. It is expected that these hearings will probe deeper than the earlier ones and will explore specific issues in greater detail. The Subcommittee anticipates that these additional hearings will be used to examine and further refine the basic principles enunciated in the preceding section of this interim report.

In addition to the hearings, further studies and examination of the issues will be performed by the Committee staff; additional background data will also be assembled for incorporation into the Subcommittee's deliberations.

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STATUS REPORT ON ACTIVITIES OF THE OFFICE OF SCIENCE AND TECHNOLOGY

April 13, 1971

Lyle

I. ENVIRONMENTAL QUALITY

PSAC Panel on Chemicals and Health

On April 4-5, the PSAC Panel on Chemicals and Health met to hear a continuing series of briefings and to consider some of the major policy issues concerning, on the one hand, the development of new chemicals (pesticides, food additives, drugs) and, on the other, an adequate degree of human safety. The Panel had described the results of a series of experiments on NTA (a phosphate substitute in detergents) which had been undertaken by industry. Other briefings included agricultural feed additives, program of pesticide residue monitoring on food, critical observations of the FDA, and a review of current legislation for pesticides and other toxic substances. Previous sessions dealt with pesticides, oral contraceptives and other therapeutic drugs. A forthcoming meeting is to be dedicated to food processing and food additives. The series of briefings is nearing completion. A number of background papers are in preparation. A preliminary report is considered likely in approximately four months.

(Burger)

OST Meeting on Hazardous Trace Substances

The fourth in a series of meetings of a task group on hazardous trace substances (under Dr. Norton Nelson) met on April 6th. This group is considering the Federal resources and programs of research and monitoring in their area. In addition it is considering the adequacy of the advisory mechanism. Finally, it is working through three case studies (cadmium, arsenic, polychlorinated biphenals) to determine what kinds of information are needed for good decisions in this area and to what extent these data are available. The group received a briefing on the present and proposed NSF programs on interdisciplinary research for this area. In addition, it learned of the several NAS-NAE-NRC advisory panels concerned with trace substances.

(Burger)

OST Meeting on Epidemiology

A meeting was held in OST on April 13 to consider the government's programs and resources for epidemiological research for those diseases thought to be related to environmental agents. This meeting, which included both government and academic personnel, included a review of programs in this area of HEW, NSF, AEC, and EPA. In addition to epidemiological research programs, the panel heard a discussion of the data resources which could be used as instruments for this research.

(Burger)

Desalting

A report, "A Proposed Federal Desalting Program" prepared at the request of Senator Henry M. Jackson, Chairman, Senate Committee on Interior and Insular Affairs, has been finalized and copies have been transmitted to the Committee. On April 2, hearings were held by the Subcommittee on Water and Power Resources on Senate bill S. 991, Senator Jackson's bill to extend the Federal desalting program for five years (FY 73-78 and a bill prepared by the Department of the Interior whose purposes are very similar. The report prepared by OST for Senator Jackson recommends that a Federal desalting program be vigoursly pursued to accelerate the development of desalting technology so that it will be available at an early date to provide competitive sources of water for the nation's growing water needs. Essentially the Federal program suggested is an applications oriented research program coupled with appropriate studies plus Federal participation in construction of first-of-a-kind prototype desalting plants in cooperation with water supply authorities. Copies of the report are available upon request.

(Butcher)

II. INTERNATIONAL SCIENCE

Review of U.S.-Soviet Scientific and Technical Cooperation

On April 16-17 a group under James Fisk will meet here to hear comments from the NAS, State, Commerce, Defense, NASA, AEC, the universities and foundations regarding their scientific and technical programs with the USSR over the past twelve years. The purpose of this review is to see what lessons can be learned from past experience and to propose new

initiatives for possible Presidential use at the proper political moment in U.S.-Soviet relations.

(Neureiter)

German Science Minister

German Minister for Education and Science, Hans Leussink, will visit Washington on April 21-23 for discussions with Dr. David and other officials. The subjects to be discussed include a review of U.S.-German bilateral relations in science and technology, a comparison of science policy developments in the two countries, and German-Soviet scientific and technical relations, which have been improved as part of Chancellor Brandt's Ostpolitik.

(Neureiter)

The Science Committee of the German Parliament called on Dr. David on April 5 for a brief review of issues of common interest. The Germans were particularly interested in future directions of energy research in the United States; in the oft-rumored, but as yet not proffered, proposal of the U.S. to participate with the Europeans in a multination uranium enrichment facility to be built in Europe using U.S. gaseous diffusion technology; and in U.S.-European post-Apollo space cooperation. The Germans showed concern about the future dependability of the U.S. for enriched uranium supplies and expressed a misgiving that the U.S. might enter into a bilateral sharing of gaseous diffusion technology with the French, who have recently undertaken preliminary studies of a facility to supply future European needs based on their diffusion technology. The Germans were told that the President's decision to enter into discussions with the Europeans on a multinational facility was being discussed by the Administration with the Joint Committee on Atomic Energy. Pending the Joint Committee's concurrence, the Administration would hope to begin talks with the Europeans in the near future on a multinational, and not a bilateral basis.

(Neureiter)

Coincidentally, the Chairman of the French AEC Andre Giraud recently called on OST to feel out U.S. interest in collaborating with the French on their proposal for a uranium enrichment plant. Giraud was told that the U.S. would favor a multinational approach to any European enrichment facility.

The French have also recently signed a contract with the Soviets for enrichment of uranium for use of their new reactor cores, at a price below the present world market price. This is the third such contract with Western countries (in addition to the Swedes and the Finns) and may represent full-scale emergence on the world enrichment scene by the Soviets. Giraud tended to play down this transaction, saying that it was a small one and arguing that no one could truly depend on the Soviets for something as vital as the source of one's energy.

(Neureiter)

Dr. Sarabhai, Chairman of the Indian nuclear energy and space agencies, recently discussed with Dr. David possible U.S. involvement in an Indian operational direct broadcast satellite system for TV and telephon , which would be a follow-on to the presently planned Indian direct broadcast television experiment to go on the U.S.' ATS-F satellite in 1973. Sarabhai will submit a proposal for consideration by U.S. AID within three months.

(Neureiter)

Polish Science Minister

Chairman of the Polish Committee for Science and Technology, Jan Kaczmarek (the equivalent of Polish Science Minister), accompanied by the Scientific Secretary of the Polish Academy of Sciences, Smolenski, will visit the U.S. for 10 days beginning April 25, at the invitation of Dr. David, to explore opportunities for closer scientific and technical cooperation between the U.S. and Poland. It is apparent that the Poles will made a pitch for greater access to advanced U.S. technology, such as refining plants, electronics manufacturing technology, etc. Opportunities for greater scientific cooperation using the PL-480 funds will be discussed. The visit takes on a certain political significance in view of the recent replacement of the Gomulka government by the Gierek regime in the wake of serious public riots as well as the fact that no such high level visit of Poles to the U.S. has been possible on the Polish for many years.

(Neuteiter)

III. SCIENTIFIC AND TECHNICAL INFORMATION

On April 6, 1971, Dr. David appeared and testified before the Subcommittee on Science, Research and Development, Committee on Science and Astronautics, U.S. House of Representatives, on the National Science Foundation authorization for Fiscal Year 1972. The testimony was favorably received.

Dr. David in his testimony related that this is a time for change for science and technology in the national scene, that we are adapting new priorities for new demands, aiming at new goals on new subjects, using new ways of working and new organizations. He also discussed the NSF's role in the national picture and stated the support of basic research is a continuing and vital part of the NSF's program, and the President's budget for 1972 strongly reaffirms this role.

Attached is a copy of Dr. David's statement.

(Pagnotta)

Unemployed Scientists and Engineers

On April 1, 1971 the President met in San Clemente , California to review the unemployment situation among scientists and engineers with leaders of the civilian sector of industry, heads of professional engineering societies, representatives of academic institutions, leaders of three "self-help" organizations, and leaders of the aerospace industry.

This meeting was a follow-up to a similar discussion held in Washington on March 3, 1971. Several participants have been involved in both meetings including the President's Science Adviser, Dr. Edward E. David, Jr., and Secretary of Labor James Hodgson.

The meetings provided an opportunity to evaluate the effectiveness of the measures taken by the government last fall and winter to help these unemployed individuals. They also provided an opportunity to learn at first hand about the organizations formed to help these displaced scientists and engineers help themselves.

The President announced that $42 million would be spent this way:

$5 million for a job search program to enable 20,000 job applicants to explore possible employment opportunities in areas away from their homes.

$25 million for job retraining to help expand the capabilities of these engineers and scientists so they can move to different fields such as environmental science, urban studies and health and safety engineering.

$10 million to help 10,000 families with reimbursement money so they can move their households to jobs in different areas.

$2 million for a skill conversion fund. Small groups of professionals would explore ways to provide technological help for traditional areas of the economy.

At the close of the meeting in San Clemente, the President reaffirmed his personal conviction that the United States should maintain its position in the forefront of scientific and technological advance. Dr. David, will assemble a set of alternatives for new initiatives which could be taken. These new thrusts are to be restricted to the civilian sector of the nation's economy and each will have a high technological content.

(York)

IV. EDUCATIONAL R&D

An organizing meeting of the PSAC Panel on Youth chaired by Dr. James Coleman is planned for May 14-15.

Plans for a study by the PSAC Panel on Educational R&D of the use of technology in education to be carried out under the chairmanship of Dr. John Truxal are proceeding. New members with special expertise in this area will be added to the panel.

(Mays)

V. SCIENCE AND TECHNOLOGY POLICY

Technology Assessment

OST has received the final drafts of the MITRE Corporation contract for the development of technology assessment methodologies. The 7 volume report covers the following areas:

(1) How to select pilot studies for methodology development?

(2) Methodology for Technology Assessment.

(3) Pilot Study #1 - Industrial Enzymes

(4) Pilot Study #2 - Computers

(5) Pilot Study #3 - Automotive Emission Control

(6) Pilot Study #4 - Water Pollution and Domestic Wastes

(7) Pilot Study #5 - Ocean Farming

We are contemplating the preparation of a guidance type OST document covering what we have learned about technology assessment methods with extensive illustrations, giving due emphasis to dangers and pitfalls.

(Strasser)

VI. OST AFFAIRS

Mr. Robert Barlow terminated his services with OST on April 2, 1971. Mr. Barlow joined OST in January 1963 as Special Assistant to the Director and was responsible for energy policy, water desalting, effective use of Government laboratories, and served as principal Administrative Officer of OST until late 1967. Since 1967 he has been responsible for public affairs activities including Congressional liaison, public information, press relations and liaison with state and local government. Mr. Barlow has joined the staff of Cornell University and will serve as Special Assistant to the President of Cornell University.

(Pagnotta)

STATEMENT BY DR. EDWARD E. DAVID, JR., DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY, BEFORE SUBCOMMITTEE ON SCIENCE, RESEARCH AND DEVELOPMENT OF COMMITTEE ON SCIENCE AND ASTRONAUTICS, ON NATIONAL SCIENCE FOUNDATION AUTHORIZATION FOR FISCAL 1972, APRIL 6, 1971

Mr. Chairman and members of the Subcommittee on Science, Research and Development, I welcome the opportunity to testify on the proposed FY 1972 NSF authorization because of the growing and evolving role of the Foundation in the national research and development picture. I strongly support this emergence of NSF to which I have devoted a substantial amount of personal thought as well as staff effort from the Office of Science and Technology.

On the national scene, this is a time of change for science and technology. We as a community are adapting to new priorities and to new demands. Both the face and substance of our work are evolving. We are aiming at new goals involving new subjects using new ways of working and new organizations. I might say in passing, Mr. Chairman, that this subcommittee has had a major hand in spurring these changes and I look on them as essentials for the well-being of the nation.

During a time of change, it is well to keep basic values in mind. Fortunately, these are more lasting than the more volatile aspects such as subject matter or particular goals. In discussing NSF's role in the larger national picture this morning, I will refer to some of these values since they have been a framework for my thinking.

One lasting value is the power of understanding. When I was a child, the story went around that the man who had invented the desk-top calculator went insane after that event. This fanciful story was in response to the appearance of complexity which overwhelms the student when he first removes the cover of such a calculator. People have the same reaction today to the insides of TV sets, computers, and spacecraft. Yet we know that these things come not in a flash of isolated inspiration which exhausts the individual's store of creativity forever after, but rather represents a step-by-step build-up of complexity with deep understanding at each step. Thus understanding gives us the power to create the complex tools we need for solving society's problems.

Over the years NSF's basic research programs have contributed substantially to this step-by-step understanding. I see the support of basic research as a continuing and vital part of NSF's program. The President's budget for 1972 strongly reaffirms this role. As you have undoubtedly noted, the Foundation's total budget request for 1972 is 23% greater than in 1971. However, the amount budgeted for scientific research project support increases by 46% over 1971. This very substantial increase might be questionable if it were not that NSF will be assuming the support of top quality basic research efforts which are no longer being supported by other agencies. I understand that Dr. William McElroy, the Director of NSF, has informed you that about $54 million of this increase will be used to support projects

which have been formerly supported by other agencies. My office has worked closely with NSF and these other agencies to assure that the nation's basic research program will not suffer as a result of shifts in funding. I think we can assure you that the change of funding patterns will not disturb the top quality basic research which is the backbone of the nation's scientific and technological enterprise.

In addition to the $55 million to accommodate funding shifts, there is $27 million to expand the basic research program, particularly in fields which we feel are under-supported at the present time. These include environmental, biological, and social sciences particularly. There is also an increase of $17 million in national and special research programs generally related to the environmental area.

Mr. Chairman, as I have said, the power of understanding, combined with the permanence of the laws of nature, enablesus to perform outstanding feats for the benefit of society. However, these values must be combined with another to be truly effective. The one I have in mind is the vitality of individual excellence. It takes dedicated and highly-trained people to keep the scientific and engineering enterprise operating and, of course, these people must come initially from our educational institutions. We all recognize, Mr. Chairman, the values involved here and those values were in our minds during the budgetary process. We also had in mind the

decreasing size of the market for engineers and scientists. This implies that our programs of educational support should be aimed at increasing quality rather than increasing quantity of graduates. The FY 1972 NSF budget, therefore, shows a shift of resources to the support of current capabilities rather than programs designed to expand the capability. Thus, we propose to discontinue NSF institutional science development programs and reduce the parts of science education programs which were primarily pointed at stimulating careers in science. Much of the reduction here results from a continuing phase-out of graduate student traineeships. That program was aimed largely at stimulating the massive increase in scientists and engineers needed for our space and defense efforts in the 1960's and to supply academic staffs during the explosive expansion of our colleges and universities. These goals have been met and will continue to be met for at least the next several years without further federal stimulus. At this time it is important to utilize scientists and engineers more effectively and to avoid overproduction so that young people are not disillusioned about future careers in science and engineering.

Mr. Chairman, still another lasting value during this time of change is the integrity of purpose and the effectiveness of the scientific method. It has long been accepted in many university laboratories as well as industrial ones that clear overall purposes provide a welcome yardstick by which to measure the suitability of proposed research efforts. In a good

research laboratory there are always more possibilities than can be pursued. Clear purposes enable the researcher to choose among the possibilities that he sees in a rational way. This is what I mean by the integrity of purpose.

With respect to the effectiveness of the scientific method, I think I need not say more than that it is being applied not only to the social and life sciences but also to many other areas in which sound decision-making is important and where problems with both a social and technological content are to be solved. These values are at the root of NSF's RANN (Research Applied to National Needs) program. NSF officials have already discussed with you their plans in this regard and I am greatly excited about the potential of this new emphasis for NSF. It represents a major expansion of disciplinary research programs of the past and will lend to them the integrity of purpose. I believe that the Foundation is in a unique position to make effective use of the funds requested in this spirit for the following reasons:

-- Agencies with specific missions to accomplish must of necessity give priority to immediate problems and relatively short-range solutions. In keeping their nose to the mission grindstone, agencies are under severe pressures which dictate against development of comprehensive and long-range research. NSF with its tradition of basic research and its contacts with

universities is in a position to augment mission agency efforts with higher risk, longer range and more speculative efforts. It is from such efforts that the new possibilities for creating a different and better world come.

-- Many of the problems we as a society face today, such as pollution, urban decay and crime, are very diffuse and call for much better understanding of their overall aspects. The societal systems involved are so complicated that human intuition is not well adapted to them. This means that we can fail to anticipate the consequences of our efforts to change or improve the system. The situation calls for systems research using models which can aid our intuition. The penalty for not undertaking such studies is that our actions taken to alleviate problems often make matters worse. Such studies are related to the responsibilities of many federal agencies but none are in the excellent position NSF holds to attack such problems with advanced and imaginative resources. It is my hope that NSF can make major progress in this field and I intend to provide the support and assistance of my office to them in every way.

-- Several of the mission agencies concerned with major national problems have not over the years developed close working relations

with the nation's universities and colleges. This in part is behind the fact that our academic institutions are not being effectively brought to bear on many of our major national problems. I am convinced the universities have great contributions to make here. The NSF with its traditionally close academic relations is in a unique position to involve these institutions in priority national research efforts.

I want to make it clear, however, that universities are not the only resource that NSF will tap under the RANN program. RANN will call broadly on federal and contract laboratories and indeed any resource that has the special capabilities and skills to contribute to the solution of national problems.

In implementing this focus for NSF, we must be careful that the Foundation does not assume the responsibilities of mission agencies or duplicate their efforts. As I have explained, the NSF effort is intended to complement the work of other agencies. It is my expectation that NSF will act as a catalyst to increase the effectiveness of research efforts in many agencies of government. In such efforts I expect that research begun by NSF can be picked up by mission agencies and be supported directly by them as the research matures. Joint funding of efforts in the RANN program may very well be a vital step in this process of transfer, with appropriate attention to the stage of research and its relation to NSF's and the agency's functions.

The Office of Science and Technology is working closely with the Foundation on the RANN program to help establish close working relationships with other agencies and to help assure that NSF efforts will, in fact, complement other efforts. We are in the process of establishing a committee of the Federal Council for Science and Technology to assist in this objective. That committee will aid in establishing program objectives for RANN and assist in selecting the major program areas to receive attention. All of the agencies, of course, will be represented on that committee. Subcommittees with interdepartmental membership are being established to deal with the more detailed coordination required.

To insure that we do in fact have an integrated approach focused on significant national problems will require that the Foundation be given extensive advice and guidance. Otherwise, we may not be making the most effective use of the resources available or we may end up with conflicts in priorities and in approaches to dealing with problems. I intend to do all that I can to insure that the National Science Foundation is given appropriate advice and guidance both in the selection of problem areas for RANN support and in developing the best strategies to deal with these problems.

As you can see, this venture by NSF will require greater attention by the Executive Office of the President to the management of R&D across the spectrum of government activities. The foresight of your

committee, Mr. Chairman, in recognizing this necessity some years ago has aided us in undertaking this new venture for federal science and technology.

Mr. Chairman, again I appreciate the opportunity of reviewing with you the NSF proposed program for 1972 in the context of the entire federal R&D effort. In closing I would like to emphasize the Administration's strong commitment to both basic and problem-solving research activities. The President, in his budget message, recognized that science and technology are a major resource for the solution of national problems, but he also recognized that basic research and the understanding that flows from it are the bedrock upon which we must build for the future. The NSF budget request, in my opinion, balances these dual objectives in a proper and imaginative way.

# # #

STATUS REPORT ON ACTIVITIES OF THE OFFICE OF SCIENCE AND TECHNOLOGY

March 9, 1971

I. SCIENCE AND TECHNOLOGY POLICY

Science and Technology Policy Panel

At the forthcoming meeting on March 17, three final drafts will be reviewed by the panel prior to transmission to Dr. David and PSAC. These are:

(1) Report of the Productivity Subpanel
(2) Criteria for R&D Funding
(3) Unemployed Scientists and Engineers (Statements and Recommendations)

The Panel is currently working on recommendations for a Technology Policy and will examine the subject of Stimulating R&D in the Private Sector. (Strasser)

Meeting on Unemployment of Scientists and Engineers

In response to the expressed interest of the President, an all day workshop meeting was held on March 3 under Dr. David's chairmanship to discuss unemployment among scientists and engineers. Participants were representatives of the Federal Government, together with the heads of professional societies and representatives of industry and universities. These professional societies represent about sixty per cent of the scientists and engineers in this country and provide the most direct contact we have with this portion of our technical manpower.

With the help of Secretary of Labor Hodgson, Civil Service Commission Chairman Hampton, Labor Assistant Secretary Lovell and DOD Assistant Secretary Shillito, the steps being taken by the Administration to alleviate the problems of unemployment among scientists and engineers were presented.

As a follow-up procedure, an Interagency Task Force, headed by William Kolberg of OMB, was designated as the appropriate channel of future communication with the Administration.

At the close of the session an informal and partial survey of the private sector participants showed that there was one widely shared negative reaction. This group believes that the present situation has been created by the Federal Government, and thus the Federal Government has an obligation which is not being dealt with in an adequate way. While the remedial measures taken thus far are valuable, (See list attached to this Status Report), they have not been persuaded that these are enough.

Several possible Federal actions to alleviate the problem further are being explored. First of all it is believed that in the long run the problem will be solved by a general upturn in the economy. It is the immediate future which is of greatest concern. The number of unemployed will probably increase for the next six to eight months and then will hold constant for a similar period before declining. The following four mechanisms are under study to ease the situation in the immediate future:

1) To avoid impending lay-offs in AEC laboratories, it may be possible to transfer unneeded overhead funds for the weapons program in FY'72 to the laboratories.

2) By increasing the efficiency of management procedures of the R&D efforts in Defense it may be possible to increase the rate of obligation of funds already in the FY'71 budget. This would enable a substantial number of defense industries to hold on to their staffs. An increase in the total expenditure in FY'72 is implied by this action and its impact is being discussed with OMB.

3) Under the Manpower Development and Training Act (MDTA) two programs could be initiated to aid with this transition period for professional workers. Retraining costs can be reimbursed to firms who take in displaced aerospace and defense employees, although such programs have never before included professional workers. The other potential program is one which would reimburse relocation costs to scientists and engineers who are forced to move their homes in order to take new jobs. No funds are currently provided for these types of programs, but the cost is being examined.

4) It should be possible to employ a number of displaced scientists and engineers in federal departments on at most two-year contracts. These jobs would provide transition employment until these scientists and engineers could find openings in a more healthy economy.

(York)

Subpanel on Education and Research

The Subpanel on Education and Research of the Science and Technology Policy Panel held a meeting February 18 devoted to the interrelationship between productivity and education. Vocational education and other non-academic education was the primary subject of discussion. Programs in the government presently planned and underway appear to cover a broad spectrum of new concepts. The preliminary working paper prepared by the Subpanel at its first meeting was enthusiastically reviewed and revised. The next meeting will be held March 16.

(Savit)

II. HEALTH

Organization of the Cancer Program

In a February 13 speech to the Association of American Medical Colleges in Chicago, Dr. David disclosed the Administration's organizational approach to the attack on cancer, emphasizing that the augmented research effort should be an integral part of the life sciences within NIH.

