Annual Report to the Congress by the Office of Technology Assessment: March 15, 1977

March 1977

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LETTER OF TRANSMITTAL

OFFICE OF TECHNOLOGY ASSESSMENT
Washington, D. C., March 15, 1977

To the Congress of the United States:

DEAR MR. PRESIDENT AND MR. SPEAKER: We are pleased to submit, pursuant to section 11 of the Technology Assessment Act of 1972 (Public Law 92-484), the annual report of the Office of Technology Assessment (OTA) covering its activities during calendar year 1976.

The Technology Assessment Board is proud of the accomplishments of OTA during its third full year of operation. Ten reports totaling 23 separate volumes were published by the six original program areas. These reports include the culmination of the long-range assessments undertaken by the Office of 1974. They represent substantial progress towards fulfillment of OTA's charge, set out in the Technology Assessment Act, to "provide early indications of the probable beneficial and adverse impacts of the applications of technology."

The Office received 43 new requests for assessments during the report year, bringing the total number of requests received since operations began to 118. These figures demonstrate the confidence Congress has in the ability of the Office to meet its informational needs.

The Board is indebted to OTA Director Emilio Q. Daddario, the members of his staff, and the hundreds of committee members, panelists, and consultants who participated in the work of the Office. We also wish to express the Board's thanks to the Council chairman, Dr. Jerome Wiesner, President of the Massachusetts Institute of Technology, and the other members of the Technology Assessment Advisory Council for their assistance to the Board.

The Board was under the very able direction of Congressman Olin E. Teague, Chairman, and Senator Clifford P. Case, Vice Chairman, during the 94th Congress. Their leadership in charting productive courses for the Office will serve Congress advantageously in the years to come.

EDWARD M. KENNEDY
Chairman of the Board,
Office of Technology *Assessment*

MARJORIE S. HOLT
Vice Chairman of the Board,
Office of Technology Assessment

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DIRECTOR'S STATEMENT

Section I
DIRECTOR'S STATEMENT

The concept of technology assessment originated in 1966 as a congressional response to the growing need for considered, guiding analyses of the intricacies of complex issues presented by this technology dependent age. The mechanism evolved through painstaking deliberation to become the Office of Technology Assessment in 1972. It has been the intention of the OTA Congressional Board, and my primary goal as the first Director of OTA, to build this office into an institution presenting a new, important, and needed service for the benefit of the Congress of the United States.

This fourth Annual Report marks substantial progress towards that goal. It sets forth the numerous accomplishments of the OTA staff, which, assisted by advisors, contractors, consultants, and the hundreds of individuals and offices working with us, has moved OTA from a tentative, searching organization in 1973 to one which has developed a useful range of work styles, analytical strategies, and organizational techniques. The Office can now systematically and effectively marshal the intellectual resources of the Nation to meet the unique and constitutionally defined needs of Congress.

Calendar year 1976 marked the completion of 3 years of continuing development and useful service to the committees of Congress. OTA not only completed its first round of major long-term assessments, but also initiated succeeding extended projects. Each of OTA's original major program areas completed and delivered to Congress at least one major assessment report. Additional short-term studies were also completed by various program areas to serve the timely needs of congressional committees.

To capture and consolidate the benefits of 36 months of actual operation, and to ensure that upcoming activities will benefit from these initial substantive efforts, I asked that our program managers and senior staff carry out an examination and comparative analysis of their experience to date. In late summer and early fall, they met in a series of workshops for a detailed comparison of the diversity of approaches to, and experiences resulting from, OTA programs and projects across a range of assessment activities and objectives. There was particular emphasis on what worked and why, what could be improved and how, what was attempted without success, and what might have produced better results. This examination resulted in a successful effort which brought forth a theme and guiding principle we have all recognized from the beginning—that OTA is unique in its congressional inception and function. The workshops further manifested a key characteristic of successful technology assessments for Congress—a flexible structure with which to meet congressional needs.

It was generally discerned that there can be no automatically applied formula for meeting a particular study need; each effort must be carefully constructed, within the manpower, intellectual, and financial resources which can be brought to bear, to address the particular set of relevant issues. Program managers also concurred that, above all, OTA reports must be both characterized by and perceived to have the attributes of timeliness, quality, and credibility. Judging by the responses of the committees we have served, I believe our reports have indeed met these criteria of congressional utility.

From its inception, technology assessment has captured the interest of a wide spectrum of analysts and academicians in public and private organizations. The

OTA Board, as part of its continuing interest in the development and alternative uses of technology assessment, conducted hearings on the extent to which technology assessment is used by both government and private agencies, These hearings, outlined briefly in section IV, demonstrated that technology assessment is not only being used increasingly, but that it is characterized by varying approaches which can fit both the demands of the assessment's subject and the needs of the client. This characteristic and other operational techniques match those of OTA's program managers and their methods of conductin$_g$ assessments.

The number of projects actively being pursued increased during the year to a high of 44, 10 major reports were delivered to and used by some 25 committees or other agencies of Congress, and work was substantially advanced on 16 other projects scheduled for delivery to Congress early in 1977.

The number of requests for assessments received since OTA's inception reached 118, covering 173 different subjects—far more than OTA can accommodate with its present resources. As a measure of expanding interest in the services and perceived utility of this office, OTA was additionally called upon by Congress for assistance in some 34 bills, two of which—on railroad safety and coal leasing—were enacted into law.

The 1976 projects treated a breadth of issues and represent the accomplishment of the original OTA program outlines. These receive mention in further detail in each of the program descriptions in section III, and to illustrate their breadth and scope a selection of brief excerpts from reports completed in 1976 appear in section II.

It is clear that early warnings on the positive and negative impacts of technology are of continuing concern to Congress, As stated in the OTA Act, it is "the basic function of the Office . . . to provide early indications of the probable beneficial and. adverse impacts of the applications of technology." Early warning is a built-in aspect of most of our studies; during this year alone, the Oceans, Energy, Materials, Health, and Food Programs produced reports which contain such warnings.

The study of three new energy systems off New Jersey and Delaware noted, for example, that the development of a single floating nuclear powerplant there could lead to a profusion of similar plants in coastal areas throughout the country. Yet no policy analysis of the impacts of such a proliferation has been carried out by any responsible agency. The report also points out that, because no meaningful State participation in Federal decisionmaking exists, individual States could initiate court action to block or delay developments with which they disagree.

Reports on materials and food information systems brought into focus the need to provide policy makers with improved and integrated intelligence data to help them predict availability. The OTA examination of the Environmental Protection Agency's .5-year research and development plan noted that many influences require consideration in the development of an adequate response to environmental problems. The report said:

> Inevitably, significant social, technological, and resource changes will affect the environment. While one cannot predict the nature and time of environmental crises, an exploratory research program that attempts to anticipate problems would add a worthwhile dimension to the (EPA research) program.

The OTA Health Program assessment of medical technologies was devoted almost entirely to the need for early studies of the social, economic, institutional, personal, and legal effects of biomedical R&D.

Beyond these, there was evidence at year's end that earlier OTA reports also brought out timely instances of early warning for congressional consideration. In mid-1975, the OTA study of tanker operations was forwarded, with emphasis on their pollution and safety characteristics. In late 1976, the incidence of tanker grounding and accidents brought renewed interest in this report, which had pointed out several measures which, if implemented, might have averted some of the consequences of these incidents. (As a further example, OTA's 1975 report on the effects of natural gas curtailment was updated earl$_y$ in 1977 to serve congressional deliberations of administration proposals to deal with natural gas shortages brought on by the severe cold of the winter of 1976 -77.)

In addition to these activities, as a continually evolving organization, OTA undertook the development of a comprehensive and systematic approach to examine, identify, and analyze technologies that have not yet been placed in widespread use. In this attempt to structure an OTA function to assess longer range, more obscure developments, the Office called upon its Advisory Council for guidance. The Council Chairman, Dr. Jerome Weisner, appointed a special Council subcommittee to work with OTA staff members in examining both the requirements for such a program and alternative structures and approaches for its implementation. Dr. Weisner's letter to the Chairman of the OTA Board, reprinted in the appendix, further outlines the important thrust and activities of this effort.

The Advisory Council also continued its comprehensive and creative work to advance the assessment of national R&D policies and priorities. These Council activities are also discussed in Dr. Wiesner's letter, while OTA program work on this is described in section 111 of this report. These Advisory Council contributions, along with many others, are appreciated.

As reflected in electoral campaigns across this Nation last fall, there is an increasing trend in this country, as well as elsewhere in the world, to involve individual citizens and groups of people, more broadly interested in or affected by particular issues, in the public policy process. As a major contributive element to the credibility of our products, OTA has encouraged public participation in its assessment activities since its beginning; in the past year, this activity reached new dimensions.

The number of persons who have worked directly with OTA in advisory or participatory capacities since its start now exceeds 1,000. These included individuals distinguished and accomplished in many relevant disciplines and professions, and represented a wide spectrum of parties affected by the technologies and alternatives that are the subjects of various OTA assessments. In addition, a regional effort to involve a large group of people in the geographical area affected by proposed technologies was completed. This OTA effort brought the views of more than 15,000 people into the assessment of coastal effects of offshore energy systems. A more widespread effort, embracing representative groups and sections covering the entire Nation, was additionally being shaped as an important contributive element to the ongoing assessment on the future uses and characteristics of the automobile.

Workshops, ad hoc panels, advisory committees, and the contributions of numerous individual consultants and contractors are a distinguishing characteristic of all OTA assessment projects. Together I believe these represent a major advancement of an interactivating mechanism broadly sought by the citizens of this country. The various uses of these elements by OTA—including testimony and the occasional working side-by-side with Members of Congress and their staffs—has developed a unique and useful avenue of communication between Congress and the

citizens of this country which not only informs the public as to what Congress is doing, but: also as to the workings of Congress itself. This I believe sustains, with new richness of meaning, Jefferson's credo that "the basis of our Government (is) the opinion of the people . . ."

The experience of 3 years of assessment activity has permitted OTA to widen its base of competence and undertake a number of projects which delve into the details of issues previously touched upon only broadly. Together with adjustments made pursuant to our workshop findings, this seasoning has permitted OTA to be more responsive to Congress, taking on a number of projects and touching on issues in new areas.

The results of OTA experience to date, its adjustments during the year, and its utility to the congressional process will be further evident throughout the pages that follow.

EMILIO Q. DADDARIO
Director

Section II

EXCERPTS FROM OTA REPORTS

During 1976, OTA published 10 reports totaling 23 separate volumes. Because these reports represent the scope, depth, and breadth of OTA assessments, excerpts from several are presented in this section. These samplings provide a flavor of the report from which they were taken—they do not purport to cover the full range of findings or public policy options considered in the assessment. In addition, adjustments have been made in some cases to reflect conditions which may have changed since publication. Individual reports and their purposes are discussed further in section III.