On March 9 the Subcommittee on Health of the Senate Committee on Labor and Public Welfare began two days of hearings on S. 34, a bill to establish a National Cancer Authority separate from the NIH.

The Administration witnesses (Egeberg, Steinfeld, Marston, Baker) presented the reasons for the Administration's approach. The Association of American Colleges seconded this judgment. A weaker case was made by the representative of the Federation of American Societies for Experimental Biology. He argued that "we scientists are used to doing business with NIH" and to disrupt the system would be detrimental. Senator Kennedy, the chairman of the subcommittee, attacked him rather vigorously after his statement.

Dr. Philip Lee, former Assistant Secretary for Health and Scientific Affairs, HEW, and Mr. James Kelly, former Comptroller of HEW, indicated that they had made some mistakes in their efforts to reorganize the HEW, but one mistake they did not make was to tamper with the NIH, one of the most effective and able organizations within Government. Lee suggested a compromise position between S. 34 and the Administration's stance, one that would keep the NIH intact but move it closer in the organizational framework to the decision-making process in the Secretary's office. Senator Kennedy seemed interested in this proposal and asked Lee to write it out in greater detail and send it to him.

The advocates of a separate agency testified on March 10.

(Laster)

III. EARTH SCIENCES

STORMFURY Panel

The first meeting of the STORMFURY Panel was held on February 26 with Dr. Herbert Simon as Chairman. Some difficulty has been experienced in obtaining the services of a knowledgeable lawyer to serve on the Panel. Suggestions will be welcome. Initial discussions have delineated the basic uncertainties not only in the STORMFURY program itself but in the decision analysis so far performed to assist in future decision making. The first specific recommendation of the Panel is to obtain damage data so that the decision analysis can be based on a damage model rather than upon a phenomenologic model of a hurricane. The next meeting is scheduled for April 2 and 3.

(Savit)

Los Angeles Earthquake

The Los Angeles earthquake of February 9 proved to be unusual in many respects. It is not clear that a prior intense investigation of the area of maximum damage (i.e., area of maximum ground movement) would have indicated any cause for alarm under present techniques. If, for example, the area had been proposed as a nuclear reactor site it probably would have been given a clean bill of health geologically. No significant movement in the immediate area seems to have occurred in the last ten thousand years. Even some of the present movement is detectable in some areas only by its effect on structures, for example, differential displacement of paving, curbing, guardrails, etc. In the geologic formation the movement seems to have taken place in the form of distributed shear, rather than fracture (i.e. faulting).

Present estimates pending precise leveling and resurveying are that the San Fernando Valley has shortened by seven to fifteen feet. Recommendations for government action in the light of data from this earthquake are being intensively studied. (Savit)

Excavation Technology Panel

The first meeting of the Excavation Technology Panel was held on February 4 for the purpose of organization. The first substantive meeting will be held March 8 with Mr. Ellis Armstrong, Chairman.

(Savit)

IV. EDUCATIONAL RESEARCH AND DEVELOPMENT

HEW Organization for Education

The Administration has submitted to Congress a proposed bill to establish the National Foundation for Higher Education (NFHE) within the Department of HEW, with the Director at Executive Level V. This is a change from the bill submitted last year and not acted upon, in which NFHE was proposed as an independent agency with Director at Level II. The bill also calls for raising the Commissioner of Education from Level V to Level IV. The plan is that the NFHE, the National Institute of Education, and the Office of Education as separate entities will all report to the Commissioner who will provide appropriate coordination of their activities. Prospects for establishment of the two new agencies this year appear to be excellent.

(Mays)

Panel on Youth

Organization of this panel under the chairmanship of Dr. James Coleman is proceeding. It will study the means by which young people from age 13 to 25 are brought into society. Dr. Coleman has indicated he would be pleased if any members of PSAC wish to join the panel.

Panel on Educational R&D

Dr. John Truxal has agreed to assume the chairmanship of the Panel on Educational R&D which will be concentrating at first on a study of use of technology in education and on continued monitoring of the development of the National Institute of Education as discussed at the December 1970 PSAC meeting.

The length of time necessary to appoint panel members and the diversity of the field of educational R&D has suggested retaining the present practice of keeping a larger panel roster than would be expected to work on any particular problem. Dr. David is writing to present Panel members asking them to continue, and Dr. Truxal is making plans for additional new members with special expertise relative to use of technology in education. Dr. Truxal will welcome any PSAC members who would be interested in joining the Panel. (Mays)

V. AIRCRAFT

Hijacking Panel

The Panel meeting planned for February has been rescheduled for March 26-27, 1971, in Washington, D. C. Dr. David G. Hubbard is scheduled to brief the Panel and discuss the motivations of hijackers and possible counter measures that may be taken. Dr. Hubbard is a psychiatrist who has recently published a book entitled "The Skyjackers: His Flights of Fantasy," which is based upon interviews with successful and unsuccessful hijackers who are presently available to him in the United States.

(Drew)

VI. OST AFFAIRS

New Executive Secretary of FCST

Dr. Lawrence A. Goldmuntz has joined the OST staff to succeed Eric Ward as Executive Secretary of the Federal Council for Science and Technology. Prior to joining OST, Dr. Goldmuntz conducted his own consultant firm. In 1968-69 he served within the staff of the Assistant Secretary for Research and Technology, Department of Transportation. While with the Department, he served as Chairman of the Metroliner Steering Committee charged by the Secretary of Transportation with the task of implementing recommendations of the Government/Industry Task Force, established in April 1968. He also served as Executive Secretary of the Air Traffic Control Advisory Committee.

(Pagnotta)

March 2, 1971

Summary of Actions Taken by the Federal Government to Assist Unemployed Scientists and Engineers

1. The Department of Labor has set up a National Registry for Scientists and Engineers in cooperation with the National Society of Professional Engineers and the State of California Human Resources Development Agency. This Registry provides a central clearinghouse for applications and job openings on a national basis.

2. In cooperation with the AIAA , the DOL is supporting employment workshops for displaced aerospace and defense engineers and scientists in 34 cities. The workshops provide counseling in job search methods and information on job opportunities.

3. The DOL and State employment services has established Job Banks in 60 areas throughout the country. These Job Banks provide a daily computerized listing of local job opportunities.

4. The DOL has set up a nationwide system to exchange labor supply and demand information between states to provide scientists and engineers willing to relocate with specific job information.

5. The nationwide early warning mass layoff assistance program conducted by DOL and State employment agencies is designed to facilitate the reemployment of displaced workers through immediate action by local employment service staff upon learning of a layoff in their area.

6. The DOL is sponsoring, in cooperation with other Federal agencies, State agencies, and universities,a number of projects designed to retrain displaced aerospace engineers and scientists in bio-medical, environmental engineering, and State and local administrative fields.

7. The Office of Economic Adjustment in the Department of Defense works with community leaders to develop a local program to offset economic impacts through industrial diversification, alternate employment, and outmigration.

8. The Civil Service Commission has put into effect a number of measures to facilitate the reemployment of Federal scientists and engineers through referrals for jobs in other areas, special counseling and training, and broadening the interpretation of qualifications for employment in other fields.

9. The 10 Federal Regional Councils, set up by the President in March of 1969 and made up of the regional directors of HUD, DOL, HEW, OEO and DOT, will develop and coordinate a local program to identify displaced scientists and engineers through local professional societies and in cooperation with community leaders and government, undertake job development and information programs to facilitate their transition into other areas of employment.

STATUS REPORT ON ACTIVITIES OF THE OFFICE OF SCIENCE AND TECHNOLOGY

February 10, 1971

I. DEFENSE

OST NATO Air Operations Panel

The Air Operations Panel has completed the first draft of its report and expects to put it into final form later this month. The panel met on 5, 6, 27, 28 and 29 January, but will not meet again unless serious difficulties arise in the completion of its report. The report will treat the technical aspects of close air support, interdiction, air assault operations, and air defense. Recommendation for improvement of conventional operations will be made. (McRae)

OST NATO Nuclear Weapons Panel

The ad hoc NATO Nuclear Weapons Panel met on 11 and 12 January to continue its investigation of tactical nuclear weapons systems for NATO. The panel will meet on 10 and 11 February to consider the first draft of its report which it plans to complete prior to the end of February. (McRae)

Naval Warfare Panel

The panel met on 21 and 22 January devoting one full day to its continuing investigation of electronic warfare. It also reviewed the growing Soviet submarine threat and considered the FY-72 program for the Underwater Launched Missile System (ULMS). The Navy has completed studies of ULMS configurations as requested by the panel and has adopted a configuration which is consistent with the panel's views. The panel will meet on 18 and 19 February to continue working on its report on electronic warfare as well as to continue its investigation of the implications of the increasing Soviet submarine force. (McRae)

OST NATO Ground Operations Panel

The Panel met on 5, 6 and 7 January and has completed a draft of its final report. Conclusions are now under review, but it appears that in addition to generally recognized deficiencies in anti-armor forces, the report will consider deficiencies in NATO's capabilities for offensive and defensive electronic warfare, air-anti armor and close air support operations, night fighting, and mine/countermine operations.

(McRae)

CBW

The first annual review of chemical warfare and biological research programs has been completed by an interagency group including OST, and forwarded to the President. The recent report of the PSAC CBW Panel treating the defensive biological research program was very useful in this review. (McRae)

II. SPACE - AIRCRAFT

International Cooperation in Space Activities

Two approaches to increased international participation and cooperation in space activities have been pursued: (1) discussions with the Europeans on participation in space shuttle developments and (2) general cooperation with the Soviet Union in a number of areas.

In discussions with the Europeans on space shuttle participation, the United States has offered to provide launch services for appropriate European payloads in return for substantial European contribution to space shuttle development, substantial being interpreted as approximately 10 per cent of development cost. Dr. David is participating as a principal in these discussions. Thus far, the negotiations have not involved definitive commitments, while each side explores the range of alternatives available and the relative costs and benefits.

From the standpoint of the United States there would be a number of benefits from such European participation. Among these would be the dollar value of the European contribution, which would, in turn, reduce the total U.S. cost, and the growing rapport that could be anticipated from relationships developed in such an extensive cooperative program. In return, the United States would give up some high-level technology, which would be made available to the European participants in this program. On balance thus far, it appears that the benefits from such cooperation would exceed potential costs.

It has been made clear to the Europeans that participation in this program is subject to a decision by the United States to proceed with shuttle development. Such decision has not as yet been made, but would be expected late this year.

Significant space cooperation with the Soviet Union appears to be possible, for the first time since this subject has been raised, particularly in view of the very encouraging attitude of the Soviet representatives at recent bilateral meetings in Moscow. The Soviets proposed that working groups of technically qualified representatives of our two nations review cooperative programs and report to their respective Administrations on specific cooperative activities in the following areas:

1. Earth Resources Survey -- The Soviets have proposed an exchange of information based upon aircraft and spacecraft data at sample sites within both nations, including detailed access to ground truth at these sampling sites, as well as ocean observations. Emphasis would be upon space sensors, understanding characteristic signatures, data analysis and processing, and implications for data collection systems.

2. Space Research -- The Soviets have proposed that, in addition to formal exchange of results, we discuss scientific objectives for planetary exploration, exchange future plans for planetary and space probes to enable planning of complementary experiments, and the definition of mechanisms whereby scientists from one country can propose experiments that would be flown on the spacecraft of the other.

3. Space Biology and Medicine -- expanded exchange of information was proposed in these areas.

4. Lunar Sample Exchange -- At the urging of Dr. David, the United States proposed an exchange of lunar samples with the Soviets. This proposal was accepted and is the only area in which the Soviets were prepared to go forward without further detailed discussions. In addition, a broad range of other cooperative lunar planning activity was suggested.

5. Meteorology -- In addition to improved exchange of meteorological satellites for vertical temperature and humidity soundings, application of satellite data to numerical forecasting, and cooperation in the establishment of specific meteorological systems on a shared basis.

Caution:

Lunar Sample Exchange has been publicly announced, but the other areas mentioned above are to be held as confidential, pending approval of the basic terms outlined in a draft agreement prepared as a result of the Moscow meetings. No public discussion of the details of this agreement is to be made pending final approval, which is to occur within 60 days.

In summary, the prospects for significant progress in U.S.-Soviet relationships in space activities appear to be very good, provided that the present attitude of the Soviet government continues to be as favorable as was demonstrated at the recent meetings. (Drew)

Hijacking Panel

The next meeting of the Hijacking Panel will be held in Washington February 25 and 26. A draft Panel report is being prepared and will be distributed for discussion at the meeting. At the January meeting, the Panel heard from a representative of the Israeli government on the scope of their national anti-hijacking program, a representative of the United Kingdom on training of dogs for bomb and weapon detection, and from intelligence sources within the Federal Bureau of Investigation on the character of the anticipated threat to civil aviation. (Drew)

III. ENVIRONMENTAL QUALITY

Proposed Legislation on Electric Power and the Environment

On February 10 Dr. David sent to Congress proposed legislation to facilitate the siting of electric power plants and high voltage transmission lines and to assure that environmental protection is made an integral part of the planning, construction and operation of these facilities. The legislation was proposed by the President in his environmental message of February 8, and implements the recommendations of an interagency task force sponsored by OST's Energy Policy Staff. These recommendations were set forth in the report "Electric Power and the Environment," released to the public last October (see Status Report for October 9, 1970, p. 5). (Barlow)

National Center for Toxicological Research

On January 27, the President announced the establishment at the Pine Bluff Arsenal of a National Center for Toxicological Research. A copy of the press release is attached to this Status Report.

As a result of the President's announcement that the U.S. would renounce the use of biological warfare, Defense Department installations which had been devoted to the production of biological agents became available for other activities. The Science Adviser was asked to consider alternate scientific uses for these facilities. Independently but simultaneously an advising group to the Secretary of HEW recommended that there be established a national laboratory which could examine the biological and human health effects of a number of environmental chemical substances.

Over the course of several months, OST provided assistance in examining the proposal for this undertaking, in developing a budgetary and management plan, and in finding a suitable location. The biological facilities at the Pine Bluff Arsenal were considered and were found to be suitable. The Food and Drug Administration agreed to accept the primary responsibility for administration. Budget arrangements point to a sharing of the funding for FY'72 between FDA and the Environmental Protection Agency - the major interested agencies.

The principal use of the facility will be large-scale animal studies of a number of environmental chemicals. One of the aims of this research will be to examine the low dose ends of dose-response relationships for a number of chemical substances. The scale of the experiments will be dictated by the need for large samples to assure valid statistical results. The specific design of the experiments will rest on a great deal of preliminary basic research. A scientific advisory arrangement is being established.

(Burger)

PSAC Panel on Chemicals and Health

A Panel on Chemicals and Health chaired by John Tukey held its second meeting on February 7-8. The Panel was established to examine a number of broad policy issues surrounding human health and safety and the introduction of chemical substances (such as therapeutic drugs, pesticides, and food additives) into man's surroundings. These questions include the appropriate investment in research on biological effects of chemical substances. From

this, it is hoped will come a rational judgment about such questions as the proper balance between the public and private obligations to provide this research and the relationship between regulatory practices and research findings.

Economic implications of various policy choices are being examined. For example, it has been suggested that incentives for new developments have been discouraged by a growing list of obligations placed on manufacturers by the Federal Government before a product can be marketed.

During the course of the first meeting (Dec. 16-17, 1970) the Panel considered two current subjects as case studies, oral contraceptives and pesticides. The Panel heard from industry representatives their views of the economics of the development of these substances and the degree to which Government regulatory practices perturb this economic picture. The Panel also heard from representatives of NIH and the FDA.

At the February meeting the Panel discussed the levels and sophistication of research needed to reduce uncertainty about chemicals and human health. The following points were evaluated:

1. Adequacy of the present level of investigation into the health effects of environmental chemicals (much of which is currently performed by the private sector at the request of Government). It was pointed out by some of the briefers that there is frequently a gap between the present level of sophistication of the available tools of basic biological investigation and the level of "testing" which is applied to pesticides, drugs and food additives.

2. Materials subjected to testing for safety should be given continual review as new scientific insight is gained. This will inevitably perturb the relative stability desired by the private sector. (Burger)

OST Panel on Technology Forecasting and Health Care

A second meeting was held on January 29 of a panel which is considering an environmental forecasting effort for the Federal Government. (see Status Report for December 8, 1970, p. 3). It is expected that information developed by such a forecasting effort would be used, among other things, to direct investigations into the biological effects of expected environmental contaminants. The Panel is preparing a brief report for the Director of OST which will be available in the next few weeks. (Burger)

OST Task Force on Hazardous Substances

An OST ad hoc advisory group under the chairmanship of Dr. Norton Nelson met on December 21 to consider the general state and availability of scientific information on a number of materials which may find their way into the environment in trace quantities. It was decided that one of the goals of this task force would be to design and test a mechanism for providing scientific information on biological effects, environmental effects, material background distribution, and man-imposed perturbations on the distribution of hazardous substances. The Task Force would approach this by working through at least three case studies -- cadmium, arsenic and polychlorinated biphenyls. (Burger)

IV. FUNDING AND MANPOWER

Federal R&D Budget for FY-1972

On January 28, the day before public release of the Federal Budget for FY-1972, Dr. David briefed about 50 members of the science press on the Budget's science and technology aspects. The Budget proposes significant increases in a number of areas over the funds available in FY-1971, including a 14.7% increase for academic research and a 22% increase for NSF. Dr. David told the press: "The message is that the R&D community can look to the future with confidence."

A copy of the OST press release entitled "Federal Budget for Science and Technology - FY-1972" is enclosed with this Status Report.

(Barlow)

Negotiations to Offset Cuts in the AEC Budget

In the FY 72 budget the AEC Division of Physical Research was cut $12M below FY 71. Negotiations are under way between AEC and NSF to ensure that no first class research is inadvertently dropped. NSF will support these AEC projects out of a portion of the new funds for research which they have received in the budget. It is to be emphasized that this is not a funding transfer in the sense used earlier with the IDL's, National Magnet Lab, etc. However, there are mutual assurances that no important research will be dropped. (York)

Survey of Unemployed Scientists and Engineers

At the urging of OST, the National Manpower Register will undertake a "rapid" survey of unemployed scientists and engineers in the coming months. It is estimated that 313,000 scientists who were surveyed and responded to the April 1970 questionnaire of the National Register will be resurveyed on a short form post-card questionnaire. It is anticipated that the results of this survey will be available in mid June.

(York)

V. NATIONAL MEDAL OF SCIENCE

On January 27 the President announced the nine recipients for 1970 of the National Medal of Science. A copy of the White House press release is attached to this Status Report.

(Barlow)

FOR IMMEDIATE RELEASE JANUARY 27, 1971

Office of the White House Press Secretary

THE WHITE HOUSE

The President today announced that a new, major project aimed at investigating the health effects of a variety of chemicals will be established in the biological facilities of the Pine Bluff Arsenal, Pine Bluff, Arkansas. The new activity is to be known as the National Center for Toxicological Research.

The Center was developed as a result of a growing recognition of two kinds of needs: (1) better approaches to the understanding of what the data acquired from experimental animals means for man, and (2) more extensive facilities for the safety evaluation of the many chemicals in man's surroundings. After an extensive review of possible locations, it became apparent that the biological facilities at Pine Bluff were well suited for this project.

Pursuant to the President's decision to renounce biological warfare and confine our program to biological research for defensive purposes only, as announced on November 25, 1969, the Department of the Army will be engaged in destroying these agents at this location for approximately one year, though some facilities will become excess during that time. The Food and Drug Administration will occupy the excess facilities as the Army vacates them. It is expected that the Food and Drug Administration will take over the entire biological facility in FY-1973.

The Center will examine the biological effects of a number of chemical substances which are found in man's surroundings, such as pesticides, food additives, and therapeutic drugs. The research activities will include appropriate fundamental investigations aimed at understanding the mechanisms of action of these chemical substances, their metabolism in the animal organism and their rates of absorption and excretion. In addition, this Center will afford an opportunity to undertake directed studies aimed at an understanding of dose-response relationships, especially for realistically long exposures to low doses of chemicals. This latter category of research requires the use of large numbers of experimental animals in order to assure valid statistical results.

The National Center for Toxicological Research will be administered by the Food and Drug Administration and is expected to be a useful research resource to that organization in its task of regulating drugs, food additives and other consumer products. In addition, however, the Center is to be considered as a national resource. It will be shared and utilized by other government agencies such as the Environmental Protection Agency. Arrangements are also being considered through which cooperation with industry and the academic community can be realized.

FOR IMMEDIATE RELEASE JANUARY 27, 1971

Office of the White House Press Secretary

THE WHITE HOUSE

The President today announced the recipients for 1970 of the National Medal of Science, the Federal Government's highest award for distinguished achievement in science, mathematics and engineering.

The recipients are:

RICHARD D. BRAUER, Professor of Mathematics, Harvard University, Cambridge, Massachusetts, "For his work on conjectures of Dickson, Cartan, Maschke, and Artin, his introduction of the Brauer group, and his development of the theory of modular representations."

ROBERT H. DICKE, Cyrus Fogg Brackett Professor of Physics, Princeton University, Princeton, New Jersey, "For fashioning radio and light waves into tools of extraordinary accuracy and for decisive studies of cosmology and of the nature of gravitation."

BARBARA MC CLINTOCK, Distinguished Service Member, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, New York, "For establishing the relations between inherited characters in plants and the detailed shapes of their chromosomes, and for showing that some genes are controlled by other genes within chromosomes."

GEORGE E. MUELLER, Senior Vice President, General Dynamics Corporation, One Rockefeller Plaza, New York, New York, "For his many individual contributions to the design of the Apollo System, including the planning and interpretation of a large array of advanced experiments necessary to insure the success of this venture into a new and little known environment."

ALBERT B. SABIN, President of the Weizmann Institute of Science, Rehovoth, Israel, "For numerous fundamental contributions to the understanding of viruses and viral diseases, culminating in the development of the vaccine which has eliminated poliomyelitis as a major threat to human health."

ALLAN R. SANDAGE, Staff Member, Hale Observatories, Carnegie Institution of Washington, California Institute of Technology, Pasadena, California, "For bringing the very limits of the universe within the reach of man's awareness and unraveling the evolution of stars and galaxies -- their origins and ages, distances and destinies."

JOHN C. SLATER, Professor of Physics and Chemistry, University of Florida, Gainesville, Florida, "For wide-ranging contributions to the basic theory of atoms, molecules, and matter in the solid form."

JOHN A. WHEELER, Joseph Henry Professor of Physics, Princeton University, Princeton, New Jersey, "For his basic contributions to our understanding of the nuclei of atoms, exemplified by his theory of nuclear fission, and his own work and stimulus to others on basic questions of gravitational and electromagnetic phenomena."

SAUL WINSTEIN, deceased November 23, 1969; formerly Professor of Chemistry, University of California, Los Angeles, California, "In recognition of his many innovative and perceptive contributions to the study of mechanism in organic chemical reactions."

The National Medal of Science is the highest award of the Federal Government for outstanding contributions to scientific and engineering development. Since 1962, the award has been presented annually to the nation's most distinguished scientists.