The Feasibility And Value Of Broadband Communications In Rural Areas

A Preliminary Evaluation

FOOD INFORMATION SYSTEMS

HEARINGS
BEFORE THE
TECHNOLOGY ASSESSMENT BOARD
OF THE
OFFICE OF TECHNOLOGY ASSESSMENT
CONGRESS OF THE UNITED STATES
SIXTY-FOURTH CONGRESS
FIRST AND SECOND SESSIONS

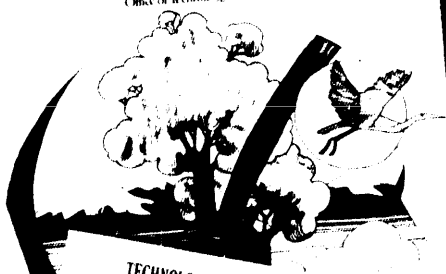
SEPTEMBER 24, 25, AND DECEMBER 20, 1975, FEBRUARY 4, 1976

Printed for the use of the Office of Technology Assessment

A Review of the
U.S. Environmental Protection Agency
Environmental Research Outlook
FY 1976 through 1980

August 1976

United States Congress
Office of Technology Assessment



TECHNOLOGY ASSESSMENT ACTIVITIES IN THE INDUSTRIAL, ACADEMIC, AND GOVERNMENTAL COMMUNITIES

An Assessment of Alternative Economic Stockpiling Policies

ANNUAL REPORT TO THE CONGRESS

for the

OFFICE OF TECHNOLOGY ASSESSMENT

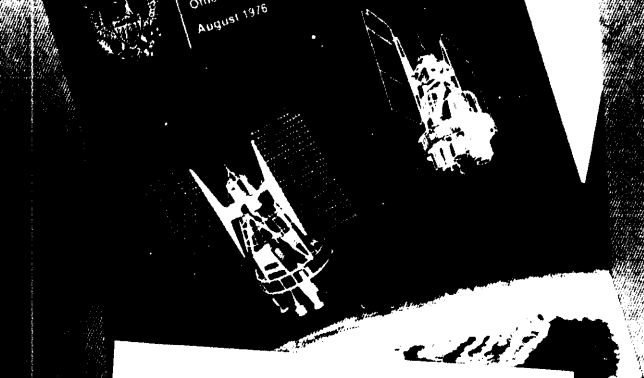
HEARINGS
BEFORE THE
TECHNOLOGY ASSESSMENT BOARD
OF THE
OFFICE OF TECHNOLOGY ASSESSMENT
CONGRESS OF THE UNITED STATES

OTA-F-35

Opportunities for

Food Information Systems
Summary and Analysis

UNITED STATES CONGRESS
Office of Technology Assessment
August 1976

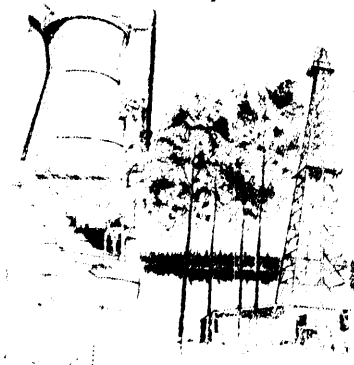


An Assessment of Community
Transit

CONGRESS

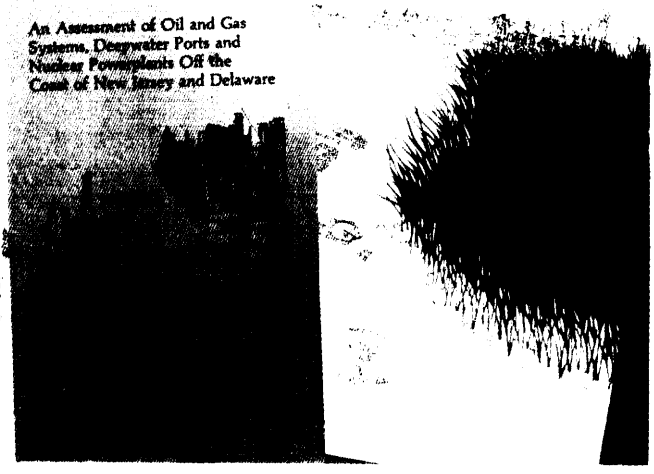
An Assessment of
Information Systems Capabilities
Required To Support
U.S. Materials Policy Decisions

Comparative Analysis of the
1976 ERDA Plan and Program

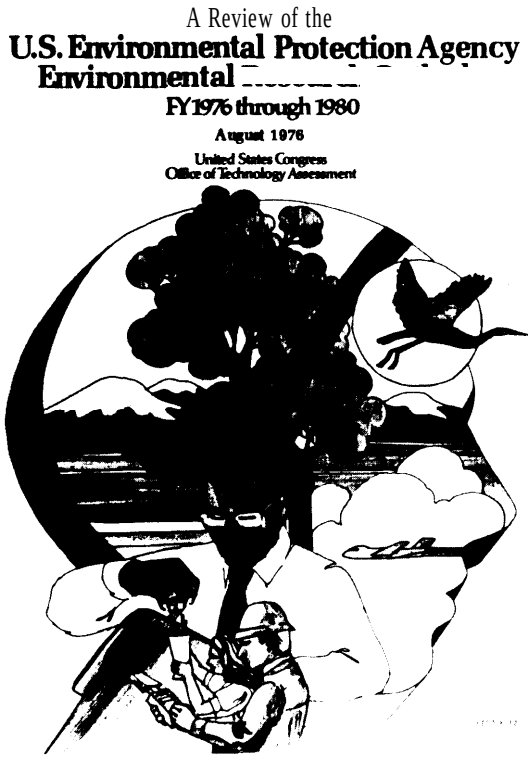


UNITED STATES CONGRESS
Office of Technology Assessment
May 1976

An Assessment of Oil and Gas Systems, Deepwater Ports and Nuclear Powerplants Off the Coast of New Jersey and Delaware



Section II
EXCERPTS FROM OTA REPORTS



A Review of the U.S. Environmental Protection Agency Environmental Research Outlook: FY 1976-80

In February 1976, the Environmental Protection Agency (EPA) presented a 158-page document to Congress setting forth its plans for research and development over the next 5 years. The Plan, proposing a comprehensive 5-year environmental research agenda for congressional review, provides a unique opportunity to develop a dialog between Congress and EPA that goes beyond the usual considerations of plans and programs for the upcoming fiscal year. Congressional interest in forward research planning by EPA, including the request for this OTA analysis, indicates the increasing importance of environmental research and development to the legislative process. . . .

The EPA 5-Year Plan does not indicate a clearly defined commitment to long-range environmental research. Where the Plan does address long-range activities, it discusses the development of techniques rather than considering which long-range issues are important. Yet, such broad long-range concerns must be at the heart of an effective environmental research planning process. . . .

The document prepared by EPA lacks the essential characteristics of a plan. It does not clearly delineate program priorities nor does it relate priorities to overall program goals. The planning process is vague and no guidelines are offered for future updates of the Plan. It is difficult to discern a rationale for the strategic thrusts suggested in the budget. . . .

Much of the work planned in researching the transport, fate, and monitoring of pollutants seems fragmented. Research into the complex processes that link emissions from a source and their effect on the biosphere has not been assigned a high enough priority to support the scientific basis of the regulatory process. . . .

Although analyses of global processes of chemical transport and transformation of pollutants may seem to have little apparent relevance to the Agency's immediate regulatory needs, EPA should ensure that no gaps exist in data about atmospheric and oceanic processes of transport of pollutants throughout the biosphere. Moreover, studies should

EPA--Documerica Photo.

Air, noise, and eye pollution emanate from situations depicted in this photograph of rush-hour traffic.

be undertaken to develop a taxonomy of ecosystems not covered by generalized studies conducted by EPA's Office of Research and Development (ORD). Such long-range studies may lead to regulations which reflect regional variations in environmental sensitivity, . . .

As individuals, EPA's scientists are well qualified and dedicated to producing high-quality research. As an organization, however, ORD lacks a clearly defined commitment to research addressing long-range environmental concerns; it appears to be preoccupied with the day-to-day demands of the regulatory process. Short-term research in support of the regulatory process is necessary, to be sure, but this should not preclude a strong commitment by ORD to long-range research. . . .

Inevitably, significant social, technological, and resource changes will affect the environment. While one cannot predict the nature and time of environmental crises, an exploratory research program that attempts to anticipate problems would add a worthwhile dimension to ORD's program.

When a regulatory agency conducts its own research to evaluate and support regulations that it must enforce there is a danger that a strong regulatory orientation will permeate the research program. If this occurs, the efficiency, content, and quality of the research being performed may be seriously degraded, It becomes a matter of special concern when the research program is not only supposed to establish regulatory support data but also promote the development of basic science in the affected areas,

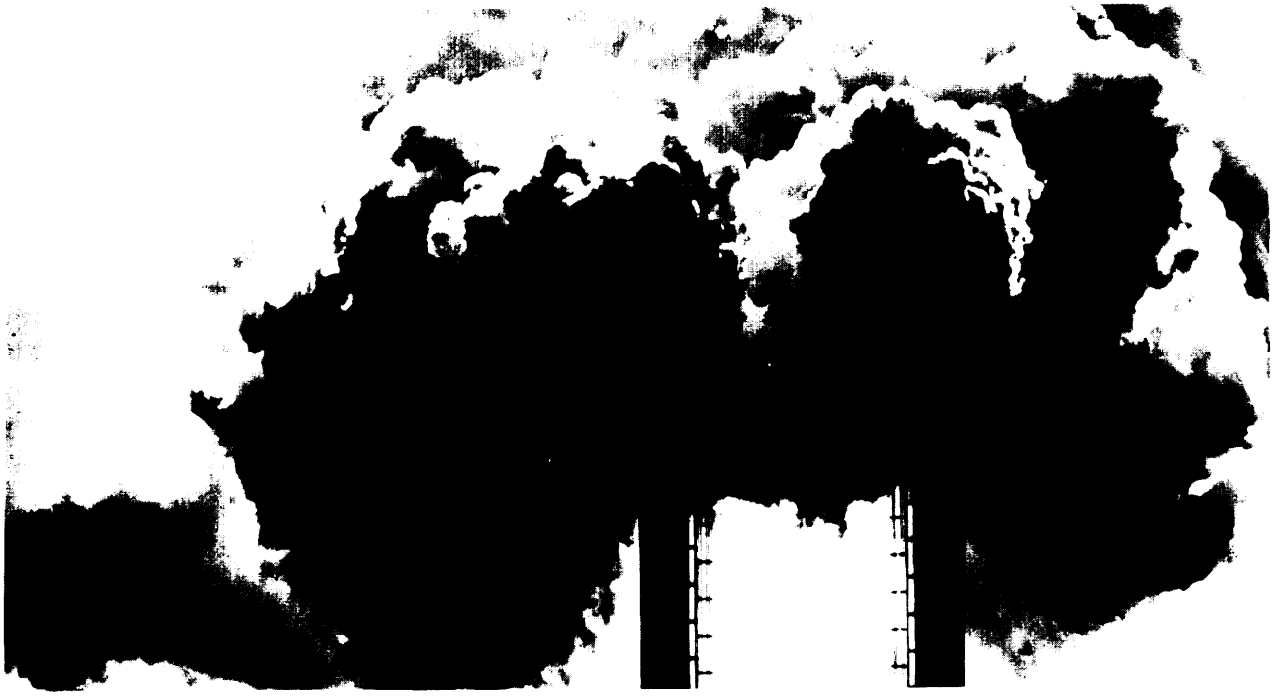
Scientific research staffs are an important base of expertise for any operating regulatory program: The accessibility y of research personnel, however, must be carefully managed to prevent their overinvolvement in the legal, procedural, and political activities of regulatory operations. . .