Recipients are judged, by a selection committee, to have profoundly changed the whole field of science or engineering in which he works. Six past recipients of the National Medal have later received the Nobel Prize.

The award was established in 1959 by Act of Congress, signed by President Eisenhower. The President's Committee on the National Medal of Science, which assists in making the selection of recipients, is currently chaired by Dr. John R. Pierce, Executive Director, Research Communications Science Division, Bell Telephone Laboratories.

# # #

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY
Washington, D. C. 20506

NOT FOR RELEASE UNTIL FRIDAY, 12:00 NOON, JANUARY 29, 1971

FEDERAL BUDGET FOR SCIENCE AND TECHNOLOGY - FY 1972

The Federal Budget submitted by the President to Congress for Fiscal Year 1972 provides for increases over the FY 1971 levels in total Federal obligations and expenditures for research and development. Markedly increased support is requested for research and development at colleges and universities.

Details regarding these aspects of the new budget are set forth primarily in Special Analysis R, published as a supplement to the Budget of the United States. Highlights include the following:

Total federal research and development up 7.6 % from $15,555 million in FY '71 obligations to $16,737 million in FY '72.

Civilian research (all agencies exclusive of DOD, NASA, AEC), up 13.8% from $2,541 million to $2,891 million.

Defense Department research and development combined, up 12.3% from $7,400 million to $8,309 million.

National Science Foundation total budget up 22% from $507 million to $622 million; its research budget (as opposed to that for development, facilities and training) up 44.5% from $324 million to $468 million.

National Institutes of Health research and development up 11.8% from $1,054 million to $1,179 million.

Research and development in colleges and universities up 14.7% from $1,653 million to $1,896 million - the entire increase coming from the civilian agencies.

In addition to reflecting a high priority placed on research and development, these budget actions illustrate certain other policy directions:

--- Increased emphasis on research aimed at solving society's problems - health, environmental pollution, energy, crime, transportation, etc.

--- A determination to maintain and increase our eminence in basic research with the National Science Foundation playing a central role.

--- The necessity to rely more heavily on increased research and development to maintain an effective defense capability.

Highlights of specific research and development programs include:

National Science Foundation

The NSF budget has undergone a substantial restructuring in terms of its directions and programs. Last year, excluding the Sea Grant Program which was transferred to NOAA, the President requested and the Congress appropriated $507 million for NSF. The new budget provides for $622 million - an increase of $115 million over last year or 22%. A major portion of the increase will be used to establish new directions in research.

There will be substantial increases in the basic research program - in the physical, biological and social science disciplines. New work in these fields will be started, and special attention will be given to the projects supported in the past by the mission agencies, particularly DOD and AEC. Of special note is the transfer to NSF of the 12 university laboratories supporting research in the material sciences which formerly had been supported by the DOD Advanced Research Projects Agency. The research program at NSF will give new emphasis to interdisciplinary work in such fields as oceanography, social sciences, and engineering. The Foundation's national and special research programs will be more than doubled in 1972 to permit expansion and initiation of major coordinated research efforts focused on the development of scientific knowledge for the solution of national problems and advancing the Nation's technology and productivity.

There has been a shift of emphasis in the educational programs at NSF away from efforts to increase the capacity of institutions to train larger numbers of scientists and engineers. Funds for improving the quality of instructional programs in science, including use of computers, will rise $4 million to $37 million.

Consistent with this general shift is the reduction of traineeships and fellowships. The NSF fellowship program will still serve as a means of setting a standard of excellence and according national recognition to the recipients, but with a reduced number of awards. Because the long-term demand for scientists and engineers can be met without special

incentives, traineeship programs aimed at increasing the number of students obtaining advanced degrees in scientific and engineering disciplines continue to be phased out in FY 1972.

The NSF institutional development programs have been reduced consistent with maintaining and improving quality while no longer attempting to increase the number of research-oriented graduate schools and research students. The "formula" or "sustaining" grant program to the heads of institutions will be continued at a slightly reduced level.

National Institutes of Health

The FY 1972 budget continues broad support for biomedical research in all areas and particularly includes an increase of $100 million to undertake an expanded, broadbased effort to conquer cancer. Additional research funds will be provided for studies related to heart disease and tooth decay. Special emphasis will be given to finding a cure for sickle cell anemia. Efforts will be expanded to increase knowledge of human reproduction and to improve the capabilities of parents to plan their families. Other major investigations will be directed toward lung diseases, the effects of environmental pollutants on health, understanding mental illness and drug addiction, and preventing the disabilities and diseases of infancy and early childhood.

In recognition of the nation's need for increased health manpower, the budget includes $95 million for a new initiative in support of health professions schools which will give them greater stability and flexibility in the use of federal grant funds. In addition, the budget provides funds to promote efforts to shorten the curriculum, expand medical school enrollment, train primary care physicians, and increase utilization of physician assistants and other paramedical personnel.

Environmental Research and Development

The most pressing need in meeting environmental problems at this time is the application of what we already know. The budget reflects this need. There is a 33% increase in the overall obligations for environmental related activities bringing the Federal commitment to nearly $5.5 billion. Environmental programs devoted to pollution control and abatement activities are increased 71% from $2.036 billion to $3.127 billion. The major item in this increase is an additional $1 billion in grants to States and localities for new waste treatment plants. The remainder of the increase (approximately $360 million) is spread over a variety of programs ranging from air and solid wastes, reduction of

pollution from federal facilities, expansion of recreational and open space areas, and expanded research, development, and operational activities involved in describing the weather, ocean conditions and disturbances. More than half of the total funds will be in the form of grants, loans, and other financial aid to State and local governments to enable them to improve their own environment.

Research and development activities in selected areas have received substantial increases in funding. Budget authority for research on pollution is increased $36 million (9%) to $426 million, and will increase still further following apportionment of the $85 million to be requested to implement air quality and solid waste legislation and other activities. Support for ecological and other basic environmental research will increase by 50% from $50 million to $75 million, with the largest single increase being in the National Science Foundation.

The Environmental Protection Agency has the largest program in pollution control research and development. There is a $10 million increase (approximately a twofold increase) for sulfur oxides control, and an increase from $2.8 million to $4.6 million for water hygiene research. Research on the health and environmental effects of pollutants, including heavy metals, pesticides, air pollutants, and others will be increased. EPA also has budgeted $10.7 million in foreign currency programs, a threefold increase over 1971, for pollution related research and development work carried out overseas.

National Aeronautics and Space Administration

Despite a slight decrease in total funding for NASA in FY 1972, from $3.38 billion to $3.22 billion, several new program starts are included as part of the NASA program.

In manned space flight, continuation of Apollo lunar missions through Apollo 17 and the Skylab programs for extended manned experience in earth orbit will provide the major thrusts. In addition, $100 million is provided for continued definition of the space shuttle and shuttle engine development.

In space science, the high-energy astronomy observatory (HEAO) will provide a new start on a series of satellites for observations of x-ray, gamma ray and cosmic ray sources.

Support for planetary exploration will go forward at a high level, with the continuation of the Mars orbiter spacecraft in 1971, the Venus-Mercury flyby mission in 1973, early pioneer spacecraft to Jupiter in 1972 and 1973, and the Viking Mars orbiter lander missions in 1975. In addition, work will begin on spacecraft definition for multiple outer planet missions, the so-called "Grand Tour" opportunities, during the latter half of the 1970's.

In applications, the budget provides for continuation of the Earth Resources Technology Satellite, Synchronous Meteorological Satellite, and the large experimental communications platforms in synchronous orbit that will provide experience with deployment of large high-gain antennas. The first of these, ATS F, will be utilized in a cooperative community TV experiment with the Indian government and is planned for launch in 1973.

The NASA aeronautics research and development program will be increased, and the development of a short take-off and landing (STOL) experimental aircraft will be initiated ($15 million).

Department of Defense

The RDT&E budget of the Department of Defense has been increased by $909 million for FY 1972. This 12% increase in Defense research and development represents the bulk of the real increase in the DOD budget. In part, this reflects a major policy decision that it is now time to increase our investment in Defense R&D so as to improve the near term readiness of our non-Vietnam committed forces and to assure their technical adequacy in the longer range. The proposed increase will provide for significant applications of technology which will:

--- Assure continued strategic effectiveness;

--- Provide for modernization of U. S. forces committed to NATO;

--- Improve the effectiveness and protection of the individual soldier;

--- Provide for modernization of the naval forces of this country; and

--- Strengthen the technological base which supplies knowledge for long-range military development.

The support of basic research by the Department of Defense will be held substantially constant in FY 1972.

CONDUCT OF RESEARCH AND DEVELOPMENT

(in millions of dollars)*

Department or agency	Obligations		
	1970 actual	1971 estimate	1972 estimate
Defense—Military functions	7,338	7,400	8,309
National Aeronautics and Space Administration	3,825	3,382	3,215
Health, Education, and Welfare	1,251	1,506	1,637
Atomic Energy Commission	1,346	1,307	1,251
Transportation	315	468	566
National Science Foundation	288	343	495
Agriculture	289	312	321
Interior	160	188	213
Commerce	124	157	181
Environmental Protection Agency	75	118	132
Office of Economic Opportunity	101	116	100
Veterans Administration	59	62	62
Housing and Urban Development	30	52	49
Smithsonian Institution	20	22	31
Justice	10	11	25
Labor	21	24	25
All other	79	87	125
Total	**15,331**	**15,555**	**16,737**

CONDUCT OF RESEARCH

(in millions of dollars)*

Department or agency	Obligations		
	1970 actual	1971 estimate	1972 estimate
Defense—Military functions	1,549	1,472	1,625
National Aeronautics and Space Administration	1,428	1,523	1,582
Health, Education, and Welfare	1,140	1,369	1,478
Atomic Energy Commission	433	423	411
Transportation	48	55	65
National Science Foundation	273	324	468
Agriculture	280	302	311
Interior	120	133	150
Commerce	85	104	130
Environmental Protection Agency	44	74	83
Office of Economic Opportunity	21	23	25
Veterans Administration	56	60	60
Housing and Urban Development	7	13	13
Smithsonian Institution	20	22	31
Justice	7	8	16
Labor	11	12	13
All other	40	42	49
Total	**5,564**	**5,959**	**6,509**

CONDUCT OF DEVELOPMENT

(in millions of dollars)*

Department or agency	Obligations		
	1970 actual	1971 estimate	1972 estimate
Defense—Military functions	5,789	5,928	6,684
National Aeronautics and Space Administration	2,397	1,859	1,633
Health, Education, and Welfare	110	137	159
Atomic Energy Commission	913	883	840
Transportation	267	413	501
National Science Foundation	15	18	27
Agriculture	9	10	10
Interior	40	55	63
Commerce	39	53	51
Environmental Protection Agency	31	41	49
Office of Economic Opportunity	80	93	75
Veterans Administration	2	2	2
Housing and Urban Development	23	39	36
Justice	3	3	8
Labor	9	12	12
All other	40	46	78
Total	**9,767**	**9,595**	**10,228**

CONDUCT OF RESEARCH AND DEVELOPMENT IN COLLEGES AND UNIVERSITIES

(in millions of dollars)*

Department or agency	Obligations		
	1970 actual	1971 estimate	1972 estimate
Health, Education, and Welfare	649	773	880
National Science Foundation	225	253	381
Defense-Military functions	218	207	205
National Aeronautics and Space Administration	131	125	110
Atomic Energy Commission	100	95	86
Agriculture	68	77	83
All other	88	123	152
Total	**1,479**	**1,653**	**1,896**

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AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
Washington, D. C. 20506
November 20-21, 1972

Monday, November 20

Item 1
9:30 - 12:00

Report of the PSAC Panel on Youth - J. Coleman, et al

Lunch
12:00 - 1:00

Executive Dining Room
Room 22 OEOB

Item 2
1:00 - 3:30

Report of the PSAC Panel on Chemicals and Health - J. Tukey, et al

Item 3
3:30 - 5:30

Chairman's Report

Tuesday, November 21

Item 4
9:00 - 12:00

Report of the PSAC Panel on Training for Research in the Biomedical Sciences - L. H. Smith, Jr., et al

Lunch
12:00 - 1:00

Executive Dining Room

Item 5
1:00 - 3:30

Chairman's Report (continued) and Other Business

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NOTES ON PSAC AGENDA
November 20-21, 1972

Item 1 Report of the PSAC Panel on Youth

Dr. Coleman and members of the Panel will present this report to PSAC. A semi-final draft will be mailed to PSAC members on Monday, November 13. PSAC comments will be considered by the Panel in preparing a final draft which will subsequently be presented to the Committee for its approval and separate views, depending on the outcome of the discussion at the November meeting.

Item 2 Report of the PSAC Panel on Chemicals and Health

Since the presentation and discussion of this report at the September PSAC meeting, it has been revised by the Panel to take into account the Committee's comments. The draft to be mailed to PSAC members on Monday, November 13, will be in final form from the standpoint of the Panel. Dr. Tukey and several Panel members will be present at the November PSAC meeting.

The report will be before the Committee for approval, subject to such views as it may wish to transmit to the Panel or to the President.

Item 3 Chairman's Report

Among the topics to be considered is the nomination of four new members to replace those retiring this December 31.

An inquiry sent to PSAC members has resulted in the enclosed responses from Drs. DuBridge and Cairns. Other members are urged to send in their suggestions or submit them at the November meeting.

Some members have asked for the list of names of candidates proposed last year. Except for those persons who were appointed or unavailable, the names included:

Health and Biomedical Sciences

Harry Eagle, Albert Einstein College of Medicine

Social Sciences

Robert M. Solow, Massachusetts Institute of Technology
Richard Nelson, Yale University

Physicists

Harold Brown, California Institute of Technology
Harold Lewis, University of California, Santa Barbara
William Nierenberg, Scripps Institution of Oceanography

Engineers

Jack Ruina, Massachusetts Institute of Technology
Ivan Getting, Aerospace Corporation
Bert Brown, General Electric
William G. Shepherd, University of Minnesota
Manson Benedict, Massachusetts Institute of Technology

Item 4 Report of the PSAC Panel on Training for Research in the Biomedical Sciences

Some 2-3 years ago, special Federal incentives for graduate training for research were phased out of the programs of NSF and AEC. They were preserved in HEW on the basis that a careful re-examination would be made of the need for their continuation. Thus, this is an active issue at present.

The PSAC Panel report addresses the question of responsibility of the Federal Government for the generation of highly trained manpower in the biomedical area and the optimal mechanisms needed for this purpose.

Enclosed is an issues paper prepared by Dr. Leonard Laster of the OST staff that will assist PSAC members in preparing for this item.

The PSAC report will be presented by the Panel chairman, Dr. Smith, with the assistance of Drs. Bennett and Wyngaarden, who also served on the Panel.

PSAC is asked to approve the Panel report. It may wish to suggest changes and to prepare a separate statement of its views for transmittal to the President.

David Beckler

David Z. Beckler
Executive Officer

AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
Washington, D. C. 20506
June 19-20, 1972

Monday, June 19, 1972

Item 1 9:30 - 10:30	Chairman's Report
Item 2	Summit Agreements on Cooperation Between the U. S. and U. S. S. R.
10:30 - 12:30	a. SALT - Jack N. Merritt, NSC Staff
Lunch 12:30 - 1:30	
Item 2 (Continued)	U. S. -U. S. S. R. Agreements
1:30 - 2:30	b. Health - Merlin K. DuVal, Assistant Secretary of HEW for Health and Scientific Affairs
2:30 - 3:30	c. Environmental Protection - G. MacDonald, Council on Environmental Quality
3:30 - 5:30	d. Science and Technology - E. David

Tuesday, June 20, 1972

Item 2 (Continued)	U. S. -U. S. S. R. Agreements
9:00 - 10:30	e. Space Cooperation - George Low, Deputy Administrator, NASA

Tuesday, June 20, 1972 (Continued)

Item 3 — Health Effects Research and Standards
10:30 - 12:30

a. Food and Drug Administration -
Charles C. Edwards, Commissioner
of Food and Drugs

b. Plans for a PSAC Report

Lunch
12:30 - 1:30

Item 1 (Continued) — Chairman's Report and Committee Discussion of Agenda Items
1:30 - 3:30

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AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
Washington, D. C. 20506
May 22-23, 1972

Monday, May 22, 1972

Item 1 — Chairman's Report
9:30 - 12:30

a. Far East Trip
b. Further discussion of Limits to Growth
c. Highlights of OST Spring Program Review

Lunch
12:30 - 1:30

Item 2 — The Computer Industry in Japan and Its Meaning for the United States - Gerald Mitchell, Western Electric Company
1:30 - 3:00

Item 3 — Environmental Health Research - David P. Rall, Director, National Institute for Environmental Health Sciences, NIH
3:00 - 5:30

Tuesday, May 23, 1972

Item 4 — Health Effects Research and Standards-Setting - Environmental Protection Agency
9:00 - 12:30

Lunch
12:30 - 1:30

Item 1 (Continued) Chairman's Report
1:30 - 3:30

d. PSAC statement on RECAT

Item 5 — Other Business
3:30 -

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NOTES ON AGENDA
PSAC MEETING
May 22-23, 1972

Item 1 Chairman's Report

a. Dr. David will report on his trip to Taiwan, Korea, and Japan. A copy of the press release announcing the visit and the members of Dr. David's party is enclosed.

b. Dr. Luenberger attended the meeting of the Committee on Science and Public Policy April 23-24 and will give his summary impressions of that meeting. There will be a further discussion of Limits to Growth.

c. Dr. Baldeschwieler will highlight issues identified in the OST Spring Review. The topics reviewed included:

National Security: International science and technology; think tanks; productivity in R&D; foreign technology; and weapons systems modifications.

Human Resources: Biomedical research; narcotics; environmental health; basic research in the AEC; population research; and education.

Civilian Technology: R&D programs in HUD; PRT/Dual Mode transportation systems; STOL/VSTOL; and the SST Climate Impact Assessment Program.

Natural Resources: LMFBR; Office of Coal Research programs; coal mine health and safety; pesticide R&D; nutrition; sludge disposal; thermal discharge; waste water R&D; and earthquake programs.

Item 2 The Computer Industry in Japan and Its Meaning for the United States

This item was deferred from the April PSAC meeting. A case study of the Japanese computer industry and its meaning for the United States will be presented by Mr. Gerald Mitchell, Manager, Electronic Switching Systems Development, Western Electric Company. This study was chaired by Dr. Donald Ling and was carried out under the auspices of the NAS Computer Sciences Board. It is one of several planned country studies.

Item 3 Environmental Health Research

Dr. David P. Rall, Director of the National Institute for Environmental Health Sciences, NIH, will present the report of the Interagency Ad Hoc Committee on Environmental Health Research, which he chaired. The Committee, sponsored by OST and CEQ, reviewed the research activities of the government aimed at understanding the health effects of environmental agents. It considered how scientific information is used in regulatory decision-making and offered recommendations about the research program and on the coupling of the research to decision-making. Its findings are based on several case studies.

The Committee's report (in draft form) was not completed in time to include with the Agenda mailing. When it is finished, however, Dr. Rall will mail it directly to PSAC members from his office in North Carolina.

Item 4 Health Effects Research and Standards-Setting

Having the background of the presentation and discussion of Item 3, the Committee will hear presentations from the staff of the Environmental Protection Agency on the EPA air pollutant effects research program and the EPA air pollution standards-setting process and rationale. This briefing was requested by the Committee as a result of its consideration of the RECAT report at the March meeting.

These presentations and discussions will provide the Committee with background relevant to the work of the PSAC Panel on Chemicals and Health and may provide a sufficient basis for the development of a PSAC position on the adequacy of environmental health research in relation to the standards-setting process. The draft statement prepared by Drs. Tape, Bennett and Fitch, which was briefly discussed at the April meeting, will be reconsidered for final action by the Committee.

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AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
April 17-18, 1972

Monday, April 17, 1972

Item 1
9:30 - 10:30 — Chairman's Report

Item 2
10:30 - 12:30 — Report on the Unit Cost of Military Systems - E. Fubini

Lunch
12:30 - 1:30

Item 3
1:30 - 4:00 — International Transfer of Technology -

a. Status of FCST Study - W. Schmidt, Treasury

b. Motives and Mechanisms for the International Transfer of Technology - R. Miller

c. The Computer Industry in Japan and Its Meaning for the U. S. - D. Ling

Tuesday, April 18, 1972

Item 4
9:00 - 11:30 — Personal Rapid Transit Systems - L. Goldmuntz

a. Jack Irving, Vice President, Aerospace Corporation

b. Edward Anderson, University of Minnesota, and Chairman of the 1971 National Conference on Personal Rapid Transit

Item 1 (Continued)
11:30 - 12:30

Lunch
12:30 - 1:30

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Tuesday, April 18, 1972 (Continued)

Item 5 1:30 - 2:30	Technical Manpower Reemployment Program for Aerospace Scientists and Engineers - J. Kelly, Department of Labor
Item 6 2:30 - 3:30	Other Business

NOTES ON AGENDA
PSAC MEETING
April 17-18, 1972

Item 1 Chairman's Report

Item 2 Report on the Unit Cost of Military Systems

Dr. Eugene Fubini, formerly Assistant Secretary of Defense for R&D, now a private consultant, will present the results of his study for the Defense Science Board on the unit cost of tactical aircraft avionics. OST staff members who attended the briefing rate it highly and feel that it has implications for government programs outside of Defense.

Item 3 International Transfer of Technology

An ad hoc Committee on International Transfer of Technology was established by the Federal Council for Science and Technology in May 1971 to examine the impact of the transfer of U.S. technology abroad on the U.S. competitive position in the world market and the impact on the domestic economy. The interagency study has been carried out under the leadership of the Department of the Treasury.

Dr. Wilson Schmidt, Director of Research at Treasury, will introduce the item with a status report on the FCST study which is nearing completion of the analytical phase. Policy issues have not yet been identified nor have policy alternatives been examined.

The enclosed report of the Task Force on Motivations and Mechanisms for the International Transfer of Technology will be presented by Richard Miller, an OST consultant, and formerly a Vice President of R.C.A. This report, based on field interviews with a selected number of U.S. firms, will be of particular interest to the Committee.

A case study of the computer industry in Japan and its meaning for the United States will be presented by Dr. Donald Ling, formerly with the Bell Telephone Laboratories. This study was carried out under the auspices of the NAS Computer Sciences Board and is one of several planned country studies. It has not yet been reviewed within the NAS, so PSAC members should regard its conclusions as tentative and the interpretations Dr. Ling's.

Also enclosed for background reading is a report by the Emergency Committee for American Trade on the Role of the Multinational Corporation in the United States and World Economies.

Item 4 — Personal Rapid Transit Systems

At its March meeting, the Committee was briefed on the report on Cumulative Regulatory Effects on the Cost of Automotive Transportation. It was agreed to follow up the meeting with discussions of (a) the status of health effects research and the process of standards-setting and (b) new transportation technologies, particularly systems for personal rapid transit.

Due to scheduling difficulties, the PRT briefing is included in this agenda. Health effects will be taken up at the May meeting.

The Committee will hear about the PRT systems studies conducted at the Aerospace Corporation and the results of the National Conference on Personal Rapid Transit held last November in Minneapolis, Minnesota.