EPA-funded research into new methods of physical coal cleaning has led to the identification of promising techniques for removing inorganic sulfur from coal. Research in physical coal-cleaning areas appears to have undergone a logical transition from an analysis phase, in which fruitful areas of control technology were identified, to an exploratory phase, in which a significant number of exploratory projects were carried out, and finally to a technology-developed phase. Such an approach may constitute an appropriate model for other areas of control technology research. . . .

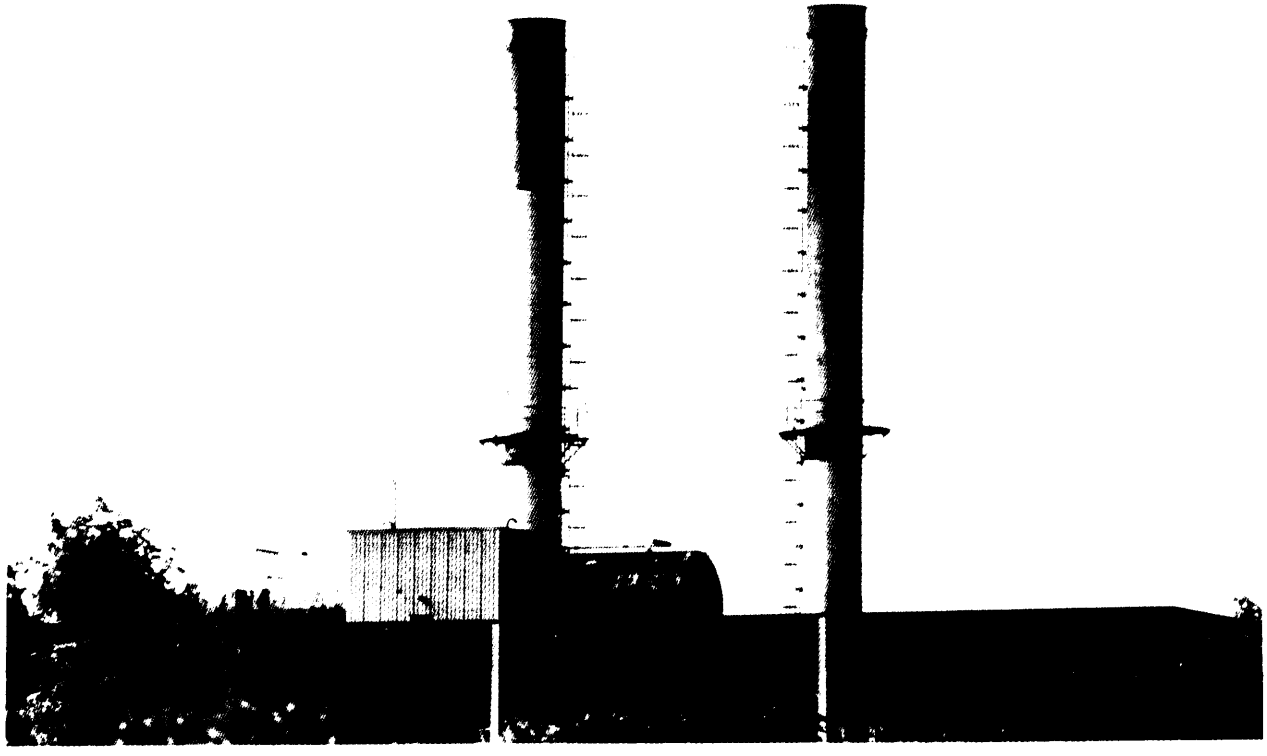
Needed improved instrumentation is currently being introduced into the environmental market. However, the administrative procedures leading to acceptance of an improved instrument or procedure are inordinately time consuming, even after the technology has been proven. Improved analytical methods could be encouraged by establishing an effective, rapid review for a suggested improved technique. This review should not emphasize rapidity at the expense of quality. . . .

Because present primary standards are based on incomplete data, long-term studies of the health effects of chronic, low-level exposure to pollutants need to be made. Parallel to this effort, sequential studies are required during and following incidents when there is a temporary, sharp increase in pollutant levels. Such studies would help give standards a firmer base. The affects of agents in the environment upon health problems such as cardiovascular and chronic respiratory disease should receive as high a priority as carcinogenesis. A method of following the population under study for 20 to 40 years needs to be developed. It is not clear whether these long-term studies are best undertaken by EPA or by another governmental agency, such as the National Institute of Environmental Health Sciences. In any case, EPA should have a strong planning and oversight role. . . .

Chronic degenerative diseases, including cardiovascular disorders, chronic bronchitis and emphysema, renal disease, and arthritis are the major causes of death and disability in the United States. Evidence suggesting that there are significant environmental factors involved in the causation or aggravation of these disorders is accumulating. Hence, there is a great need for better information on the affect on health of long-term exposures to pollutants, over and beyond that of a possible carcinogenic effect.



The pollution generated by this incinerator became so severe that citizen complaints and the closing of nearby schools forced the local government to discontinue its operation in January 1974.



The same incinerator after closing, July 1975

EPA—Documerica Photos.

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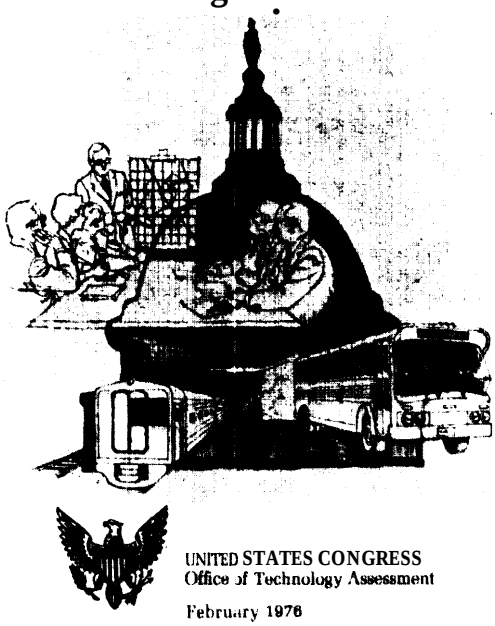
An Assessment of Community Planning for Mass Transit



An Assessment of Community Planning for Mass Transit

In spite of efforts to create a structure for effective, coordinated regional planning, responsibility for transit planning and decisionmaking is fragmented among a great number and variety of local, regional, and State agencies of Government. The separate responsibilities of each are not clearly enough defined for any one agency to have decisive authority over either setting policy or obtaining financing and other commitments necessary to implement a plan.