Enclosed for your information are documents distributed at the March meeting: a speech by L. Goldmuntz of the OST staff on New Urban Technologies and a paper by L. Bush of the Aerospace Corporation on The Economics of High-Capacity PRT Systems.

Item 5 — Technical Manpower Reemployment Program for Aerospace Scientists and Engineers

J. Kelly, of the Department of Labor, will bring the Committee up to date on the results of the Technical Manpower Reemployment Program in providing training and job opportunities for unemployed scientists and engineers in the aerospace industries.

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MAR 14 1972

AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
March 20-21, 1972

Monday, March 20, 1972

Item 1 — Chairman's Report
9:30 - 12:00

a. PSAC Statement on Laser-Induced Fusion

b. Further Discussion of the PSAC Work Program for 1972

Lunch
12:30 - 1:30

Item 2 — Environmental and Safety Questions on Nuclear Reactor Licensing
1:30 - 3:30
L. Rogers, Division of Radiological and Environmental Protection, and S. Hanauer, Division of Reactor Licensing, Atomic Energy Commission

Item 3 — Earthquake Hazards Program - U.S. Geological Survey
3:30 - 5:30

Tuesday, March 21, 1972

Item 4 — Report of the Ad Hoc Committee on Regulatory Effects on the Costs of Automotive Transportation (RECAT) -
9:00 - 12:30
Alan Berman, Director of the Naval Research Laboratory

Lunch
12:30 - 1:30

Item 5 — Other Business
1:30 -

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NOTES ON AGENDA
PSAC MEETING
March 20-21, 1972

Item 1 Chairman's Report

a. PSAC Statement on Laser-Induced Fusion. A question has raised by the OST staff concerning the PSAC statement on laser-induced fusion that warrants further discussion by the Committee; i. e., the Committee's assessment that "at present, we conclude that the prospects of the laser-pellet approach to obtaining power are remote." Drs. Gage and Balzhiser will present their comments.

b. Further Discussion of the PSAC Work Program for 1972. Following the February meeting, Dr. Piore agreed to define further the proposal for a PSAC study on Goals in Science and Technology (GIST), a copy of which was distributed at the February meeting. (It was proposed that PSAC prepare a report incorporating its views on science and technology policy in a number of areas of national concern that might serve as a basis for planning policies and programs beyond January 1973.) Although Dr. Piore will be unable to attend this meeting, the Chairman invites further discussion of this study proposal. Dr. Baldeschwieler will comment on the possibilities for relating this effort to an examination of program issues for the FY 1974 budget.

Item 2 Environmental and Safety Questions on Nuclear Reactor Licensing

At the PSAC meeting last October, the Atomic Energy Commission staff briefed the Committee on the status of AEC R&D efforts, and the adequacy of current technology, to assure nuclear reactor "safety." At this meeting, the AEC staff will discuss the environmental effects of nuclear power in light of the recent Court of Appeals decision, which called for an extensive risk/benefit analysis to consider and balance the environmental effects of the nuclear facility and alternatives for reducing or avoiding adverse environmental effects. Particular emphasis will be given to rule-making hearings on radioactive releases from nuclear power plants and emergency core cooling systems in nuclear power plants.

Item 3 Earthquake Hazards Program

There will be a briefing by the U. S. Geological Survey on the FY 73 R&D program aimed at minimizing earthquake hazards. The earthquake program is a multi-faceted one. It includes engineering studies based upon lessons learned from the San Fernando Valley earthquake, which produced damaging ground motions considerably in excess of what was expected from an earthquake of that magnitude. These will include strong-motion studies, evaluation and mapping of hazards as a function of local geologic conditions, and development of improved design standards for earthquake resistant structures. The earthquake prediction and control programs will require a more basic research program to start. The prediction research is based upon a partially confirmed hypothesis that appropriate instrumentation along an active fault will detect "forerunners" in the form of more or less systematically aligned microearthquakes, changes in tilt or water table, or variations in electrical or magnetic properties. It is not known with what accuracy a prediction might be made; the appropriate public response will have to be developed when and if the research shows favorable results. The proposal for research on earthquake control is based upon an extrapolation of the observation of microearthquakes induced by injection of fluids into deep wells in oil field secondary recovery operations. The hypothesis is that it may be possible to relieve accumulated strain in the rocks by a series of small, artificially induced earthquakes producing relatively little damage rather than by a single great natural earthquake.

In millions of dollars, the earthquake budgets for FY 72 and FY 73 are as follows:

	FY 1972	FY 1973
NOAA	5	8
USGS	4	10
NSF	3	6
Totals	12	24

Item 4 — Report of the Ad Hoc Committee on Regulatory Effects on the Costs of Automotive Transportation (RECAT)

Dr. Alan Berman will brief the Committee on the report of the ad hoc Committee on this subject, established by the OST in April 1971. The Terms of Reference of the panel were distributed with the February agenda, but the presentation was postponed to the March meeting. The printed report will be available about the middle of the week of March 13 and will be mailed if there is time in advance of the meeting.

One of the purposes of the PSAC discussion is to consider the broader implications of this type of study in terms of the needs and mechanisms for continuing analytical studies and assessments of this type involving the interests of several departments and agencies. Another such issue which is planned for the April meeting of PSAC is the study of International Transfer of Technology which was conducted under the auspices of the Federal Council for Science and Technology.

AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
February 21-22, 1972

Monday, February 21, 1972

Item 1 — 9:30 - 12:30 — Chairman's Report

a. Further Observations on the FY 1973 R&D Program

b. Presidential Message on Science and Technology

c. PSAC Work Program for 1972

Lunch — 12:30 - 1:30

Item 2 — 1:30 - 3:30 — Superconductors -- Their Development and Applications - B. W. Birmingham, et al

Item 2 (Continued) — 3:30 - 5:30

Tuesday, February 22, 1972

Item 3 — 9:00 - 12:00 — Report of PSAC Panel on Health Services Research and Development - Kerr White, et al

Lunch — 12:00 - 1:00

Item 4 — 1:00 - 2:30 — Report on the Cumulative Regulatory Effects on the Costs of Automotive Transportation (RECAT) - Alan Berman, Naval Research Laboratory

Item 5 — 2:30 - 4:00 — Other Business

NOTES ON AGENDA
PSAC MEETING
February 21-22, 1972

Item 1 Chairman's Report

a. Further Observations on the FY 1973 R&D Program. Dr. David will report on developments since the President's budget was submitted to the Congress, including observations based on a series of briefings that he has been giving to industry, university, and other groups.

b. Presidential Message on Science and Technology. In his State of the Union address, the President said:

> "I shall soon send to the Congress a special message proposing a new program of Federal partnership in technological research and development -- with Federal incentives to increase private research, and federally supported research on projects designed to improve our everyday lives in ways that will range from improving mass transit to developing new systems of emergency health care that could save thousands of lives annually."

The preparation of the initial draft has been undertaken by the OST. Dr. David will discuss its general outlines with the Committee and will solicit suggestions concerning the substance of the message.

c. PSAC Work Program for 1972. This will be a continuation of the discussion begun at the January meeting of the Committee. Statements are being prepared on the objective of the proposed PSAC Panel on Technology Policy and on the proposal that the Committee as a whole develop a statement on federal policies and programs on science and technology which could be submitted early next year. The question of the future direction of the American educational system, discussed at the January meeting (e.g., the long-term effects of court decisions on busing), will be the subject of remarks by Dr. Coleman.

Item 2

Superconductors -- Their Development and Applications. There will be a presentation on superconductivity, led by Mr. B. W. Birmingham of the National Bureau of Standards, Boulder, Colorado. After an overview statement by Mr. Birmingham, the materials problems and the near- and far-term applications will be covered. This briefing, like the January discussion of lasers, is designed to highlight important new technologies and to develop a consensus by PSAC on the importance and direction of this area of R&D and organization of the federal government.

Enclosed is a copy of the final version of the PSAC statement on lasers. A question has been raised for further discussion concerning the assessment that "At present, we conclude that the prospects of laser-pellet approach to obtaining power are remote."

Item 3

Report of PSAC Panel on Health Services Research and Development. Dr. Kerr White, Chairman of the Panel and Professor of Medical Care and Hospitals, Johns Hopkins School of Hygiene and Public Health, together with other members of the Panel, will present the final report of the PSAC Panel. Enclosed is the final report and the Charge to the Panel.

Item 4

Report on the Cumulative Regulatory Effects on the Costs of Automotive Transportation (RECAT). In April 1971, the OST established an ad hoc committee concerned with cumulative regulatory effects on the costs of automotive transportation. The study group was located in the Naval Research Laboratory, headed by its Director, Dr. Alan Berman. The OST turned to NRL because of its breadth of talent and technical competence, as well as its neutral position with respect to automotive safety and environmental regulation. The Terms of Reference of the Panel are attached.

The report of the Panel will be publicly available within the next several days, and will be mailed to PSAC members if there is sufficient time in advance of the meeting. This type of study has implications that go well beyond the specific subject matter as regards the need for and method of conducting analytical studies and assessments of this type that involve trade-offs across the different responsibilities

and interests of several federal agencies. Based on this experience, it appears that there is a need to have a more systematic method of identifying the problems requiring this type of analysis and for allocating the responsibility for carrying them out. The PSAC members should have this broader aspect in mind, as well as the specifics of the RECAT study.

AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Old Executive Office Building
January 17-18, 1972

Monday, January 17, 1972

Item 1 9:30 - 12:30 — Chairman's Report

a. FY 73 Federal R&D Outlook

b. PSAC Program for 1972

c. Status Report on Chemicals and Health Panel - E. Burger

Lunch 12:30 - 1:30

Item 2 1:30 - 4:00 — Laser-Pellet Fusion Research - AEC Representatives and Others

Tuesday, January 18, 1972

Item 3 9:00 - 11:30 — Research Applied to National Needs - Alfred Eggers, Assistant Director for Research Applications, NSF

Lunch 12:00 - 1:00

Item 4 1:00 - 2:30 — Report of the Commission on Population Growth and the American Future - Charles F. Westoff, Executive Director

Item 5 2:30 - 4:00 — Other Business

NOTES ON AGENDA
PSAC MEETING
January 17-18, 1972

Item 1 — Chairman's Report

a. FY 1973 Federal R&D Outlook. Dr. David will discuss some of the directions of the FY 1973 R&D program as reflected in the results of the budget preparation.

b. PSAC Program for 1972. Dr. David would like the Committee to consider concentrating its efforts during 1972 on the preparation of a report on science and technology for submission to the President shortly after the January 1973 Inauguration. Such a report, prepared largely by PSAC members, would aim at policy and program recommendations and guidelines for the Presidential term. Enclosed are reports by Presidential ad hoc task forces on science policy which will provide useful background for Committee discussion. Also enclosed is a report by the Science Council of Canada which suggests another approach to the framing of a comprehensive report on science policy. If Committee members wish to pursue this task, it will be necessary to discuss terms of reference, organization and membership (including the need for an intensive period of activity during the summer).

Item 2 — Laser-Pellet Fusion Research. Representatives from the AEC weapons laboratories (LRL, LASL) and the NRL will review the progress of high power laser development and irradiation experiments designed to improve the understanding of laser-pellet interaction mechanisms. The representatives will discuss the possibility of demonstrating feasibility of laser-pellet fusion devices and their research programs to achieve this objective.

Item 3 — Research Applied to National Needs. Dr. Albert Eggers, NSF Assistant Director for Research Applications, will review the RANN program, together with members of his staff. Attached is a recent brochure describing the

objectives and general nature of the program. This presentation is important and timely from the standpoint of the increasing emphasis on directed research and the role of the NSF in this regard.

Item 4 — Report of the Commission on Population Growth and the American Future. Mr. Charles Westoff, Executive Director of the Commission on Population Growth, will discuss substantive issues which have been highlighted over the past several months and will indicate the tenor of the recommendations that will be emerging. Committee reactions will be helpful to the Commission. Enclosed for background information is an interim report by the Commission, issued last March.

AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Executive Office Building
December 20-21, 1971

Monday, December 20, 1971

Item 1 9:30 - 12:30 — Chairman's Report

a. Federal Water Pollution Control Act Amendments of 1971 - W. Butcher

b. PSAC ad hoc Group on Community Development and Research - P. Moynihan

c. Superconductivity - G. Tape

Lunch 12:30 - 1:30

Item 2 1:30 - 3:00 — System Dynamics - Jay Forrester, Professor of Management, M.I.T.

Item 3 3:00 - 4:30 — International Science Issues - H. Pollack, Director of the Bureau of International Scientific and Technological Affairs, Department of State

Tuesday, December 21, 1971

Item 4 9:00 - 11:30 — An Assessment of the Current U.S. Naval Capability With Respect to NATO Commitments, Report by PSAC Panel on Naval Warfare - I. Getting, et al.

Item 5 11:30 - 12:30 — An Assessment of the Soviet Space Program - October 1970, Report by a PSAC ad hoc Panel - Allen Donovan

Lunch 12:30 - 1:30

Item 6 1:30 - 3:30 — Other Business

Note: The report of the Naval Warfare Panel will be distributed Monday afternoon for reading prior to the Tuesday a.m. presentation.

NOTES ON AGENCA
PSAC MEETING
December 20-21, 1971

Item 1 Chairman's Report

a. Federal Water Pollution Control Act Amendements of 1971. Dr. Butcher will report on the status of this legislation, which would set as a national goal that "the discharge of pollutants into the navigable waters be eliminated." A panel of water quality specialists was convened by Dr. David to consider this legislation. A copy of its report is attached.

b. Community Development and Research. Following the November meeting of PSAC, an ad hoc group was convened by Professor Moynihan to explore the area of community development and research. Pat Moynihan will report on the results of the meeting held December 19.

c. Superconductivity. Another topic identified at the November PSAC meeting for attention by the Committee is the area of superconductivity, which had been the subject of an earlier communication from Dr. Garwin. Dr. Tape will report on his further discussions with knowledgeable individuals and will propose that a briefing on superconductivity be given at the February meeting of the Committee.

Item 2 System Dynamics

Jay Forrester, Professor of Management at M.I.T., will discuss a new approach to social systems based on the application of system dynamics. The general approach is outlined in the attached reprint from Technology Review.

By making some fairly natural assumptions about the inter-relations between such things as capital investment and pollution, population density and quality of life, and natural resource expenditure, among others, dynamic forecasts are made of the values of these quantities into the future. Through this simulation, it might be possible to determine, at least roughly, the long-range impact of programs of birth control, pollution abatement, etc.

Action: If the Committee is of the view that this new approach to social systems should be strongly encouraged by the federal government, it may wish to consider possible next steps, such as the convening of an ad hoc group to further explore the possibilities and recommend an action program.

Item 3 International Science Issues

Mr. Herman Pollack, Director of the Bureau of International Scientific and Technological Affairs, Department of State, has been asked to discuss the broad area of international science as viewed from his vantage point in the Department of State. Norman Neureiter has prepared the attached background note on current international science issues of possible interest to the Committee.

Action: Over the years PSAC has approached international science matters in a number of ways: (a) a PSAC international science panel to serve as a sounding board and adviser to State's office of international scientific affairs, with reports on a series of selected topics; (b) PSAC ad hoc groups on special issues, e.g., development assistance, U.S.-U.S.S.R. cooperation; and (c) PSAC subpanels on the international aspects of domestic programs, e.g., international space cooperation. It is timely for the Committee to take another look at this question and the extent to which it wishes to become involved in international science and technology issues.

Item 4 An Assessment of the Current U.S. Naval Capability With Respect to NATO Commitments

The Naval Warfare Panel will present tentative findings of its recent review of the technical aspects of our NATO naval posture. Its deliberations focused primarily on U.S. naval forces, though some consideration was given to some aspects of allied naval capabilities. The Panel reviewed a substantial number of R&D programs in an attempt to set priorities on those efforts directly involved in the support of NATO.

Action: The report is before the Committee for its review and comment prior to finalization. Due to its security classification, copies of the report will be distributed for reading in the Conference Room Monday afternoon.

Item 5 An Assessment of the Soviet Space Program - October 1970

A special Panel of the PSAC, chaired by Dr. Allen Donovan of the Aerospace Corporation, has been reviewing Soviet space program activity and will be reporting on the results of that review. This Panel has been in existence for a number of years and last reported to the PSAC in October 1970. The present report will review progress in the Soviet space program over the past year and provide projections of anticipated Soviet activities in both manned flight and space science programs. The material is based upon both open-source and intelligence data and therefore the report will be available only at the meeting.

Action: In light of anticipated Soviet achievements, PSAC will be asked to approve the report for possible transmission to the President.

December 10, 1971

International Science and Technology

International science and technology is not an easy subject to summarize. Individual programs and projects are too diverse, their motivations too varied to permit simple categorization, or ready formulation of a comprehensive policy. However, as an introduction to Herman Pollack's presentation, this brief paper mentions a number of the issues with which those who deal in international science and technology policies and operations in the Government are presently concerned.

One of the most critical policy issues relates to the role of the Government in international technological cooperation. International commercial competition in the world is increasing. America's high technology export capability is increasingly challenged in world markets by firms of other countries. Development costs for new technologies continue to mount, taxing a private firm's ability to carry them, and Governments throughout the world are increasingly subsidizing their industries to keep them competitive. Furthermore, the application of many systems, such as space-based communications or aeronautical control satellites are not questions which can be decided by one nation acting alone.

A key policy question is to what extent should the U.S. Government enter into relationships with foreign governments in the development and

application of new technologies, particularly in areas where at the present moment the U.S. is in a commanding technological position. Specific examples now before the House are (1) sharing with other countries of U.S. gaseous diffusion technology for uranium enrichment; (2) a possible cooperative role for other nations in the Post-Apollo space program; (3) joint development, operation, and ownership of a North Atlantic air traffic control satellite (aerosat); and (4) future application of earth resources sensing technologies.

A second broad issue in this area is whether the U.S. Government should take explicit steps to attempt to maximize the use of the world's technical resources in both basic research and applied research on social technologies.

Should the U.S. seek, in a structured way, to intensify the links between U.S. scientists and their institutions with those abroad in order to maximize the return of new knowledge from the R&D investments by the world's nations? In the big science areas such as high energy physics, astronomy, radioastronomy, etc., but also in fields of biomedical research, environmental health studies, etc., this would appear highly desirable. In the varied fields of applied research relating to societal problems (often lumped broadly under environment) such as air and water pollution control, urban decay, housing technology,

earthquake prediction and control, etc., where many nations share identical problems, more cooperation appears essential to permit nations to combine their resources on finding solutions. The CCMS activity in NATO has proved to be an innovative and useful approach to international cooperation in this area.

Related to these problems are the activities of the many international organizations such as OECD and the specialized agencies of the UN, all of whom now have programs touching on science and technology. There may be an attempt at the Stockholm Environmental Conference next year to try to define the appropriate roles for various of these organizations in the environmental field. There are also the demands of the developing nations for increased assistance in furthering their own economic progress. A split between developed and developing nations is appearing in preparations for Stockholm with the LDC's looking upon the environmental preoccupations of the developed nations as a constraint upon LDC development.

A final issue is the use of scientific and technical programs as active instruments of U.S. foreign policy. This has been particularly important with the socialist nations where scientific and technical exchange programs have often been the main areas where a harmonious relationship has been possible. These activities continue to expand

with many nations. A question of top interest is whether it will be possible to develop this aspect of U.S.-Chinese relations in the period following the President's trip. Certainly, science and technology have been very important in our revitalized ties with Romania and Yugoslavia since the President's visit to those countries.

Funding these scientific programs, undertaken for foreign policy reasons, has not always been easy, particularly in a period of sequeezed science budgets. Our strategy has been to look to NSF to include, with State and OST guidance, appropriate requests in their annual submission to cover these programs. However, in a trade-off between domestic science and these foreign policy-oriented programs, the nature of NSF's principal mission means that domestic science wins. OMB has now initiated with OST a staff study to deal with this problem of funding international science programs and we hope a resolution of this issue will be forthcoming next year.

In general, OST has taken the position that the Department of State's role in managing and coordinating the rapidly proliferating international scientific and technical efforts of the U.S. Government should be strengthened. Despite serious personnel ceiling limitations in the past, it appears that our efforts this year have been successful. Furthermore, State has shown new leadership in trying to coordinate

interests of many agencies in a number of programs, such as in the use of the PL-480 excess currencies abroad. Our intention would be that State, through a continuous liaison with OST, would make sure that its positions taken on international science matters were fully consistent with domestic interests as viewed from the Executive Office. A clearer definition of the relationships between the agencies, State, OST, OMB, and the budget process will be expected to emerge from the OMB-OST study.

PSAC members should be prepared to raise with Mr. Pollack any issues in this area which they may feel to be of pressing concern.

Norman P. Neureiter

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AGENDA
PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Room 208, Executive Office Building

Monday, November 15, 1971

Item 1
9:30 - 11:00 Chairman's Report

a. Technological Opportunities
b. Cannikin Test - G. Moe

Item 2
11:00 - 12:30 Research in Community Development - HUD R&D Program - H. Finger, D. Luenberger

Lunch
12:30 - 1:30

Item 3
1:30 - 3:30 National Policy for Technology, a report of the National Science Board - T. Jones et al

Item 4
3:30 - 4:30 Federal Computer Policy - J. Cunningham, OMB

Tuesday, November 16, 1971

Item 5
9:30 - 10:30 Research on Aging - Dr. Charles Lowe et al, L. Laster

Item 6
10:30 - 12:30 Space Shuttle Issues and Options - A. Flax, et al

Lunch
12:30 - 1:30

Item 7
1:30 - 3:30 Other Business

a. Status of Energy R&D Studies and Program - R. Balzhiser
b. Federal Policies on Protection of Privacy - M. Noll
c. Committee Discussion

NOTES ON AGENDA
PSAC MEETING
November 15-16, 1971

Item 1 Chairman's Report

a. Cannikin Test. Gordon Moe will report on considerations leading to the Presidential decision to proceed with Cannikin and on the environmental effects of the test.

b. Technological Opportunities. The President has indicated to Dr. David that he would like to be briefed on new developments in science and technology that have major potential for applications. Accordingly, Dr. David would like to discuss with PSAC specific topics on which the Committee would be interested in preparing (15-minute) briefings for the President. Several possibilities come to mind: Superconductors, Automation and Computers, and Superconductivity -- topics that the Committee identified last spring (see attached communication from Richard Garwin on technological opportunities in the application of superconductivity). Attached for your consideration is a list of topics circulated before the October PSAC meeting which included water desalting, weather modification, earthquake prediction and control, unconventional automobile propulsion, and high power lasers.

Item 2 Research in Community Development. The research program of the Department of Housing and Urban Development is broadening its focus to encompass, in addition to building technology, more of the total dimension of community development. The corresponding new areas of research often involve social experimentation as well as analytical conceptualization and may have a significant impact on subsidy proposals and urban growth policies.

Some of the research programs presently under way include: (a) Integrated Utilities Demonstration to provide more efficient utility service while reducing pollution; (b) Housing Allowance Experiment to test various proposed new subsidy schemes; (c) Public Housing Management Experiment to develop management structures; and (d) Urban Analysis to better understand the nature and causes of growth patterns, the formation of blighted areas, and the relationships between government and

planning. Documents describing the Integrated Utilities Demonstration and Housing Allowance Experiment are enclosed. These were prepared as part of the Technological Initiatives exercise.

Dr. Harry Finger, Assistant Secretary of Housing and Urban Development, will open this Item with a presentation of the HUD approach to R&D in this area. This will be followed by an Executive Session, when Dr. David Luenberger of the OST staff will speak to the problem of defining and developing the Federal R&D program in this area and will make proposals to the Committee for possible follow-up actions.

Item 3 — National Policy for Technology. The enclosed report, prepared by a committee of the National Science Board headed by Dr. H. G. Stever, will be presented, in Dr. Stever's absence, by Dr. Tom Jones, President of the University of South Carolina, and possibly other members of the NSB Panel. The report is being presented to gain the benefit of PSAC reactions. The Committee may wish to consider what steps should be taken to implement the findings of the report, if accepted by NSB and PSAC.

Item 4 — Federal Computer Policy. Joseph F. Cunningham, Chief of the Office of ADP and Property and Supply Management in the Office of Management and Budget, will brief the Committee on Executive Office policies concerning the management of computers.

The OMB (together with GSA and the National Bureau of Standards) has statutory responsibility for policy development on computer procurement and utilization by the Executive Branch. This briefing was suggested at the October meeting of PSAC after questions were raised concerning policies on the use of computers for research purposes, particularly the use of government computer facilities for academic research.

Item 5 — Research on Aging. On October 6, 1969, the President called for a 1971 White House Conference on Aging "to consider the many factors which have a special influence on the lives of the aging and to submit recommendations to all levels of government and the private and voluntary sectors as well." (The White House press release is enclosed.) Dr. Charles Lowe and others from the National Institute for Child Health and

Human Development will discuss the on-going research and research opportunities on aging. Dr. Laster will summarize the views of consultants OST has convened to examine the NICHHD research program. An objective is to make a contribution to the work of the White House Conference. (Laster memorandum to PSAC members attached.)

Item 6

Space Shuttle Issues and Options. The PSAC ad hoc Space Shuttle Panel chaired by Dr. Alexander H. Flax, President of IDA, has been reviewing NASA plans for the development of a reusable space transportation system in order to provide both OST and OMB an independent assessment of this program and its relationship to our national goals and objectives in space. The Panel began its study with a comprehensive program review in August and has continued meeting on a monthly basis, during which time extensive additional inputs have been received from NASA, DOD and the principal aerospace contractors. An assessment of this program has been difficult, since the design approach to a reusable space launch system has been evolving rapidly as new approaches are proposed or new criteria are established. The study and technology development phase of the shuttle program has been under way for about two years and despite the rapid evolution of the designs over recent months, it is the view of NASA that a development decision should be made as part of the FY 73 budget. As an input to this decision process, Dr. Flax has summarized panel views on the NASA approach and has outlined a number of alternatives to the full-scale development program proposed by NASA. The principal issues involve: (1) the level of space flight activity that can be envisaged for the decade of the '80s, (2) future character and pace of a manned space flight program, (3) the state of technology in several critical areas such as structure, reusable thermal insulation, and high specific impulse reusable propulsion systems. Dr. Flax will discuss these issues and preliminary findings of the Panel.

AGENDA

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

Monday, October 18, 1971

Room 208, Executive Office Building

Item 1
9:30 - 10:30 Chairman's Report

a. PSAC Membership
b. O. E. C. D. Ministers of Science Meeting

Item 2
10:30 - 12:30 PSAC Panel on Health Services R&D
A Status Report on Emerging Issues, by
Dr. Kerr White, Johns Hopkins University

Lunch
12:30 - 1:30

Item 3
1:30 - 5:30 New Technological Initiatives

a. Status Report -- L. Goldmuntz
b. Specific Issues -- OST Staff
c. Selected Scientific and Technological Initiatives for PSAC Follow-up -- PSAC discussion

Tuesday, October 19, 1971

Item 4
9:00 - 11:30 Environmental Effects of Nuclear Power
Presentation by the Atomic Energy Commission

Item 5
11:30 - 12:30 Strategic Long-Range Standoff Weapons --
A Report by an OST ad hoc Panel

Lunch
12:30 - 1:30

Item 6
1:30 - 3:30 PSAC Discussion

NOTES ON AGENDA
PSAC MEETING
October 18, 19, 1971

Item 1 Chairman's Report

a. PSAC Membership. At the September meeting it was agreed that three PSAC subcommittees would be formed to collect and review the names of prospective PSAC members to take the places of Messrs. Simon, Tape and Wood:

Health -- L. H. Smith, Jr., and P. Handler
Social Sciences -- J. Coleman, H. Simon and P. Moynihan
Physical Sciences and Engineering -- R. Garwin,
S. Buchsbaum and K. Olsen.

Attached are the communications received concerning the selection of new members. Those PSAC members who have not, as yet, submitted their proposals are requested to do so prior to the October meeting.

Item 2 PSAC Panel on Health Services R&D. Dr. Kerr White, Chairman of the Panel and Professor of Medical Care and Hospitals, Johns Hopkins School of Hygiene and Public Health, will discuss the progress and direction of the work of the panel and the issues involved. Attached is the "Charge" to the panel and the panel's definition of "health services R&D."

Item 3 New Technological Initiatives. Since the September meeting, a great deal of work has gone into shaping the technological initiatives that were developed by the departments and agencies, including exposure to an ad hoc external review by selected consultants with expertise in the areas concerned. Some PSAC members have been involved in these reviews; others were unable to participate because of schedule conflicts. Dr. Goldmuntz will summarize the over-all status of the effort and OST staff members will speak to specific initiatives and the issues that have been highlighted in the review process.

The initiatives have been largely directed at the short-term development and application of technology rather than on longer-range scientific possibilities. Attached is a memorandum to PSAC members identifying several such possibilities and requesting an indication from the Committee whether it wishes to pursue these or other possibilities, and to give an indication of relative priority for Committee review. Drs. Bennett, Truxall and Garwin are requested to present brief oral reports on the initiatives they previously agreed to explore.

Item 4 Environmental Effects of Nuclear Power. The AEC staff will present a briefing on the status of the AEC research and development efforts and the adequacy of current technology to assure "safety," particularly the implications of quantifying the safety factors included in cost/benefit analyses, in the following areas:

(1) nuclear reactor safety, including a review of progress on the Emergency Core Cooling System study;

(2) radiation protection standards, especially the effect of new guidelines; and

(3) high-level radioactive waste disposal, with special attention to the Lyons, Kansas, salt mine site.

They have also been asked for comments on the concern that cost/benefit analysis applied to the question of nuclear vs. other types of plants would result in development of an ad hoc energy policy on a plant-by-plant basis.

This briefing and discussion has particular relevance to the recent appeals court decision which called for an extensive risk/benefit analysis to consider and balance the environmental effects of the nuclear facility and the alternatives for reducing or avoiding adverse environmental effects. In this connection, there is attached a memorandum by Stephen Gage of the OST staff on the potential effect of this decision.

Item 5 — Report of the OST Ad Hoc Panel on Strategic Long-Range Standoff Weapons. This OST panel was convened to address the role and feasibility of long-range standoff weapons as a prospective element of the U.S. strategic forces. Dr. Val Fitch, chairman of the panel, will lead the discussion. Other panel members were Allen Donovan, Aerospace Corporation; John Hopfield, Princeton University; Robert LeLevier, R&D Associates; and John Martin and John Walsh of the OST staff.

AGENDA

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

Sunday, September 19, 1971

Room 208, Executive Office Building

Item 1	Chairman's Report
	a. PSAC Membership b. Changes in OST Organization c. Technological Initiatives d. Report of PSAC Panel on Science and Technology Policy e. OECD Ministers of Science Meeting
Item 2 11:00 - 12:30	Drug Abuse Prevention -- Jerome Jaffe
Lunch 12:30 - 1:30	
Item 3 1:30 - 3:30	Astronomy in the Space Program -- H. Friedman

Monday, September 20, 1971

Item 4 9:00 - 11:00	Enhancing the Nutritional Quality of Food Supply Through Technology: An Interagency Proposal -- Gerald Combs et al
Item 5 11:00 - 12:30	MIT Science Policy Studies: Supply and Demand of Scientists and Engineers -- H. Holloman, MIT, and Richard Freeman, University of Chicago
Lunch 12:30 - 1:30	
Item 6 1:30 - 3:30	Other Business

NOTES ON AGENDA
PSAC MEETING
September 19, 20, 1971

Item 1 Chairman's Report

a. PSAC Membership. The attached rotation schedule for PSAC membership indicates that the terms of Drs. Simon, Tape and Wood expire December 31, 1971. In addition, Dr. Baldeschwieler has requested that he be replaced on the Committee at the end of this year in view of his appointment as Deputy Director of OST. The Chairman would like to have a general discussion of the Committee's future membership needs and specific possibilities for membership. Where possible, a biographical and narrative statement on the qualifications of each proposed candidate should be provided.

b. OST Organization. The Chairman will describe recent changes in OST organization designed to strengthen internal coordination and leadership and the coupling between OST and the OMB.

c. Technological Initiatives. The current status of the effort to develop a set of technological initiatives, involving the federal departments and agencies, will be reviewed. This effort has been accorded heightened importance in the President's Message to the Congress on the economy on September 9 (enclosed) in which he indicated that he would present proposals to the next session of the Congress on "new approaches toward ensuring the maximum enlistment of America's technology in meeting the challenges of peace."

The Chairman will discuss with the Committee ways in which PSAC (and individual PSAC members) can contribute to the formulation of these initiatives -- through critical review and by developing supplementary approaches where appropriate. As a first step, the technological initiative on nutrition will be presented to the Committee on Monday morning (see Item 4).

Item 1 (Continued)

d. Report on Science and Technology Policy. The final report of the PSAC Panel on Science and Technology Policy is enclosed, together with a memorandum from Gabe Strasser explaining the changes made pursuant to the discussion at the July PSAC meeting. Although it is not contemplated that there will be extended discussion of this report, the Chairman will summarize his meeting with Mr. Haggerty (to take place on Monday, September 14) and invite general comment.

e. OECD Ministers of Science Meeting. The meeting of the Ministers of Science of OECD member countries will be held in Paris on October 13, 14. Dr. David will lead a U. S. delegation. The Ministers of Science, or their equivalent, from 21 countries of Western Europe, the United States, Canada and Japan will exchange views on ways to enhance the contributions of "Science and Technology for Society," the theme of the meeting, and will agree on matters for cooperation within the OECD.

Item 2 Drug Abuse Prevention

Dr. Jerome H. Jaffe, Special Consultant to the President for Narcotics and Dangerous Drugs, will discuss the work of his Office of Drug Abuse Prevention. He has indicated a desire to utilize the help of PSAC and its consultants on the scientific and technical aspects of the drug abuse problem and may propose the creation of a special PSAC panel for this purpose. Enclosed are copies of the Presidential Message to the Congress on drug abuse prevention, June 17, 1971, and the announcement of the appointment of Dr. Jaffe.

Item 3 Astronomy in the Space Program

Dr. Friedman will speak on this topic, followed by a presentation of the pros and cons of NASA's "Grand Tour Program." As background material, enclosed are the chapter on Astronomy from the NAS report, "Priorities for Space Research 1971-1980," and copies of memos from Dr. Gell-Mann to Dr. David and from Dr. Greenstein to Dr. Gell-Mann.

Item 4 Nutrition

An Interagency Proposal for "Enhancing the Nutritional Quality of the Food Supply Through Technology" will be presented by Dr. G. F. Combs of the Department of Agriculture, assisted by representatives of HEW, Commerce and Defense.

The proposal involves the development of a food fortification policy (by FDA), with standards and guidelines for new or modified foods. It includes the development of (1) a central data bank on food composition, (2) up-to-date information on food consumption by specific population groups and effect on health, and (3) complete information on requirements and safe levels of intake of nutrients -- all of which are needed to monitor such a food fortification policy.

It is designed to improve the nutritional quality of our foods as a means of preventing malnutrition (undernutrition and overnutrition). It includes a large-scale project for iron enrichment of milk (by subsidy) and fortification of cereal products and other selected foods, with field evaluation. The presentation and restoration of nutritive values of highly processed foods, development of nutritionally important new foods and modification of some existing foods to improve their nutritive value are also planned.

Item 5 Supply and Demand of Scientists and Engineers

During the past summer, an MIT study group under the leadership of Dr. Herbert Hollomon has been studying the effective use of science and technology in the United States. They are engaged in the preparation of eight background studies, as follows:

1. Supply and demand of scientists and engineers
2. The profitability of industrial R&D
3. The analysis of the present non-defense, non-space federal R&D activities
4. A review and critique of the relationship between technology and trade

Item 5 (Continued)

5. A summary of adjustment mechanisms
6. A review of policies and programs of industrialized countries that encourage science and technology and their use
7. A review of several of the past interventions of the federal government to encourage science and technology (agriculture and nuclear energy)
8. A review of what is now known about the process of invention, innovation, and diffusion of technology

The results of the first of these studies, "Supply and Demand of Scientists and Engineers," will be presented by Dr. Hollomon and the study director, Richard Freeman, Associate Professor of Economics at the University of Chicago.

Expiration of Appointments of PSAC Members

	Dec. '71	Dec. '72	Dec. '73	Dec. '74
David	----------	Ex Officio	----------	
DuBridge				X
Baldeschwieler		X		
Buchsbaum			X	
Cairns			X	
Coleman			X	
Fitch			X	
Friedman				X
Garwin		X		
Gell-Mann		X		
Haggerty		X		
Handler	----------	Ex Officio	----------	
Moynihan				X
Olsen				X
Simon	X			
Smith			X	
Tape	X			
Truxal				X
Wood	X			

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AGENDA

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

July 19, 20, 1971

Room 208, Executive Office Building

Monday July 19, 1971, 9:30 a.m.

Item 1	Chairman's Report
9:30 - 12:30	President's Report on Science and Technology
12:30 - 1:30	Lunch - Sandwiches in the Conference Room
Item 2	National Astronomy Program
1:30 - 2:30	a. Report on the NAS Astronomy Survey Committee -- Jesse Greenstein, California Institute of Technology
2:30 - 4:00	b. NSF Astronomy Program Review -- R. Fleischer, Assistant Program Director, Astronomy Section, et al
Item 3	Status Report on the PSAC Chemicals and Health Panel
4:00 - 5:30	-- J. Tukey

Tuesday, July 20, 1971, 8:30 a.m.

Item 4	Science Policy
8:30 - 11:00	a. Report of the PSAC Panel on Science and Technology Policy -- P. Haggerty et al
11:00 - 12:30	b. New Concepts of Science Policy -- A Report to the Secretary General of the Organization for Economic Cooperation and Development -- H. Brooks
12:30 - 1:30	Lunch - Sandwiches in the Conference Room
Item 5	Commission on Government Procurement, R&D Study Group
1:30 - 2:30	-- W. J. Price, Chairman
Item 6	Other Business
2:30 -	

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NOTES ON AGENDA
PSAC MEETING
July 19, 20, 1971

Item 1 Chairman's Report

a. President's Report on Science and Technology. A final draft of the report is enclosed herewith. Copies have been distributed to key members of the White House and Executive Office Staff for comment. Individual chapters have been sent to the departments and agencies concerned. Please take extra caution that the report not be shown or distributed to third parties.

b. Other topics to be discussed under this item are being developed.

Item 2 National Astronomy Program

a. Dr. Jesse Greenstein will discuss the work of the NAS Astronomy Survey Committee which has not as yet completed its report. Dr. Greenstein's views will provide useful background for the following NSF Staff presentation of the results of the NSF Astronomy Program Review. A letter from Bruce Gregory of the NRC Division of Physical Sciences is enclosed concerning the origin and direction of the Survey Committee.

b. The NSF Astronomy Program Review is one of several internal NSF staff reviews of fields of science. The review and the PSAC presentation will cover the topics indicated in the attached outline submitted by James Wright of the NSF staff.

Item 3 Status Report on the PSAC Chemicals and Health Panel

Dr. John Tukey, Chairman of the Panel, will review the work of the panel and the issues that have been raised thus far, for Committee discussion and reaction. Dr. Edward Burger of the OST Staff has prepared the attached statement for your background information.

Item 4 Report of the PSAC Panel on Science and Technology Policy

Patrick Haggerty will discuss the conclusions of his panel on Science and Technology Policy. He is expected to be joined by the following panel members: William Carey, Eugene Fubini, Richard Nelson,

Item 4 (Contd)

Fred Seitz and Edward Teller. The panel concluded that it could be most productive by making recommendations dealing with how to make the President's science advisory mechanism (Science Adviser, PSAC, OST, FCST) more effective and that is the principal subject matter of the panel's final report. The report covers (a) fundamental policy responsibilities and structure for such an advisory mechanism; (b) procedures; (c) guidelines for the support of academic science, and (d) proposed criteria for federal support of science and technology. (A copy of report is attached.)

Item 5 Commission on Government Procurement -- R&D Study Group.

Dr. William J. Price, Chairman of the R&D Study Group of the Commission on Government Procurement will present its preliminary conclusions and recommendations to PSAC. The final report of the Study Group will be submitted to the full Commission next September. Dr. Price would welcome the informal comments and reactions of the PSAC members. Background material on the nature of the Commission, its task, and the membership of the R&D Study Group is attached.

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

June 14, 15, 1971

Room 208, Executive Office Building

Monday, June 14, 1971, 9:30 a.m.

Item 1 9:30 - 11:00	Chairman's Report a. Retirement of Mrs. Beard* b. Energy Message c. Technological Initiatives
Item 2 11:00 - 12:30	SST Environmental Research Program - R. Cannon, Assistant Secretary of DOT for Systems Development and Technology
12:30 - 1:30	Lunch - Sandwiches in the Conference Room
Item 3 1:30 - 3:30	Report of the Nuclear Physics Panel - NAS Physics Survey - D. A. Bromley, J. Weneser, T. Lauritsen, H. Feshbach
Item 4 3:30 - 5:30	NSF Report on Science and Engineering Doctorate Supply and Utilization - C. Falk, Director, Division of Science Resources and Policy Studies

Tuesday, June 15, 1971, 8:30 a.m.

Item 5 8:30 - 10:30	International Trade - Peter G. Peterson, Assistant to the President for International Economic Affairs
Item 6 10:30 - 11:30	R and D and Economic Growth - P. McCracken, Chairman, Council of Economic Advisers (Tentative Item)
11:30 - 1:00	Lunch - Sandwiches in the Conference Room

* There will be a PSAC reception in honor of Mrs. Beard in Room 213 at 5:30 p.m., Monday.

Tuesday, June 15, 1971 (Cont'd)

Item 7 — OST Spring Preview of Technical Issues for FY 1973 (Cont'd)

1:00 - 2:30

a. Transportation - L. Goldmuntz
b. Justice - L. Goldmuntz
c. Energy - D. Freeman
d. International Cooperation - N. Neureiter

Item 8 — Other Business

2:30 - 3:30

(Revised 5/11/71)

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

May 17, 18, 1971

Room 208, Executive Office Building

AGENDA

Monday, May 17, 1971, 9:30 a.m.

Item 1 9:30 - 10:00	Chairman's Report
Item 2 10:00 - 12:00	Meeting with Mr. George Shultz, Director, Office of Management and Budget
12:00 - 1:00	Lunch - Sandwiches in Conference Room
Item 3 1:00 - 3:00	Report of PSAC Subpanel on Increasing Productivity through Educational and Technological Change - A. Bueche, C. Savit
Item 4 3:00 - 4:30	Report on the U. S. Metric Study - L. Branscomb, D. DeSimone, Bureau of Standards
Item 5 4:30 - 5:30	Technological Initiatives

Tuesday, May 18, 1971, 8:30 a.m.

Item 6 8:30 - 12:00	OST Spring Preview of Technical Issues for FY 1973 - OST Staff
12:00 - 1:00	Lunch - Sandwiches in Conference Room
Item 7 1:00 - 3:00	Annual Report on Science and Technology
Item 8 3:00 -	Other Business

NOTES ON AGENDA
PSAC MEETING
May 17, 18, 1971

Item 1 Chairman's Report

The first half hour will be devoted to preparation for the meeting with George Shultz at 10:00 a.m. Mr. Shultz is not expected to make a presentation to the Committee, but, rather, will respond to questions of general concern to the Committee. Two matters identified in Dr. David's letter of invitation to Mr. Shultz are (a) the economic policy related to productivity and the question of federal stimulation of R&D and innovation in the manufacturing and service sectors and (b) the question of the federal role in the support of research in the civilian sector. Background for this discussion is provided in draft Chapter 9 of the Annual Report on Science and Technology, the report of the PSAC subpanel on productivity (see Agenda Item 6), and a draft statement on criteria for federal support of R&D prepared by the Haggerty Panel on Science and Technology Policy. Note also the enclosed memorandum to Dr. David from Herbert Simon.

Item 2 Meeting with Mr. George Shultz, Director of the Office of Management and Budget

See attached biographical material.

Item 3 OST Spring Preview of Technical Issues for FY 1973

As PSAC members are aware, Dr. David has been holding a series of meetings with representatives of the federal departments and agencies to become more fully informed as to the major problems and opportunities in the federal R&D programs. There will be a report by the OST staff on the results of some nine preview sessions that will have been held by the date of the PSAC meeting. For the most part the previews have dealt with issues with multi-agency involvement, although some have been on an agency basis. The following will be covered at the PSAC meeting: HEW, HUD, Commerce, EPA, Ecology, Environmental Health, Health Services, Educational R&D and Innovation, and Aeronautical and Aircraft Engine R&D.

Item 4 Technological Initiatives

From time-to-time PSAC has discussed the question of possible initiatives that might be taken by the government to generate new

Item 4 Technological Initiatives
(Cont'd)

technologies and technological innovations that can provide a desirable range of options for future federal programs. Dr. David has asked that this again be included in the agenda to: (a) solicit PSAC views on the general approach of identifying promising technologies for focused initiatives, (b) identify the priority areas of technology that are "ready" for concerted effort, (c) determine the willingness of individual members of PSAC to take responsibility for preparing an assessment and options paper during the next several months on a particular technology, in consultation (as desirable) with outstanding experts in the field and with the help of OST staff.

Enclosed for your background are the "Possible Initiatives" paper previously distributed, a memorandum from D. Beckler to Dr. Heffner on this subject, and an article by Dr. David in Technology Review.

Item 5 Report on the U. S. Metric Study

Dr. L. Branscomb and Mr. D. DeSimone will take the lead in a discussion of a draft report on the U. S. Metric Study conducted by the Bureau of Standards pursuant to P. L. 90-472 of August 9, 1968. This report has been sent separately by the Bureau to PSAC members. The policy issues, responsive to Congressional concerns, are identified in the 23 page summary at the beginning of the report; three options for action are presented. This provides a useful focus for the PSAC discussion.