This fragmentation has led to a number of major problems: 1) inability to set priorities among projects and use funds efficiently, 2) inadequate consideration of transit improvements based on changes in management of streets and highways, and 3) ineffective integration of transit and land-use planning. . . .

Critics fear that engineering consultants may be biased toward a particular technology because they are experienced in it, and that the consultants may have a vested interest in producing a plan they would be qualified to design and construct. Under these circumstances, accountability is reduced if decisions are made by the consultant while board members give rubber stamp approval. . . .

Among the shortcomings of transit planning is the inability to control the effects of transit systems, particularly land-use impacts. Transit planning has tended to emphasize fixed, long-range plans at the expense of short-range improvements, despite evidence—in Seattle, for instance—that such short-term plans are popular. [Traditionally, planners have conceived of the construction of transit systems in terms of long segments, instead of small, staged increments.]

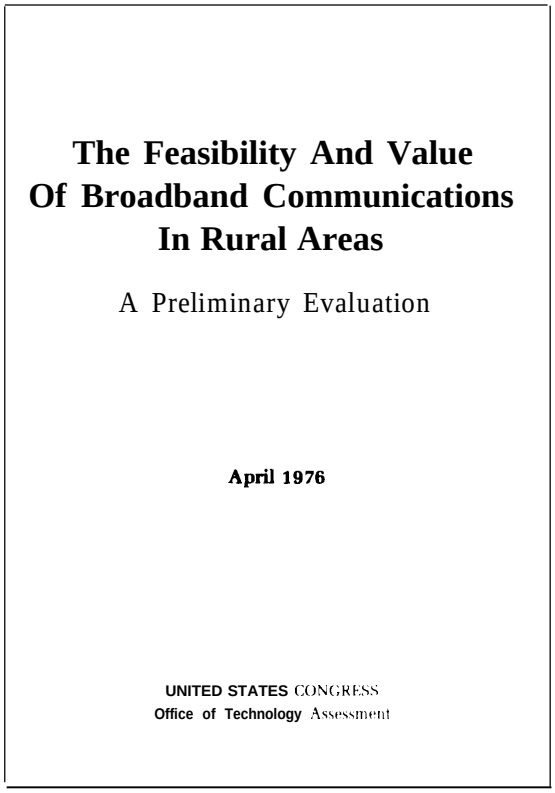
In Washington, for example, 45 miles of the 98-mile Metro system are presently under construction, A Federal report published in July 1975 observed that if Metro planners had focused all available funds on contiguous links, more miles of transit would have been in operation than will be under Metro's present schedule. . . .

The Federal funding program fails to provide incentives to achieve certain national and local goals. Several issues arise from these failings, including insufficiency of current funding levels, narrow definition of the purposes for which funding is available, and separation of highway and transit funding. . . .

Although numerous statements of goals are contained in Federal legislation and administrative guidelines, critics argue that these goals often are formulated in a way that is too general to be useful. In other words, existing goals offer no concrete answers to the central question of how much public transportation people want, what purpose it should serve, and who should pay for it. These questions underlie a national debate over how to create a rational, systematic process of setting specific objectives and developing criteria to determine whether policies and programs are accomplishing what they set out to do. . . .

A number of measures might be taken to improve the efficiency with which the Federal transit dollar is spent. The highway and transit financing mechanisms might be merged to

permit joint planning and implementation of projects. More funds could be allocated by formula or, alternatively, by tying discretionary grants to specific criteria. This would increase financing stability and predictability as well as encourage a better balance between regional and local planning. The flexibility between funds for operating and for capital uses could be increased. This would encourage a better balance between regional and local needs. The purposes for which transit funds could be used might be broadened to improved coordination between transit and land-use planning.



The Feasibility and Value of Broadband Communications in Rural Areas

Broadband systems link doctor and patient, teacher and pupils, police substation and headquarters, or, in other words, substitute communications for travel in the delivery of services. . . In view of the high promise of broadband communications, the reality of their actual use has been the more disappointing. . . As of now, not one system exists which offers rural areas the full range of services' that could be supplied. , . The major barrier to extending broadband systems beyond town limits has been their reliance on entertainment services as a principal source of revenue. . .

A cause for optimism in thinking that rural operators might succeed in assembling combinations of services derives from the potential savings to be realized in a rural setting. Because distances and thereby transportation costs are higher, potential savings from reducing travel might make a given broadband service economically attractive in a farm area where it might not be in a city. . . .

At the present time, a massive Government program to support rural broadband systems might be premature. While planning is well underway for such a system in Trempealeau County, Wis., no full-service area coverage system presently exists anywhere in the United States. Not enough is known about the detailed nature, feasibility, and value of such systems to encourage deployment by means of routine and standard operating programs. . . .

Instead of a large-scale Government program, the logical next step would seem to be a series of system demonstrations in which broadband services would be tailored to meet the specific and different needs of individual rural localities. Different services will have different cost-effectiveness ratios, depending on the demographic, socioeconomic, and institutional characteristics of the community. System demonstrations can provide data on what works, where, and under what conditions. . . .