Item 6 Increasing National Productivity through Educational and Technological Change

Last summer the President appointed a Commission on Productivity. Subsequently, Dr. David was asked to assist a Working Group of the Commission concerned with the relationship of education and R&D to productivity. To obtain an analysis of the effects of education and R&D on productivity from the S&T viewpoint, a PSAC subpanel was formed, chaired by Dr. Arthur Bueche. That subpanel has studied relevant literature and heard from several experts in economics and education. Their resulting report comprises a summary of present knowledge and a set of recommendations for government actions which could be expected to produce an increase in national productivity. Dr. Bueche will present the panel report to the Committee.

Item 7 OST Annual Report on Science and Technology

Enclosed are three redrafts of chapters to be included in the Annual Report: National Security, Basic Science and Academic Research, and Scientific and Engineering Manpower. Aside from editorial and language changes, we would appreciate the further views of PSAC members on (a) whether the important issues are adequately brought out and (b) the policy directions indicated in the draft.

For instance: Is the manpower chapter overly bleak in terms of future opportunities? If so, what should be said about future prospects? Does the Committee wish to discuss further the question of training and institutional grants in the Academic Science chapter? Should it include a brief account of recent advances in basic science that offer the possibility of major breakthroughs in understanding or application? (If so, we would appreciate your written suggestions.) With regard to the National Security chapter, are the policy implications and directions sufficiently strong and clear? Is the general treatment in proper balance, etc. ?

David Beckler
Executive Officer, PSAC

REVISED
3/8/71

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

March 15, 16, 1971

Room 208, Executive Office Building

AGENDA

Monday, March 15, 1971, 9:30 a.m.

Item 1
9:30 - 12:30

Chairman's Report

Follow-up of Meeting with the President
- -- Cancer Initiative
- -- Unemployment of Scientists and Engineers
- -- Energy Goals - H. Simon
- -- Incentives for Industrial Support of Research at Universities - P. Haggerty

Future Work of the Committee (continued from Feb. Meeting)
- -- Possible Initiatives for PSAC/OST
- -- Status and Future Work of PSAC Panels

Lunch - 12:30 p.m. - 1:30 p.m.

Item 1 (cont'd)
1:30 - 3:00

Chairman's Report

Item 2
3:00 - 4:30*

Behavioral and Social Science Research in the DOD - H. Simon; Henry David, National Research Council

Tuesday, March 16, 1971, 8:45 a.m.

Item 3
8:45 - 10:00

Defense Research and Development Program for FY 1972 and its Directions - J. Foster, Director of Defense Research & Engineering

Item 4
10:00 - 11:30

Report of the Naval Warfare Panel - J. Fletcher

* At 4:30 p.m. copies of the Naval Warfare Panel Report (Top Secret) will be distributed for reading in the Conference Room in preparation for the Tuesday morning discussion.

Tuesday, March 16, 1971 (Cont'd)

Item 5 11:30 - 12:30	Educational Research and Development - Frank Westheimer; James Coleman; John Truxal
	Lunch - 12:30 p.m. - 1:30 p.m.
Item 5 (cont'd) 1:30 - 3:00	Meeting with Sidney P. Marland, Commissioner of Education

ANNOTATED AGENDA
PSAC MEETING
March 15, 16, 1971

Item 1 Chairman's Report

This item will mainly concern the follow-up of matters emerging from the PSAC Meeting with the President in February:

a. Cancer Initiative

The Chairman will report on developments since the February meeting of the Committee, and Dr. Laster will review the progress of Congressional hearings on legislation to establish a Cancer Authority.

b. Unemployment of Scientists and Engineers

A working conference on the employment problems of scientists and engineers in the aerospace and defense industries was held on March 3rd in Washington. Participants included representatives of the Federal Government, private industry and the academic world together with leaders of a majority of the professional engineering and scientific societies having national membership.

The enclosed background papers on the conference may assist the Committee in responding to the President's expressed concern.

c. Energy Goals

During the committee discussion with the President, Dr. David touched on the issue of technological goals, mentioning clean energy for the 1980's. The President expressed an interest in receiving advice on this point.

Last September the PSAC Panel on the Environment proposed a study on a national policy for energy, fuels and pollution (enclosed). Dr. Simon is redrafting this study proposal for further consideration at the March meeting. To assist your preparation for this discussion, I am enclosing a recent draft paper on Energy Policy and Energy Research Goals prepared by Dr. Seaborg for the Federal Council for Science and Technology, together with agency comments.

d. Industrial Support of University Research

Mr. Haggerty will amplify his remarks to the President on the desirability of a special tax incentive to stimulate industrial support of university research. Follow-up steps to bring this to the attention of the Treasury have been taken in accordance with the President's wishes.

Item 2 Educational Research and Development

At 11:30 a.m. Dr. Westheimer will review the past work of the PSAC Panel on Educational Research and Development in preparation for the meeting after lunch with Commissioner Sidney Marland of the Office of Education.

The future work of the Educational R&D Panel will also be considered.

In his letter of invitation to Commissioner Marland, Dr. David indicated that the Committee would like to hear about his overall plans, particularly those concerned with educational research and development. He has also been invited to identify problems where PSAC efforts might be helpful.

Item 3 Behavioral and Social Science Research in the DOD

The enclosed report by the NAS Advisory Committee on the Management of Behavioral Science Research in the DOD was prepared in response to a DOD request for advice on how its research programs in the behavioral and social sciences could be best organized and managed. The report is included on the agenda because of its implications for improving the coupling of social sciences research to policy formulation and problem solving at the Presidential level and through the governmental structure. This study is included as a provisional agenda item subject to expected clearance by the DOD which has just received the report. It replaces a previously planned item on the evaluation of social programs which had to be deferred until the April meeting.

Item 4 Defense R&D

Dr. Foster, Director of Defense Research and Engineering, will speak on the program implications of the FY 1972 budget for Defense research and development. The RDT&E budget was increased by $909 million in FY 1972, a 12 per cent increase. Some of the PSAC suggestions made in response to Dr. Foster's earlier request for the identification of problems deserving special attention are reflected in the 72 program proposals.

Item 5 Naval Warfare

Dr. Fletcher will present the report of the PSAC Naval Warfare Panel on the use of Electronics in Naval Warfare. This report explores selected aspects of the Naval electronic warfare program, its current status and possible future actions. It deals with an evolving set of technologies involving electromagnetic surveillance and tracking sensors and systems. Since the report is Top Secret it will be distributed during the meeting with reading time set aside on Monday afternoon.

Dr. Fletcher will also outline a proposal for a new study by the panel dealing with submarine warfare.

Item 6 Future Work of the Committee

This item was listed on the Agenda for the February meeting, but time did not permit more than a preliminary discussion. Enclosed is a list of possible initiatives developed for the purpose of assisting the identification of specific targets of concentration for OST during the coming year. PSAC may wish to select a small number of these or other topics for ad hoc priority attention from the standpoint of possible Presidential concern or interest.

A list of PSAC panels, their membership and status was circulated with the February Agenda. The Chairman wishes to direct attention to the question of the number of panels, and whether their work is sufficiently focussed on major problems deserving Presidential attention.

David Beckler

David Z. Beckler
Executive Officer

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

February 22 and 23, 1971

Room 208, Executive Office Building

AGENDA

Monday, February 22, 1971, 9:30 a.m.

Item 1 (9:30 - 11:30) — Chairman's Report:

a. Implications of the FY 1972 Budget.
b. Public Participation in Technological Change -- Project Stormfury Case Study.
c. Unemployment of Scientists and Engineers.

Item 2 (11:30 - 12:30) — Future Work of the Committee:

a. Areas of Possible Presidential Initiatives.
b. Status and Directions of PSAC Panel Activities.

Lunch — 12:30 - 1:30

Item 3 (1:30 - 3:00) — Organization of the Cancer Program --
Benno C. Schmidt, Chairman of the Board, Sloan Kettering Institute;
Henry S. Kaplan, Stanford University, (Committee of Consultants on Cancer, Senate Committee on Labor and Public Welfare)

Item 4 (3:00 - 4:00) — Evaluation of Social Programs -- H. Simon

Tuesday, February 23, 1971, 8:30 a.m.

Item 5 (8:30 - 10:00) — Research Applied to National Needs: A New Program of the National Science Foundation -- R. Bisplinghoff, Deputy Director of the NSF

Item 2 (Cont'd) (10:00 - 12:00) — Status and Direction of PSAC Panel Activities

Lunch — 12:00 - 1:00

Item 6 (1:00 - 3:00) — NAS Report on Computers in Society -- A. Oettinger, Harvard University

Item 7 (3:00 - 4:00) — Other Business

ANNOTATED AGENDA
PSAC MEETING
February 22, 23, 1971

Item 1 Chairman's Report

a. FY '72 Budget

At the January meeting, the Committee was briefed on the FY '72 budget. Enclosed is a copy of Dr. David's remarks at the press conference and a copy of Special Analysis R on the Federal Research and Development Programs. This item will afford an opportunity for the Committee members to raise questions concerning the implications of the '72 budget as it affects Federal support of research and development. Officials of the Office of Management and Budget have been invited to meet with the Committee (not yet confirmed).

b. Public Participation in Technological Change

Following the PSAC discussion of Toffler's book "Future Shock" and receipt of PSAC comments, Dr. David transmitted a memorandum summarizing the situation (enclosed). He has been asked to develop these ideas further, particularly on means for increasing public participation in the evolution of change within our society. Dr. Simon has suggested that the operational use of hurricane modification (Project Stormfury) be used as a case study of the question of public participation in technological decision making. The scientific and technical status of hurricane modification was presented to the Committee by representatives of the National Oceanic and Atmospheric Administration at the January meeting. At that time the Committee agreed to establish a panel to examine the decision-making procedures in making operational use of techniques for hurricane modification. Enclosed is a preliminary issues paper prepared by Dr. Simon to serve as the basis for the establishment of the panel. PSAC members are asked (a) to suggest additional ideas for increasing public participation in government decision making involving the introduction and use of new technologies and (b) to comment specifically on the terms of reference for the planned PSAC study of policies governing operational use of hurricane modification measures.

Item 1 Chairman's Report
(Cont'd)

c. Unemployment of Scientists and Engineers

Dr. David will review the present situation concerning the problem and prospects of unemployed scientists and engineers in the aerospace industry and plans for dealing with this problem.

Item 2 Future Work of the Committee

Dr. David has asked that there be ample time for PSAC discussion of its future work and the status of its panel activities. There is a question as to whether there are too many panels and whether the work is sufficiently focused on major problems, particularly on matters deserving Presidential attention. To assist the discussion of this item, two papers are enclosed: (a) A list of topics where possible initiatives might be proposed to the President. This list was initially prepared to set some specific goals for the work of OST. It may also assist the Committee in identifying particular problem areas where PSAC may wish to establish ad hoc groups to develop proposals for submission to the President. The Committee is invited to comment on this list and to suggest other topics for priority attention. (b) A current status report on PSAC panels, their membership, and current activities is enclosed.

Item 3 Organization of the Cancer Program

In the State of the Union message, the President made a commitment to "launch an intensive campaign to find a cure for cancer". At its January meeting, the Committee was briefed by officials of the National Institutes of Health on the present status of research sponsored by the National Cancer Institute. Senators Kennedy and Javits have introduced a bill to establish a National Cancer Authority as an independent agency of government to "conquer cancer at the earliest possible date". There is considerable sentiment in the Congress favoring a separate Cancer Authority. Dr. Laster has prepared the enclosed issue paper which presents arguments for and against the Congressional initiative. Two members of the Congressional Panel of Consultants on the Conquest of Cancer have been invited to present the case for the Cancer Authority. The Committee may wish to draft a statement on the merits of Federal organization for mounting a directed program of cancer research for submission to the President.

Item 4 Evaluation of Social Programs

Following the meeting last September with the President at which he asked the Committee to look into the problem of evaluation of social programs, the Division of Behavioral Sciences of the National Research Council and the Social Sciences Research Council were asked to undertake follow-up examinations. Dr. Simon will report at the meeting on the present status of the effort of the NRC Behavioral Sciences Division to prepare a policy statement on the substantive aspects of social program evaluation and research. It is expected that the policy statement will be finalized for discussion at the March meeting of the Committee. The Social Science Research Council has made a proposal for a summer study workshop to distill what we now know about the design and evaluation of social intervention programs and to assess strategies for developing methods and improving capabilities to conduct evaluations. The National Science Foundation has invited the SSRC to submit a formal proposal for the funding of this workshop.

Item 5 Research Applied to National Needs

The FY '72 budget for the National Science Foundation includes an $81 million program on Research Applied to National Needs. This is a directed program aimed at stimulating research efforts directly related to problems of society and the environment. It would bring together NSF problem-focused research into a single set of program activities. Enclosed is a statement on the content of the RANN program which builds on a $34 million level of effort in FY '71 largely in the environmental area (the program of Interdisciplinary Research Relevant to Problems of Our Society--IRPOS). Dr. Raymond Bisplinghoff, Deputy Director of the National Science Foundation, will present the RANN program to the Committee for discussion (description enclosed). In this connection, an extract of the minutes of the Federal Council for Science and Technology is enclosed which highlights special problems of interagency coordination in bringing about a coordinated effort between the NSF and the mission agencies with provision for orderly transfer as the work moves toward application.

Item 6 Computers in Society

In response to a suggestion by the OST, the National Academy of Sciences convened a panel of distinguished citizens to examine the present status and development of computers in education, particularly from the standpoint of their impact on educational institutions. The

Item 6 Computers in Society
(Cont'd)

panel, under James Oates, former Chairman of the Board of the Equitable Life Assurance Society, found it desirable to broaden the scope of the problem to encompass the "impact of computers and allied technologies on the American society". The panel's report has been transmitted to Dr. David by Dr. Handler (enclosed). Dr. Anthony Oettinger of The Aiken Computation Laboratory of Harvard University will meet with the Committee to provide background information on the work of the NAS panel. There are two points to be kept in mind in regard to this report. First, the Panel is not an "expert" panel. It is a panel of concerned citizens with credentials in the management of private and public enterprises. Second, in making its recommendation for a Presidential commission on the impact of computers on our society, the Panel apparently wishes to place more stress on the need for a broader examination of this problem rather than on the precise mechanism for conducting the examination.

David Beckler
Executive Officer

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Minutes of Meeting - 28 January 1972

The meeting convened at 2:00 p.m. in room 4203 of the New Executive Office Building, Washington, D. C.

Attendance:

Members:

Dr. Edward E. David, Jr.	CHAIRMAN	OST
Dr. Lawrence A. Goldmuntz	Executive Secretary	OST
Dr. Ned D. Bayley		Agriculture
Dr. Raymond L. Bisplinghoff (for Wm. D. McElroy)		NSF
Dr. Robert H. Cannon, Jr.		DOT
Mr. Harold B. Finger		HUD
Dr. Robert V. N. Granger (for Herman Pollack)		State
Dr. Clarence A. Larson (for James R. Schlesinger)		AEC
Dr. George M. Low		NASA
Dr. Martin Prochnik (for Wm. T. Pecora)		Interior
Dr. Eberhardt Rechtin (for John S. Foster)		DOD
Dr. Ernest S. Tierkel (for Merlin K. DuVal)		HEW
Dr. James H. Wakelin, Jr.		DOC

Observers:

Dr. David Challinor (for S. Dillon Ripley)	Smithsonian
Mr. Martin B. Danziger	Justice
Dr. David D. Elliott (for Wm. A. Anders)	NASC
Mr. Hugh F. Loweth (for Donald B. Rice)	OMB
Dr. Lee M. Talbot (for Russell E. Train)	CEQ
Mr. Albert C. Trakowski (for Stanley M. Greenfield)	EPA
Mr. Fred Warren (for John N. Nassikas)	FPC

Commission on Government Procurement:

Mr. James Carpenter
Mr. William Goldwater
Dr. William Price
Mr. James Roach (Mitre)

Others:

Mr. George Auman	NBS
Dr. Lewis M. Branscomb	NBS
Mr. William Carey	A. D. Little
Mr. William R. Coupland	NASA
Dr. Gus D. Dorough	DOD
Dr. Spofford G. English	AEC
Dr. Sherwood Godden	Treasury
Mr. Jon K. Hartzell	OMB
Dr. M. Frank Hersman	NSF
Mr. N. Richard Miller	Treasury/OST
Dr. John E. Mock	Georgia Science & Technology Commission
Mr. Boyd C. Myers	NASA
Mr. O. A. Neumann	DOC
Dr. David Rall	HEW/NIEHS
Dr. Wilson E. Schmidt	Treasury
Mr. Alan Siegel	HUD

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Administration's Proposed R&D Budget, FY '73

Dr. David presented the Administration's proposed R&D budget for FY '73. The highlights of this budget were distributed to the members of the Council. On an obligation basis, the Administration's proposed R&D budget increased by $1.4 billion from $16.4 billion to $17.8 billion. The percent increase in defense, including AEC military-related programs, was 9% whereas domestic programs increased 15% and space programs decreased 3%. The major increments in the domestic sector R&D are in transportation which increased 46% from $456 million to $666 million, with increased emphasis on intercity ground and urban mass transportation and improving transportation's environmental impact, especially in the quiet aircraft engine field. Cancer research increased 27% from $337 million to $430 million. Low pollution electric power research increased 22% from $392 million to $480 million. Reduction of loss due to natural disasters increased 46% from $93 million to $136 million. Urban/social problem R&D increased 37% from $103 million to $141 million. Environmental research increased from $115 million to $154 million or 34%.

Commission on Government Procurement

The Congressional Commission on Government Procurement presented the final report of the R&D Study Group and an interim report on utilization of resources for science and technology. There were a number of reservations with respect to some of the Commission recommendations. Dr. David

asked a committee consisting of Dr. Raymond Bisplinghoff, Dr. Ned D. Bayley, and Dr. Eberhardt Rechtin to meet with Mr. James Roach, Mr. James Carpenter and Dr. William Price of the Commission on Government Procurement to review the recommendations. Dr. David asked Dr. Bisplinghoff to chair this effort.

Interim Report of the FCST Ad Hoc Committee on International Transfer of Technology

Dr. Wilson Schmidt introduced the presentation of an interim report of the committee prepared by Mr. N. Richard Miller. The Federal Council requested the committee to release this interim report because of the timeliness of the survey of industry opinions on the transfer of technology.

Policy for Expanded Interagency Cooperation in the Use of Federal Laboratories

The Federal Council asked its chairman to transmit to the Office of Management and Budget, with its endorsement the policy statement prepared by the FCST Committee on Federal Laboratories.

Roles for Science in 1976 Bicentennial

Dr. David asked Dr. Bisplinghoff to recommend to the Federal Council roles for science in the 1976 Bicentennial. Dr. Bisplinghoff was asked to select from the Federal Council membership a committee that will serve with him to generate these recommendations. Any member or observer of the Federal Council who is interested in serving with Dr. Bisplinghoff can inform him directly.

Approval of the Final Report of the FCST Committee on Intergovernment Science Relations

-and-

Combined 1970-71 FCST Annual Report

The above two items were postponed for the next meeting of the Council.

Civil Service Directives

Dr. Rechtin indicated that directives to (1) reduce average grade level, (2) reduce total force level, and (3) increase technical competence,

result in some contradictions and some management difficulties. During reductions in force, Civil Service regulations operate so as to force a release of junior individuals, which tends to increase the average grade level. To the extent that junior people are better educated and motivated, such a reduction in force works against increased competence. There was insufficient time to discuss these problems. They will be deferred for another meeting of the Federal Council.

Lawrence A. Goldmuntz
Executive Secretary

Approved by the Chairman

on _____

References

* Federal Budget for Science and Technology - FY '73
OST Press Release dated 24 January 1972

* Presentation of the FY '73 Budget for R&D
by Dr. Edward E. David, Jr., Director, OST, for 24 Jan. 72 release

* Federal R&D Programs, Special Analysis R

* Overall Federal R&D Outlook

* Conduct of R&D Obligations

* State of the Union Message as presented to the Congress
20 Jan. 72 White House Press Release

** List of R&D Study Group Recommendations
Charts: Recommendation Overview
Presentation by Commission on Government Procurement

*** Policy for Expanded Interagency Cooperation in the Use of Federal Laboratories
1 March 1972 statement as prepared by the FCST Committee on Federal Laboratories, revised 11/30/71 by review group, and approved at 1/28/72 FCST meeting.
with 3/1/72 Chmn FCST forwarding memo to Dir OMB

A Public Technology: A Tool for Solving National Problems
Draft report of the Committee on Intergovernmental Science Relations.

FCST Annual Report
19 Nov. 71 memo fm Exec. Secy, FCST, to Chmn and Exec. Secys of FCST Ctes re preparation of.

Current Committees of the Federal Council
List dated November 1971

Tentative Schedule of FCST Meetings for 1972

* FCST Membership List dated March 1972

* Mailed 2/28/72
** Distributed at the meeting
*** Distributed with minutes

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Minutes of Meeting - 24 March 1971

The meeting convened at 2:20 p.m. in room 208 of the Old Executive Office Building, Washington, D. C.

Attendance

Members:

Dr. Edward E. David, Jr.	CHAIRMAN	OST
Dr. Lawrence A. Goldmuntz,	Executive Secretary	OST
Dr. Ned D. Bayley		Agriculture
Dr. Robert H. Cannon, Jr.		DOT
Mr. Harold B. Finger		HUD
Dr. William D. McElroy		NSF
Mr. Herman Pollack		State
Dr. Martin Prochnik (Acting)		Interior
Dr. Eberhard Rechtin (for Dr. John S. Foster)		DoD
Dr. Glenn T. Seaborg		AEC
Gen. Jacob E. Smart (for Dr. Geo. M. Low)		NASA
Dr. Ernest S. Tierkel (for Dr. Roger O. Egeberg)		HEW
Dr. James H. Wakelin		DOC

Observers:

Mr. John D. Darroch	CEA
Dr. Stanley M. Greenfield	EPA
Mr. Hugh F. Loweth (for Dr. Donald B. Rice)	OMB
Mr. Irving Slott (Acting)	Justice
Dr. Lee Talbot (for Dr. Russell E. Train)	CEQ

Others:

Col. John Berga	DOT
Dr. Raymond L. Bisplinghoff, Alternate	NSF
Dr. Lewis M. Branscomb	NBS
Mr. Ray Dillon	Marine Council
Mr. Arnold W. Frutkin	NASA
Dr. Clayton E. Jensen	DOC
Mr. Winton B. Rankin	HEW
Dr. Julius Rubin	AEC
Mr. T. K. Treadwell	Marine Council

Dr. David opened the meeting by welcoming Mr. James H. Wakelin, Jr. Assistant Secretary of Commerce for Science and Technology, as the Federal Council member from the Department of Commerce. He replaces Dr. Myron Tribus who has left the government.

1. Dr. David called attention to the March 22, 1971 letter received from Tom Owen, Assistant Director for National and International Programs, National Science Foundation, regarding the June 30, 1973 total solar eclipse which will occur over Central Africa. The Federal Council agreed that the National Science Foundation should coordinate the national effort for observation of the eclipse. (Note: This agreement was confirmed by a letter dated 8 April 1971 from Dr. Edward E. David, Jr. the President's Science Adviser, to Dr. Thomas B. Owen.)

2. The Spring Preview of Technical Issues for FY '73 which the Office of Science and Technology is conducting this year, was reviewed with members of the Council.

3. The Committee to Propose Energy R&D Goals was approved as a Federal Council endeavor. Terms of reference are attached. There was some discussion about the feasibility of conducting this study using a lead agency approach. Because of the great number of government agencies involved in energy R&D, and because the study must dovetail with the McCracken study, it was agreed that the Federal Council mechanism was appropriate to the problem. The manner in which this Committee operates with the interested departments and agencies of the government will have to be defined very carefully. The energy policy staff within the Office of Science and Technology has responsibility for developing this mechanism. When this is accomplished, Dr. David will present the proposed operating procedure and composition of the Committee to the Federal Council. The following agencies were suggested to be represented on the Committee:

Atomic Energy Commission
Department of the Interior
National Academy of Sciences
Department of Commerce (including National Bureau of Standards)
National Science Foundation
Department of Housing and Urban Development
Department of Transportation

4. The Energy Paper presented by Dr. Seaborg was distributed.

5. The terms of reference of the proposed FCST Committee on Marine Science and Engineering were approved with the understanding that the prospective chairman would give consideration to the following subcommittees:

Marine Environmental Prediction
Marine Mapping, Charting and Geodesy.

This FCST Committee should also consider its relationship to the Committee on International Ocean Affairs (chaired by the State Dept.); the Interagency Decade Planning Group (chaired by NSF); the Interagency Arctic Research Coordinating Committee (chaired by NSF); the NATO CCMS Working Group (chaired by CEQ); the Lake Restoration Demonstration Project (responsibility of EPA); Coastal Zone Management (under the Dept. of the Interior); Coastal Zone Research Coordination, which should perhaps become the responsibility of the Marine Science and Engineering Committee.

6. The Federal Council Committee on Automation Opportunities in the Service Areas was approved in accordance with attached terms of reference.

7. A Federal Council Committee on RANN Coordination was approved with terms of reference as attached.

8. The Federal Council Committee on High Technology Markets, Exports and Licensing was approved with the attached terms of reference.

Lawrence A. Goldmuntz
Executive Secretary

Approved by the Chairman
on 14 May 1971

Attachments

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
24 March 1971 Meeting

REFERENCES

Spring Technical Review
12 Mar. 71 Chmn, FCST memo to Members & Observers instituting spring review of major technical issues.

* Spring Review of Technical Issues for FY '73
23 Mar. 71 listing of subjects and OST personnel involved.

Suggested FCST Committee to Propose Energy R&D Goals
16 Mar. 71 draft charter.

* Energy Policy and Energy Research Goals
23 Mar. 71 revised paper prepared by Dr. Glenn T. Seaborg, AEC, incorporating paper of 25 Jan. 71 on Oil Shale Resources, and various comments on 25 Jan. 71 draft by agencies.

* Establishment of an Interagency Committee on Marine Science and Engineering
22 Mar. 71 draft charter -- replacing
11 Mar. 71 Memo of Agreement for Proposed Committee on Marine Affairs (distributed 17 Mar. 71).

Proposed FCST Committee on Automation Opportunities
17 Mar. 71 draft charter.

* Proposed FCST Committee on RANN Coordination
22 Mar. 71 draft charter -- replacing
16 Mar. 71 draft charter (distributed 17 Mar. 71)

Proposed Ad Hoc FCST Committee on High Technology Markets, Exports and Licensing
12 Mar. 71 draft charter

Designation of Dr. Lawrence A. Goldmuntz as Executive Secretary of the Federal Council for Science and Technology
17 Feb. 71 Chmn, FCST memo to Members with attachment:
9 Mar. 71 OST Press Release "Lawrence Goldmuntz Joins OST" incorporating biographical sketch.

* Distributed at the meeting.
All others distributed 17 Mar. 71.

THE WHITE HOUSE

WASHINGTON

8 April 1971

Dear Dr. Owen:

At the 24 March 1971 meeting of the Federal Council for Science and Technology, it was agreed that the National Science Foundation would have responsibility for national and international coordination of the United States effort related to the June 30, 1973 solar eclipse. This role of the National Science Foundation will be contained in the formal minutes of the Federal Council meeting when they are issued later this month to the Federal Council membership.

Sincerely yours,

(signed)

Edward E. David, Jr.
Science Adviser

Dr. Thomas B. Owen
Assistant Director for National
and International Programs
National Science Foundation
1800 "G" St., N.W.
Washington, D. C. 20550

10 May 1971

PRELIMINARY TERMS OF REFERENCE
FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
COMMITTEE TO PROPOSE ENERGY R&D GOALS

The demand for clean energy to meet the nation's needs now and in the future clearly indicates that today's technology for producing, converting, transmitting and utilizing energy will not be adequate in the decades ahead. A number of new technologies are being developed by industry and government work independently or jointly (breeder reactor, coal gasification, etc.). But, the individual firms and agencies involved all have limited interests and mandates in the energy field and it is doubtful that all of the most promising technologies are, in fact, being developed much less on an appropriate time table. The federal government has a key role to play in ensuring that an adequate technological base is established for energy supply and utilization in the years to come. The FCST is in a uniquely good position to assist in discharging this reponsibility of government.

The first step which must be taken is to analyze all of the prospective new technologies on a comparable basis to determine where they stand technically and to assess their promise as commercial energy systems. Stress should be placed on those technologies not now being vigorously supported rather than those technologies which have been selected for priority support. We should examine possibilities that are

only now emerging in the research stage. The lead time could be long -- as much as 30 years. The idea is to take a long look ahead and be sure that we are not passing up promising technological opportunities.

The primary object of this effort is to identify what more should be done rather than to rejustify programs which industry and government have already determined should go forth. The effort would thus build on such short term studies as the Domestic Council's Energy Subcommittee's current effort which covers the next 5 years.

The obvious step after determining the technological opportunities would be to decide who should fund and carry out the promising work not now being supported and to devise mechanisms to assure that the work is, in fact, carried out. These questions involve basic policy issues rather than technical questions and are expressly excluded from the proposed study. The subsequent policy issues of implementation would be handled separately by government and industrial organizations using the study report as a source of objective analysis.

The analysis of future energy technologies requires that we first develop sharply defined criteria to provide an overall framework by which to analyze each technology. Next, we will need to develop a list of all of the energy technologies that warrant investigation. The study would then be to evaluate each possibility in light of the criteria established. While it is too early to establish a detailed work plan, it

appears that a contractor with a strong full-time analytical capability supported by panels of consultants familiar with each of the major technological areas is needed. It is, therefore, useful to consider the study as divided into two parts with the FCST working closely with the contractor in the development of the framework for analysis, the criteria and identification of the technical options before the second phase of actually analyzing the technologies is undertaken. The general contractor should be an organization such as NAE-NAS or a university like MIT having a strong energy team with access to consultants for the panels.

Part I - Development of Framework for Analysis

The development of a framework for analysis of each major new energy technology and the identification of the new technologies to be so analyzed is a task requiring the concentrated effort of a relatively few individuals with broad experience in the energy field, including its related economics, environmental and resource considerations. The framework should include criteria and procedures for assessing the state of technology, the potential economic benefits and the potential impact on the environment and natural resources. It is expected that the framework for assessing the state of technology would be sufficiently detailed as to the need for additional basic and applied research, bench

scale and prototype development and pre-commercial demonstration so as to indicate roughly the time and funding required before the technology could have a significant impact on the energy economy. The analysis of economics would not be in the form of detailed cost benefit studies but would, drawing upon those experienced in producing and consuming energy, indicate the technical reasons why new systems may cost more or less to build and operate than existing reference systems. The analysis of environmental and resource impact would likewise require the establishment of reference systems upon which to compare new technologies. Brief analyses of future environmental and resource requirements would be required in this regard but extensive resource and demand projections are not envisioned as part of the study. In developing this framework, it may well be useful to apply them to one or more new technologies whose problems and benefits are well know.

The list of new technologies to be analyzed during Part II should concentrate on those new inventions or extensions of technological developments which may have a noticeable impact on the energy economy rather than on including all of the specialized technologies being developed for specialized or limited applications. Technologies for fuel mineral exploration, mining, transportation and on-site consumption should be included as well as new systems for the bulk generation of electric power.

Part II - Analysis of New Energy Technologies

Panels of consultants would be established for each major technical area to analyze the new technologies in accordance with the framework provided. Each panel would consider several but related technologies within their expertise. It would be expected that members of the panels be drawn from industry, the universities and the technical societies, and that the contract would provide funds for consulting fees and travel expenses. Such panels would be sympathetic to the technologies involved by the nature of their membership so needed objectivity must be provided by the active participation of one or more members of the contractor's staff in the panel meetings. It may be useful to have separate economics and environmental panels to meet with and review the results of the technical panels providing continuity as well as objectivity in these crucial areas.

The results of these analyses should be discussed in a report which describes briefly each concept analyzed, its technical status, potential economic benefits, its impact on the environment and resources and any other far- reaching impacts it may have on society. The results should also be summarized in a manner useful to policy makers. This would include the establishment of priorities or rankings for alternative technologies capable of meeting similar needs.

Accomplishments of the study should take on the order of 12 to 18 months depending upon the capability and extent of the contractors inhouse staff. The work would be monitored by an FCST committee on energy R&D chaired by OST. This group would receive periodic reports by the contractor and provide the liaison with the government agencies as well as formally review the interim report covering the framework for analysis and the final report.

TERMS OF REFERENCE
for
FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
COMMITTEE ON MARINE SCIENCE AND ENGINEERING

In recognition of the need for a continuing interagency mechanism for the coordination of marine science and engineering, the Chairman of the Federal Council for Science and Technology hereby establishes the Committee on Marine Science and Engineering under the auspices of the Federal Council for Science and Technology.

1. Purpose

The purpose of the Committee will be to ensure the planning and coordination of Federal activities in marine science and engineering and related matters. It will identify the need for and foster studies or investigations considered appropriate, and it will review annually the Federal marine science and engineering program and budget. The Committee will assist the Office of Science and Technology in the preparation of an annual report for transmittal by the President to the Congress.

2. Scope

The Committee will be concerned with Federal scientific and engineering initiatives and programs relating to the marine environment.

3. Organization

a. Chairmanship. The Committee will be chaired during the first two years of its existence by the Administrator of the National Oceanic and Atmospheric Administration. After the two-year period the location of the Chairmanship will be reconsidered. Responsibility for the conduct of the work of the Committee will rest with the Chairman.

b. Meetings. The Committee will determine its schedule of meetings as required. The Committee will also meet at the call of the Chairman. The Chairman will call meetings at the request of a Committee member or members.

c. Memberhip. Each Federal agency with a program in the marine area will have membership on the Committee (generally the membership will consist of the same agencies that participated in the National Council on Marine Resources and Engineering Development).

d. Subcommittees. The Committee may form subcommittees or task groups, usually ad hoc in nature, for the conduct of its required work.

e. Staff. An Executive Secretary will be provided by the National Oceanic and Atmospheric Administration.

TERMS OF REFERENCE
for
FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
COMMITTEE ON AUTOMATION OPPORTUNITIES
IN THE SERVICE AREAS

The Federal Council for Science and Technology Committee on Automation Opportunities in the Service Areas will recommend technological possibilities, with particular emphasis on automation techniques, for reducing the cost of delivering services in areas of government interest, such as Education, Health, Housing and Transportation Services. These service areas have certain common attributes:

(1) Labor intensivity is high.
(2) Increased costs contribute significantly to recent increases in the cost-of-living.
(3) Demand has and will continue to increase.
(4) There is nearly universal dissatisfaction with the quality and availability of the service.

In each area, but in a different context and in a different way, automation techniques can probably be more fully developed and utilized to extend service and lessen costs.

For example, the application of automation aids to education seems to be limited by (1) an understanding of applicable teaching methodologies, (2) the cost of displays, video files and central processors. There are recent advances in computer technology -- for example, semi-conductor memories and cathodochromic displays -- that may well be sufficient to decrease costs so that computer techniques may be competitive with present manual costs.

In housing, benefits of mass production and automation can probably only be felt after there is sufficient market aggregation to make the application of such techniques reasonable, but within this context the benefits are likely to be substantial. In transportation, there are many potential benefits of automation techniques, probably the most neglected and important being in urban mass transit where 60 to 80% of the operating dollar is consumed by manpower charges. Vehicles (rail or road)

operating on dedicated lanes, are susceptible to automated operation. Ticketing and passenger information services can be made substantially less labor intensive than current operating systems. Automatic surveillance against vandalism and lane obstructions may become economic with sufficient development. Intrinsic vehicle design can reflect minimum mean time to failure and mean time to repair concepts and can incorporate diagnostic equipment to lower the number and skill levels of maintenance personnel.

Some health services can be made less costly. For example, automated multiphasic health testing systems have been developed to perform health assessment utilizing paramedic personnel. There are both technological and institutional limits to its widespread application. The institutional limits derive from a conservative constituency and insufficient demonstration of the cost and effectiveness of the equipment currently available. Technological limitations exist also; for example, the ability to identify cells as automatically as desirable and the availability of diagnostic algorithms.

In each general area there are automation opportunities in difficult and different contexts. The context in each area determines the kind of automation techniques applicable, the technological developments that may be necessary, the demonstrations or institutional modifications required before widespread adoption, the strategy and time scale of implementation.

There are other federal areas that may be examined, such as law enforcement, Post Office, Patent Office, etc.

This Committee shall consist of a parent body and subpanels in each of the identified service areas. The parent committee role is to continuously refine the objectives of the study, monitor the progress of the subpanels, expedite the interchange of information in this area between the departments and agencies, provide technology forecast inputs and prepare the final report. Each subpanel will be responsible for defining the automation context in its area, the automation opportunities, the development and institutional program required, and a projection of the resulting benefits. The final report of the Committee will recommend governmentwide and agency development programs necessary to provide the cost and service advantages where they exist in the areas studied. This report shall be submitted to the Chairman of the Federal Council for Science and Technology by May 1, 1972.

OST:1 May 1971.

TERMS OF REFERENCE
for
FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
COMMITTEE ON RANN COORDINATION

To assist the National Science Foundation in its Research Applied to National Needs Program (RANN), the Chairman of the Federal Council for Science and Technology hereby establishes an FCST Committee on RANN Coordination, to be chaired by the Office of Science and Technology and with membership consisting of representatives from the National Science Foundation, the Office of Management and Budget, the Office of Science and Technology, and those agencies with mission responsibilities which fall within the scope of the RANN program.

The Committee will act as an intergovernmental advisory group to the National Science Foundation for the selection of the major program areas to be funded under RANN, and for endorsement by the Federal Council for Science and Technology. The Committee will meet as necessary to review the major programs which have been proposed for RANN to insure that they are complementary to that of the mission oriented agencies. These reviews will also include consideration of the priority of the programs in evolving administration policies and national needs, and will assist in resolving differences which may arise from time to time.

Panels will be formed under the Committee to correspond to each major program area of RANN. Each Panel will consist of the National Science Foundation Program Manager for its area, representatives from the Office of Science and Technology, as well as the other agencies that are affected in a significant way by the research which is carried out. An Office of Management and Budget representative may attend as an observer. Each Panel will be chaired by the National Science Foundation representative and will be the principal means through which the ongoing interagency coordination is carried out.

The Panels will meet at regularly specified times and act as intergovernmental advisory groups to the Program Managers in the conduct of the research. They will constitute the initiation points in the process of interagency fund transfers, personnel interchanges and the transfer of projects and programs from the National Science Foundation to other agencies. Each Panel will have a secretary supplied by the National Science Foundation who will be responsible for administrative matters relating to the Panel's operations, including the circulation of an agenda prior to and the preparation of minutes after each meeting.

OST:3 May 1971

TERMS OF REFERENCE
for
FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
COMMITTEE ON HIGH TECHNOLOGY MARKETS, EXPORTS AND LICENSING

The FCST Committee on High Technology Markets, Exports and Licensing will examine the importance of overseas markets for the health and growth of United States technological enterprises in the face of increasing imports from abroad and strong competition from other developed nations for expanding markets, including those of the Socialist countries. There is evidence that the United States share of overseas markets for high technology products is shrinking; that Japan, U.K., and the Common Market are increasingly exploiting high technology markets abroad, including the Socialist countries. Furthermore, the United States is now faced with unemployment of engineers and scientists who will depend on prospering high-technology industries for jobs in the future.

This interagency study will touch on the possibility of establishing policies on the sales of U.S. technology and know-how to developed countries. The United States may have exported technology (as distinct from technological products) at a bargain price to Japan and others. It should also examine the commercial implications arising from present U.S. export control policies, and other matters relating directly to the economic viability of U.S. high-technology industries.

This study will not conflict with efforts under NSM-71 on foreign access to United States strategic technology or to the continuing process of embargo list review conducted by the Department of Commerce. It will focus on the challenges being posed by foreign competition to U.S. high-technology industries and possible actions the government might take in response.

OST:3 May 1971

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Minutes of Meeting - 28 September 1971

The meeting convened at 2:15 PM in Room 213 of the Old Executive Office Building, Washington, D.C.

Attendees

Members:

Dr. Edward E. David, Jr.	CHAIRMAN	OST
Dr. Lawrence A. Goldmuntz	Executive Secretary	OST
Dr. Ned D. Bayley		Agriculture
Dr. Theodore R. Britton (for Mr. Harold B. Finger)		HUD
Dr. John V. N. Granger (for Mr. Herman Pollack)		State
Mr. Clarence E. Larson (for Dr. James R. Schlesinger)		AEC
Dr. George M. Low		NASA
Dr. William D. McElroy		NSF
Dr. Robert Q. Marston (for Dr. Roger O. Egeberg)		HEW
Dr. Martin Prochnik (for Dr. William T. Pecora)		Interior
Dr. Eberhardt Rechtin (for Dr. John S. Foster)		DOD
Dr. James H. Wakelin, Jr.		DOC

Observers:

Mr. John D. Darroch	CEA
Dr. J. Clarence Davies (for Dr. Russell E. Train)	CEQ
Mr. Carlyle Hystad (for Dr. Donald B. Rice)	OMB
Dr. S. Dillon Ripley	Smithsonian

Others:

Mr. William R. Coupland	NASA
Dr. Spofford G. English	AEC
Dr. Harold Glaser	NBS
Dr. Dale W. Jenkins	Smithsonian
Mr. Alan R. Siegel	HUD
Capt. Gordon H. Smith, USN	DOD

Commission on Government Procurement:
Mr. James Carpenter, Mr. Robert Hughes, Mr. Richard Pierson, Mr. William J. Price, Mr. George Wheeler, Mr. Clotaire Wood

OST:
Dr. Richard E. Balzhiser, Mr. Gabor Strasser, Mr. J. Frederick Weinhold

The Commission on Government Procurement presented a brief resume' of their tentative recommendations. Some of these seemed sufficiently different from the material previously submitted that it was the consensus of the Council that they would like to receive copies of the flip charts used in the presentation. It was decided that an ad hoc group be organized to meet with the Commission to describe to them some of the perceived difficulties.

Mr. Gabor Strasser reviewed the results of the Office of Science and Technology contract on technology assessment. The report of this work, entitled "A Technology Assessment Methodology" has been distributed to the agencies for their information.

Mr. J. Frederick Weinhold reviewed the progress of the contractor (Associated Universities) supporting the FCST Energy R&D Goals Committee. The work statement is attached. Mr. Weinhold will be chairman of the FCST Energy R&D Goals Committee.

Dr. Richard E. Balzhiser was introduced as the newly appointed Assistant Director of the Office of Science and Technology, responsible for natural resources. The energy R&D goals program becomes his responsibility within OST.

Dr. Goldmuntz presented a brief review of the progress on the Domestic Council study on new technology opportunities. A copy is attached.

The Report on Environmental Quality R&D: A Review and Analysis of Federal Programs, was presented by Dr. Dale W. Jenkins. The report was unanimously accepted for publication. Its recommendations were accepted and Dr. Jenkins and his staff were commended by the Federal Council for the excellency of their report.

Lawrence A. Goldmuntz
Executive Secretary

Approved by the Chairman
on_____

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
28 September 1971 Meeting

REFERENCES

Ecological Effects of Pesticides on Non-Target Species
June 1971 OST Report - distributed to FCST mailing list 8/12/71
(available from GPO for $2.00; Stock #4106-0029)

A Technology Assessment Methodology MTR-6009
June 1971 study for OST by Mitre Corp. (consists of a Summary and six volumes as follows: (distributed to FCST 20-23 Aug. 71)

Vol. I - Some Basic Propositions
Vol. II- Automotive Emissions
Vol. III Computer-Communications Networks
Vol. IV- Enzymes (Industrial)
Vol. V- Mariculture (Sea Farming)
Vol. VI- Water Pollution: Domestic Wastes

The Effects and Control of Heated Water Discharges
Nov. 1970 Report of FCST/COWRR Problem Area Task Group
(distributed to FCST mailing list 8/30/71)

A Revised Memorandum and Statement of Government Patent Policy
Issued by President Nixon on 8/23/71 by OST Press Release of 8/24/71 (distributed to FCST mailing list on 9/20/71)

Commission on Government Procurement resume of their recommendations
Group #11 "Research & Development Study Group"

* Revised Agenda for 9/28/71 FCST Meeting (dated 9/27/71)

* Domestic Council Study on New Technology (Privileged, OUO)
9/18/71 Memo to Dr. EEDavid from Dr. LAGoldmuntz identifying 8 broad areas of study.

* Work Statement for FCST Energy R&D Goals Committee Contractor (Associated Universities)

* Distributed at the meeting.

Work Statement for FCST Energy R&D Goals Committee Contractor
(Associated Universities)
as presented by J. Frederick Weinhold at 28 Sept. 71 FCST Meeting

SECTION A - OBJECTIVES

The demand for clean energy to meet the Nation's needs now and in the future clearly indicates that today's technology for producing, converting, transmitting, and utilizing energy will not be adequate in the decades ahead. A number of new technologies are being developed by industry and Government working independently or jointly (breeder reactor, coal gasification, etc.). But, the individual firms and agencies involved all have limited interests and mandates in the energy field and it is doubtful that all of the most promising technologies are, in fact, being developed, much less on an appropriate timetable. The Federal Government has a key role to play in ensuring that an adequate technological base is established for energy supply and utilization in the years to come. The President, in his message on energy of June 4, 1971, made priority commitments in three energy R&D areas and asked his "Science Adviser with the cooperation of the Council on Environmental Quality and the interested agencies, to make a detailed assessment of all the technological opportunities in this area and to recommend additional projects which should receive priority attention."

The objective of this contract is to provide the framework for analysis and the detailed assessment of these technological opportunities so that the Science Adviser in cooperation with the other agencies can recommend the projects requiring priority attention.