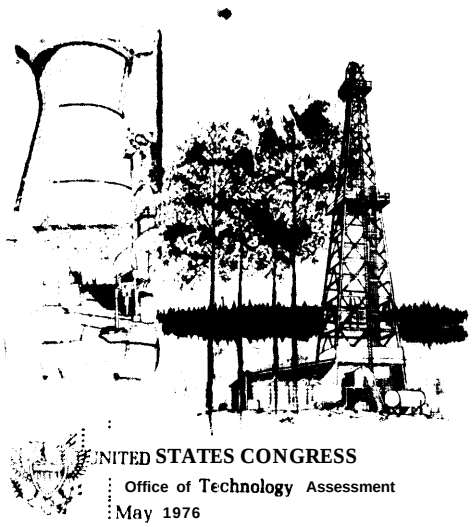
Meeting many rural health needs by broadband communications is technically feasible. In addition, patient acceptance of telemedicine is high and the potential of broadband communications to improve quality of care by increasing patient access to services previously

unavailable to them has been demonstrated. While ensuring privacy and confidentiality remain problems for physicians, these have not prevented application of telemedicine so far. . . .

In general, technology is not now a limiting factor in bringing broadband communications to rural areas. If several two-way public services must be transmitted simultaneously, then channel capacity of conventional cable systems could be a limiting factor. Meanwhile, existing technology is adequate to test the feasibility and value of public service and/or commercial use of broadband communications in rural areas. . . .

The Trempealeau County Project most closely illustrates a systems approach. A county-wide cable and microwave system available to all residents is planned. Schools will use the system to improve the quality of education and reduce costs associated with teacher salaries and transportation of pupils between schools.

Comparative Analysis of the 1976 ERDA Plan and Program



NOTE: This report represents the third on the budget and research and development plans of the Energy Research and Development Administration (ERDA). The 1976 "Comparative" report looked back to what OTA had said in its 1975 "Analysis" report and compared that with what ERDA had done n response in *1976.*

The excerpts taken from the **1976** report therefore include both what OTA said in 1975 and then an analysis of the changes ERDA has or has not made. To note which sections came from which report, the paragraphs are marked "Analysis" to signify the 1975 report, and "Comparative" to signify the **1976** report.

Comparative Analysis of the 1976 ERDA Plan and Program

Comparative

In the year since the formation of the Energy Research and Development Administration (ERDA), domestic production of natural gas declined 6.9 percent and crude oil 4.5 percent. At the same time, petroleum imports accounted for 37 percent of the Nation's total petroleum consumption in 1975 and are now approaching 40 percent. Achieving energy independence by 1985 has become all but impossible and even holding dependence to present levels through 1985 would be a formidable achievement. The energy situation is serious and continues to deteriorate. In addit ion to Federal action a sense of urgency, public awareness, and participation is required. These factors affirm the need for a national energy policy and a crucial role for ERDA in the years ahead. . . .

Analysis

The ERDA research, development, and demonstration (RD&D) plan states five national energy goals to which energy RD&D should contribute. [The five goals are: U.S. security and independence; a strong and healthy economy; freedom of choice regarding

life styles; world stability and international cooperation; and environmental protection.] Heavy emphasis on self-sufficiency, as opposed to environmental concerns, will have major consequences in the quality of life and economic well-being of the American people. Similarly, emphasizing self-sufficiency rather than international cooperation will have major impacts on U.S. foreign policy. Emphasis among these goals warrants congressional review. Unless there is agreement between the Administration and Congress on the priorities given different energy goals, development of ERDA's RD&D program is made more difficult. . . .

Comparative

Although they have not gone as far as suggested in the OTA analysis, ERDA is focusing their efforts more in the direction of solving energy problems rather than on just developing technology options. The principal evidence for this is ERDA's increased emphasis on conservation. In the revised Plan, they state that "reduction of unnecessary waste in energy consumption" is required for successful achievement of national goals. . . .

Analysis

ERDA's program plans, budgetary commitments, and professional staffing do not give adequate attention to social, economic, environmental, and behavioral research needs, even though the legislative record makes it clear that ERDA is given responsibility beyond technological RD&D. Such research is needed for two reasons: (1) to better understand the relationships of energy and the quality of life, and (2) to identify nontechnological constraints to increased energy supply or reduced energy demands. . . .

Comparative

The increase in funding from FY 1976 indicates a stronger commitment by ERDA to socioeconomic RD&D, although there is no strategy for funding across the whole of ERDA. This does not imply, however, that all socioeconomic research should be funded from one office. This is, in fact, probably not conducive to integration of socioeconomic and technical research, but it does suggest the need for a comprehensive plan for this research. . . .

Analysis

ERDA's basic research program has been largely inherited from the agencies that it incorporated. It is therefore not surprising, but nonetheless worrisome, that given ERDA's short life the basic research program does not, in large measure, reflect its RD&D goals. In particular, a need exists to reexamine a) the relationship between ongoing research and ERDA's program disciplines, b) the integration of basic and supporting research, c) the distribution of emphasis on inhouse and contracted research, and d) the role of the national laboratories vis-a-vis universities and industry. . . .

Comparative

Most of the questions and uncertainties raised by OTA last year about ERDA's basic research program remain. A need still exists to examine the integration of basic and supporting research and the distribution of resources between national laboratories, universities, nonprofit research centers, and private industry. In particular, a need remains to examine the role and purpose of ERDA's basic research program (a) within ERDA, and (b) within the total national R&D effort. . . .