In keeping with this objective, the study will analyze all of the prospective new technologies on a comparable basis to determine where they stand technically and to assess their promise in commercial energy systems, as well as their relative impact on the environment. Stress will be placed on thos e technologies not now being vigorously supported rather than those technologies which have been selected by the President for priority support. Possibilities that are only now emerging in the research stage will be examined since the lead time could be long--as much as 30 years. The idea is to take a long look ahead and be sure that the Nation is not passing up promising technological opportunities.

The primary object of this effort is to identify what more should be done rather than to rejustify programs which industry and Government have already determined should go forward. The effort would thus build on the work of the Domestic Council's Energy Subcommittee, as delineated in the President's message.

distributed at FCST 9/28/71 meeting by Weinhold

The obvious step after determining the technological opportunities is to set priorities and decide who should fund and carry out the promising work not now being supported. These questions involve basic policy issues rather than technical questions and are expressly excluded from the proposed study. The subsequent policy issues of implementation would be handled separately by Government and industrial organizations using the study report as a source of objective analysis.

SECTION B - SCOPE OF WORK

The study will be moving into new areas where there are large unknowns and a lack of sound data. It is, therefore, not possible at the outset to identify in detail the total scope of work required. For this reason, the effort will be divided into several steps, each of which is necessary for the subsequent steps and for completion of the final study.

STEP I. Preliminary Assessment. On the basis of available knowledge and data, the overall field of energy technology will be surveyed to determine (1) which general technical options offer the most promise and should be studied in detail; and (2) which are the critical elements in a common framework for analyzing these areas. The result of the first step will be a detailed study plan for the remainder of this study.

It is estimated that this step will require about 3 months.

STEP II. Framework for Analysis. The development of a common framework for analysis of each major new energy technology will involve the concentrated effort of a relatively few individuals with broad experience in the energy field, including its related economics, environmental and resource considerations. The framework should include criteria and procedures for assessing the state of technology, the potential economic benefits and the potential impact on the environment and natural resources. It is expected that the framework for analysis would require that each technology assessment be sufficiently detailed as to the need for additional basic and applied research, bench scale and prototype development and pre-commercial demonstration so as to indicate roughly the time and funding required before the technology

could have a significant impact on the energy economy. The analysis of economics would not be in the form of detailed cost benefit studies but would indicate the technical reasons why new systems may cost more or less to build and operate than existing reference systems. The analysis of environmental and resource impact would likewise require the establishment of reference systems upon which to compare new technologies. Brief analyses of future environmental and resource requirements would be required in this regard but extensive resource and demand projections are not envisioned as part of the study.

The result of this step will be the preparation of a working guide or report to be used by the panels evaluating each of the new technologies. It is estimated that this step will require about 3 months.

STEP III. Analysis of New Energy Technologies. The list of new technologies to be analyzed will concentrate on those new inventions or extensions of technological developments which may have a noticeable impact on the energy economy rather than on including all of the specialized technologies being developed for specialized or limited applications. Minor product improvements, the traditional responsibility of the manufacturing industry, would likewise be excluded. Technologies for fuel mineral exploration, mining, transportation and on-site consumption should be included as well as new systems for the bulk generation of electric power.

Panels of Experts (approximately 10 are envisioned) would be established for each major technical area to analyze the new technologies in accordance with the framework provided. Each panel would consider several but related technologies within their expertise. The contract provides funds for necessary consulting fees and travel expenses. Such panels would be sympathetic to the technologies involved by the nature of their membership, so needed objectivity will be provided by the participation of one or more members of the contractor's staff in the panel meetings. The need for separate economics and environmental panels will be considered in Step I.

The results of these analyses should be discussed in reports which describe briefly each concept analyzed, its technical status, potential economic benefits, its impact on the environment and resources and any other far-reaching impacts it may have on society. The results should also be summarized in a manner useful to policymakers. This would include rankings of alternative technologies capable of meeting similar needs.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY
WASHINGTON, D.C. 20506

18 September 1971

MEMORANDUM FOR DR. EDWARD E. DAVID, Jr.

From: Dr. Lawrence A. Goldmuntz

Subject: Domestic Council Study on New Technology

The Domestic Council study on new technology is defining opportunities in eight broad areas. These are listed briefly below with a description of the most important technological thrusts in each area to the extent they have been identified as of this date.

1. Transportation

Chairman: Dr. Robert Cannon
Deputy: Mr. Alfonso Linhares

The transportation study has identified three transportation goals and the long- and short-term development programs that can achieve these objectives.

(a) A short-term (achievable in five years) reduction in urban congestion accomplished by demand-actuated traffic control in addition to bus preference systems and coupled with a longer term program whose feasibility should be apparent by 1976, to provide low cost widely distributed automatic personal transportation for urban densities beyond the reach of conventional mass transit.

(b) A concerted approach to provide a cleaner, quieter, safer transportation. An expansion of the quiet engine and airport noise reduction programs; some development, training and implementation of technology that will reduce truck noise levels by 10 db; an expansion in the high specific energy and specific power battery development program; a technology development program to reduce the cost of tunnel construction; an improvement in emergency health services and highway safety programs to further reduce deaths, injuries and economic losses from auto traffic accidents; a program to reduce rail grade crossings; and finally, harbor traffic control systems to reduce maritime accidents.

(c) An effort to increase the efficiency and productivity of the movement of people and goods. A major development and implementation program to improve passenger and rail transportation on the Eastern Seaboard in time for the 1976 bicentennial celebration and the planning for extending these capabilities to a national rail system; relief of impending congestion in the Northeast Corridor intercity highway system by real time information systems and by improving the connectivity of the system; an expansion of the advanced aircraft transport and engine technology program in the subsonic, supersonic and hypersonic regimes; the expansion of VSTOL development to higher capability, quieter vehicles to test the market potential by 1976; an expansion of the development of tracked levitated vehicle systems to establish their potential for high speed intercity travel by 1976; and finally, the development of a nationwide cargo security system to reduce pilferage losses.

The aircraft portions of this program, while imbedded in the three objectives described above, will also be separately presented as a program package which is primarily a NASA responsibility.

2. Communications for Social Needs

Two approaches toward developing the social experiments and hardware technologies to demonstrate the application of improved communication capabilities to the needs described below are being developed by the Office of Telecommunications Policy and NASA under the chairmanship of Walter Hinchman and Leonard Jaffe, respectively.

An alternative wired community and an interactive satellite system capable of operation with augmented ground receivers will provide the basis for demonstrating the effectiveness of electronic mail service, the delivery of health care to city centers and rural communities, the delivery of social, educational and cultural services to rural and city center communities, and finally, the rapid dissemination of fingerprints and other services to enhance the administration of justice.

3. Natural Resources

Chairman: Dr. Frank Clarke, Dept. of the Interior
Deputies: Dr. Lindsay D. Norman, Interior
Dr. William S. Butcher, OST
Mr. Donald F. Moore, NOAA

The goals of this group are to provide technology opportunities to enhance the economic development of the natural resources of the United States in a manner that minimizes injury to the environment. Four major resources areas are discussed: water, mineral, continental shelf, and forest resources.

(a) In the water resources area an expansion of the desalinization technology development and demonstration program seems indicated if we are to meet the 1980 requirements in many portions of the country; a new program to improve the consumptive efficiency with which we use irrigation water from 50% to 70% seems promising; (If successful, we will have the remarkable result of providing for all municipal water requirements in the Southwest by the projected saving due to irrigation efficiency in that region.) a program to integrate the management of a typical river basin, the Susquehanna, taking into account all the separate activities of the Department of the Interior, Department of Agriculture, Corps of Engineers, Department of Transportation, and Environmental Protection Agency, and State and local authorities; and the development of technologies applicable to the more complete recycling of waste water.

(b) The mineral resources program has several objectives: technology to improve our ability to discover mineral resources; the extraction of resources from reserves that were previously economically unattainable; technologies useful to develop mining procedures that would be compatible with the environment; a program to improve the efficiency of underground mining; and finally, various mineral processing technologies relating to the extraction of alumina from clays, the use of non-magnetic taconite ores, and a way to produce synthetic rutile.

(c) The third element of the natural resource program is the development of technologies that will permit wider, more economic and environmentally sound exploitation of resources of the continental shelf. The living resources on the continental shelf can be more efficiently developed by mariculture experiments, more rapid surveying and monitoring methods to permit the timely prediction of the distribution and abundance of fish; and the development of an open sea stable platform to test systems to culture fin fish and shellfish in the open sea. The non-living resources of the continental shelf can be made more readily available by more extensive geophysical mapping of the resources area, by developing the technology to exploit sand and gravel deposits in an environmentally sound way; and by utilizing cool ocean water for power-plant cooling, and in some locations air conditioning and mariculture.

(d) The ability of our national forests to provide an additional two billion board feet may be developed if aerial logging techniques can be developed to be economic for sparse lumbering of steeper slopes under environmentally sound conditions.

4. Urban/Suburban Development

Chairman: Mr. Harold Finger, HUD

The economic preservation and development of the urban environment requires the accomplishment of certain social experiments and the development of some technologies. In the new technologies initiative program two social experiments are being proposed: (1) an experiment to determine the effectiveness of housing allowances as compared to housing subsidies; (2) experimental techniques to preserve neighborhoods that might otherwise be abandoned. A much enhanced program to understand urban development as driven by basic demographic changes and as satisfied by a variety of alternatives such as new cities, new cities within cities, or trend development, will be undertaken to determine the social capabilities of these various alternatives as well as their economic impacts; various policy options to achieve desirable alternatives will also be explored. A hard technology effort is proposed to develop an integrated utility system that will have minimum environmental impact and improve natural resources utilization. Initial cost studies have indicated that such an approach is more economic than current techniques. The purpose of this program will be to demonstrate that conjecture. This waste management system is applicable to dwelling unit aggregates of 3,000 to 6,000 units.

5. Productivity

Chairman: Dr. Robert W. Cairns, Commerce

Major inputs are being prepared by the following working groups. However, it is too early at this time in the development of their work to indicate which programs will survive.

(a) Working group on the international competitive stature and productivity of key industries.

Chairman: Dr. Harold C. Passer, Commerce

(b) Working group on technologies that are broadly supportive of productivity improvement or that can establish international commercial advantages.

Chairman: Dr. Lewis M. Branscomb, NBS

(c) Working group on the utility of State commerce extension services to enhance the efficiency of industry.

Chairman: Mr. William T. Knox, Commerce

(d) Working group on deep ocean platforms, ship automation and nuclear propulsion.

Chairman: Mr. Marvin Pitkin, MARAD

6. Health Care

Chairman: Dr. Merlin DuVal, HEW

This initiative consists of two major elements: one dealing with a program to enhance the nutritional quality of the food supply through technology, another dealing with technologies that can improve the efficiency with which we deliver health care and with expansion of the clientele that receives this care. The nutrition program first attempts to define dietary adequacy and then develops techniques to assure adequate diets by devising standards for nutrient fortification; the development of methods of processing, storing and preparing foods to minimize nutritative losses; the development of staple and processed foods with higher nutrient levels.

The health care delivery program is in an early stage of development.

7. Technology for Meeting the Air Quality Standards Economically

Chairman: Dr. Stanley Greenfield, EPA

This program addresses a variety of technological opportunities to attempt to meet the air quality standards with greater efficiency and economy than currently available. It consists of a proposed waste management pilot plant to be located at one of the four Chicago incinerators that will demonstrate the economy of existing technologies for the reclamation and recycling of the metal, mineral, fiber and energy values of urban refuse.

One of the purposes of a plant of this size would be to provide sufficient output of the reclaimed metals, glass and fiber products to establish their market value which in turn determines the economy of the overall process. Another program will propose to exploit, with industry participation, an advanced power cycle which will be a combined gas turbine/steam turbine plant. Low cost high sulfur fuel is gasified. Hydrogen sulphide is recovered and the "clean" gas is then burned driving a gas turbine whose exhaust gases provide the energy for a steam turbine. If inlet blades of silicone nitride (or other materials) can tolerate a gas temperature of 2500° Fahrenheit, a thermodynamic efficiency of 45% to 50% is predicted. Another element of this program measures the regional production and ventilation of pollutants to confirm certain analytical models that have been developed. When confirmed, these models could be used to locate large emission sources at such points in a region to minimize their impact on the air quality. The last element in this program relates to a series of efforts to improve our understanding of the health disbenefits for various pollutant levels and the consideration of the strategies which in some sense best counter these effects.

8. Protection from Natural Disasters

Chairman: Dr. John W. Townsend, NOAA

There are several major technology efforts in this program. (1) relating to weather warning and modification; (2) relating to earthquake warning and modification, and volcano, flood and landslide damage prediction; (3) the application of technology to the early detection and suppression of forest fires; and (4) the development of technology and standards applicable to community actions for disaster protection.

PRES. COPY

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
EXECUTIVE OFFICE BUILDING
WASHINGTON, D.C. 20506

December 18, 1972

MEMORANDUM FOR:

Members and Observers
Federal Council for Science and Technology

A summary of the FCST meeting of November 14, 1972, is attached.

The next meeting of the FCST is planned for January 23, 1973, in Room 208 of the Old Executive Office Building. It will be an executive session for members and observers only.

DV De Simone

Daniel V. De Simone
Executive Secretary

Attachment

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Summary of Meeting - 14 November 1972

MEMBERS:

Edward E. David, Jr.	Chairman	OST
Daniel V. De Simone	Executive Secy.	OST
Ned D. Bayley		Agriculture
Theodore R. Britton, Jr. (for Harold B. Finger)		HUD
Gus Dorough (for Capt. Gordon H. Smith, USN)		Defense
C. E. Larson		AEC
George M. Low		NASA
Robert Marston (for Dr. Merlin K. DuVal)		HEW/NIH
Herman Pollack		State
Martin Prochnik (for Dr. William Pecora-deceased)		Interior
Richard Simpson		Commerce
Guyford Stever		NSF
Jerry Ward (for Dr. Robert Cannon)		Transportation

OBSERVERS:

William A. Anders	NASC
David Challinor	Smithsonian
J. D. Darroch	CEA
Stan Greenfield	EPA
Richard F. Hill (for John N. Nassikas)	FPC
Lyndon E. Lee, Jr.	Veterans
Hugh Loweth	OMB
Lee M. Talbot (for Russell E. Train)	CEQ

OTHERS:

Harvey Averch	NSF/RANN
John D. Baldeschwieler	OST
David Z. Beckler	OST
Raymond L. Bisplinghoff	NSF
David D. Elliott	NSC
William Hoff	NSF
N. Pat Ralston	Agriculture
Robert D. Tollison	CEA

The meeting was an executive session to discuss S. 32, a bill "to amend the National Science Foundation Act of 1950 in order to establish a framework of national science policy and to focus the nation's scientific talent and resources on its priority problems, and for other purposes". The meeting was devoted primarily to the implications of S. 32 regarding the organization and conduct of federal R&D.

The Chairman noted that although S. 32 identifies a number of science policy issues that have been of concern for many years, the fanfare given this bill has suggested that little, if any, attention has been given to these policy issues and that the area of civilian technology, in particular, has been largely ignored by the Executive Branch. In fact, the Chairman observed, federal obligations for civilian R&D have increased 65% since 1969 and a variety of programs aimed specifically at the civilian sector were featured in the federal budget for FY '73.

The Chairman emphasized, however, that dealing with the problems associated with the priorities and criteria governing R&D efforts is a continuing task. Nevertheless, he said, S. 32 is not a realistic way to deal with these problems. However, the bill does illustrate, he added, that there appears to be a general lack of understanding and appreciation on the part of too many people as to what are the realities and trade-offs in coping with these problems.

Dr. Stever noted that the vote for S. 32 was 70 to 8, and that, as passed by the Senate, the bill would drastically amend the basic NSF Act of 1950. He expressed reservations with respect to the bill, emphasizing, in particular, the provisions of this legislation which would appear to assign to NSF the responsibility for setting scientific and technological priorities among the various agencies, a function which seemed more appropriately performed within the White House. He expressed concern also with respect to the proposed Civil Science Services Administration (CSSA), because it would tend to distort the primary mission of NSF, which is to support basic scientific research. Moreover, he noted that the CSSA would not be responsible to the National Science Board; if established, it would become virtually an independent agency within NSF. Dr. Stever observed that the CSSA would, if established, probably become a "tail wagging the dog."

In closing, Dr. Stever noted that following his own testimony before the Congress, the Vice Chairman of the National Science Board, Roger W. Heyns, testified on behalf of the Board. It was noted that Dr. Heyns' testimony took a different tack from that presented by Dr. Stever.

Attached is a copy of hearings of September 26 and 27, 1972, on S. 32 which were held before the Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics. These hearings include the testimony of Dr. Stever (p. 54) and Dr. Heyns (p. 92).

Dr. Ned Bayley offered the following comments with respect to S. 32: (1) In addition to the economic situation, shifts in R&D emphases have also caused dislocations and displacements of scientific and technical personnel; (2) the mission agencies are concerned with the users of scientific and technical talent whereas the clientele of S. 32 are the scientists and technologists themselves (the bill is thus input oriented); (3) it would appear that a better statement of what the agencies are actually doing, including the directions and priorities of their R&D, would be helpful in improving public understanding; (4) NSF's support of basic science is essential also to the mission agencies, for they rely on this science base; and (5) it would be undesirable and impractical to empower NSF with the authority to make grants to other agencies for the conduct of R&D, as contemplated under S. 32.

In closing the meeting, the Chairman asked the members for their comments on the organization and conduct of federal R&D and how available resources might be more effectively applied to civilian problems.

The Chairman intends to devote future meetings of the Council to these and other major questions concerning Federal scientific and technological efforts. The next meeting of the Council will be held on January 23, 1973.

D. V. De Simone

Daniel V. De Simone
Executive Secretary

Approved by the Chairman
on December 14, 1972

Attachments

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

July 1, 1971

Dr. Carl York
Executive Office of the President
Office of Science and Technology
Washington, D. C. 20550

Dear Dr. York:

Here is an outline of the topics we wish to discuss in the presentation to the President's Science Advisory Committee on July 19, 1971 at 1:30 P.M. The headings in the outline do not imply the amount of time we wish to spend. A greater emphasis will be placed on the material in sections III and IV. The probable order will be for the Astronomy Section to present their material and then to have David Heeschen and other people speak.

If there is any drastic change in the program, we shall inform Mr. Beckler.

Sincerely yours,

James P. Wright

James P. Wright
Program Director for Galactic
and Extragalactic Astronomy

Copies To:

J. Greenstein
California Institute of Technology

David Heeschen
National Radio Astronomy Observatory

William McElroy
National Science Foundation

William E. Wright
National Science Foundation, MPS

Astronomy Program Review

Outline

I. Astronomy
II. Astronomers
III. Federal Role in Astronomy
IV. Issues

* * * * * * * * * * * * *

I. Astronomy

- A. Nature of Astronomy
- B. Relation to Other Sciences
- C. Scientific Problems and Discoveries
- D. Planning - Scientific

II. Astronomers

- A. The Individual Astronomer
- B. Academic Astronomy
- C. Research Institutions
- D. Statistics

III. Federal Role in Astronomy

- A. Agencies
  1. DOD and ONR
  2. NASA
  3. NSF
- B. Planning

IV. Issues

- A. The Changing NSF Role
- B. International Astronomy
- C. Manpower
- D. Scientific Priorities

July 6, 1971

Note for PSAC Meeting

Ask about KMS's approach to fusion using lasers.

Dr. Segal is president of that company.

OCT 6 1971

EXECUTIVE OFFICE OF THE PRESIDENT

OFFICE OF SCIENCE AND TECHNOLOGY

WASHINGTON, D.C. 20506

4 October 1971

MEMORANDUM FOR

Dr. Henri Busignies, International Telephone & Telegraph
Dr. Donald A. Dunn, Stanford University
Dr. Peter C. Goldmark, CBS Laboratories
Dr. Henry S. McDonald, Bell Telephone Laboratories
Dr. Walter E. Morrow, Jr., Lincoln Laboratories
Mr. Kenneth H. Olsen, Digital Equipment Corporation
Mr. Thomas F. Rogers, The Mitre Corporation
Dr. John G. Truxal, Brooklyn Polytechnic Institute

Subject: Meeting of Review Panel on Communications for Social Needs

We wish to thank you for your willingness to serve on this review panel. The meeting will take place on Saturday, 9 October 1971, at 9:00 AM, in Room 208 of the Old Executive Office Building, 17th & Pennsylvania Ave., N.W., Washington, D.C. It should be completed by 5:00 PM.

We are sending you, under separate cover, background material pertinent to this review. If you encounter any difficulties, please call me at the number indicated below.

Lawrence A. Goldmuntz
ph: 202 = 395-3534

cc: William R. Magruder, WH

THE PRESIDENT'S SCIENCE ADVISORY COMMITTEE

EXECUTIVE OFFICE BUILDING

WASHINGTON, D.C. 20506

November 10, 1972

HEALTH CARE

MEMORANDUM FOR

President's Science Advisory Committee

In response to a question raised at the last PSAC meeting concerning the method of financing the Social Security System, enclosed is an excerpt from a report of the 1971 Advisory Council on Social Security.

David Beckler

David Z. Beckler
Executive Officer

SOCIAL SECURITY FINANCING

Introduction

Financing of the cash benefits and financing of the Medicare parts of the social security program are closely interrelated and should be considered together. For this reason the Council's findings and recommendations on financing are dealt with in this section rather than in the separate reports on cash benefits and Medicare.

The plan of financing the cash benefits and hospital insurance parts of the social security program is as follows: Employees and self-employed people pay social security contributions on their annual earnings up to the maximum amount counted for social security purposes—$7800 for 1968–1971 and $9000 beginning in 1972. Each employer pays social security contributions on the first $7800 paid to each of his employees in the year ($9000 after 1971). The supplementary medical insurance program is financed out of monthly premiums paid by or on behalf of older people who enroll in the program and by matching amounts from general revenues. All social security contributions, and also the monthly premiums paid by people age 65 and over who have enrolled in the supplementary medical insurance program, are automatically appropriated to the old-age and survivors insurance, disability insurance, hospital insurance, and supplementary medical insurance trust funds. The matching contributions made by the Federal Government for the supplementary medical insurance program are appropriated by the Congress and are transferred into the supplementary medical insurance trust fund.[51]

The boards of trustees, which by law are composed of the Secretary of the Treasury, the Secretary of Labor, and the Secretary of Health,

[51] General revenues are used in the cash benefits program only to finance (a) special payments made on a transitional basis to certain uninsured people age 72 and over, (b) benefits attributable to military service before 1957, and (c) non-contributory wage credits provided for members of the military service after 1967. General revenues are used to finance the cost of hospital insurance benefits under a special transitional provision for certain men who reach age 65 prior to 1975 (1974 for women) and who are not eligible for social security cash benefits based on covered work.

Education, and Welfare, are responsible for holding the trust funds and for making annual reports to the Congress.

The four trust funds are kept separate from one another and from all other accounts in the Treasury. The law provides that money received by the trust funds can be used only to pay social security benefits and the administrative expenses of the program. Money not needed currently for these purposes is invested in interest-bearing obligations of the United States and in the obligations issued by certain federally sponsored agencies. All of the interest paid on these investments is deposited in the social security trust funds and helps to meet the costs of the program.