Analysis

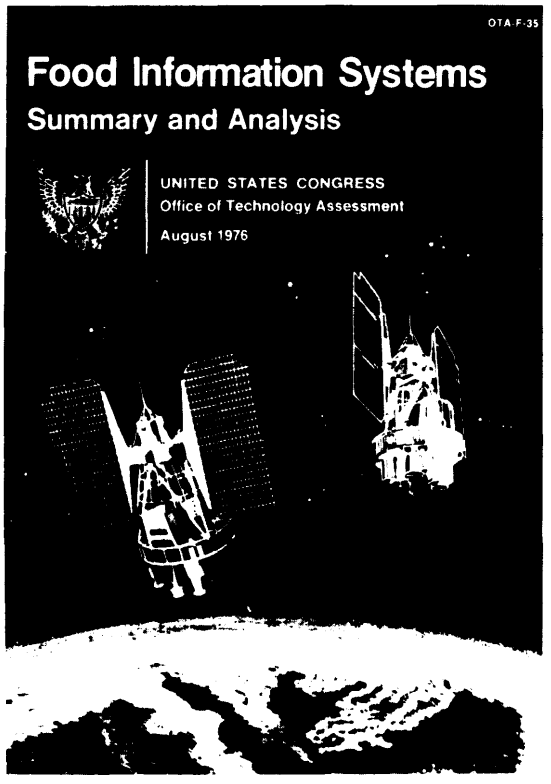
All three major "inexhaustible" sources identified by the ERDA Plan are producers of electricity having high capital cost and low operating or fuel cost, Examination of the functional energy needs indicates that other concepts, although having less ultimate potential, should be given equal priority. Intensive electrification itself will have a noticeable social impact and may present problems of vulnerability and reliability. Alternatives include expanded direct use of solar, geothermal, and other direct heat sources for industrial processes, production of synthetic liquid or gas fuels by solar or nuclear energy,

and increased emphasis on hydrogen, biomass, and conservation. . . .

Comparative

The original issue intended to convey the point that development of nonelectric energy technologies should be given greater emphasis. It was not meant that the technologies supporting electric energy should be deemphasized.

ERDA has changed this relative emphasis to a slight degree in terms of the way it characterizes the various technologies it is developing. The principal example is conservation, which is placed with the highest-ranking RD&D technologies. There has been an increase in emphasis on nonelectric uses of geothermal sources. Beyond these, however, few changes from the earlier ERDA Plan can be identified. . . .



Food Information Systems

The phenomenal increase in prices of grains and soybeans in 1972-73 was not predicted by the Department of Agriculture (USDA) or by land-grant universities. The deficiencies in current information systems include inadequate or obsolete data, poor information systems in other countries, inadequate analysis of information (particularly by the overseas network of agricultural attachés), and a fragmented structure fen- information within USDA that encourages institutional conflicts of interest and hinders effectiveness. Members of Congress had no independent means for dealing with the food policy issues which arose at that time. This apparent breakdown in the information systems on which Congress had traditionally been dependent led to a request that OTA analyze the adequacy of these resources. . . .

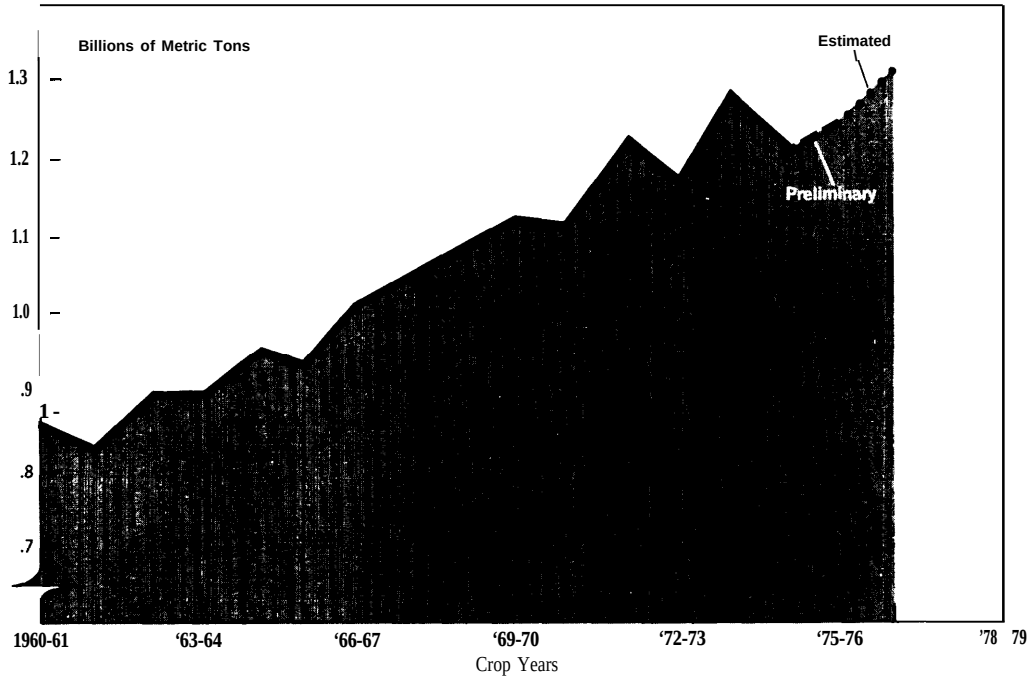
The Food and Agriculture Organization (FAO) of the United Nations is the major source of information on world agriculture, Most of FAO's problems and deficiencies are those encountered in any attempt to collect and disseminate data from a large number of governments with diverse capabilities and policies. These deficiencies can also be attributed in part to the limitations on FAO action inherent in an international or intergovernmental organization. . . .

[Internationally,] in the area of key inputs, fertilizers, and pesticides, the information is neither timely, accurate, nor adequate. The reasons for this vary. First, the production and distribution of these products are carried on by a mix of private and public enterprises, sometimes within the same country. Some countries, for their own reasons, do not divulge their most recent statistics on current status or plans, even though they presumably have them. The private firms involved often are reluctant to disclose information which they believe may affect their competitive position. . . .

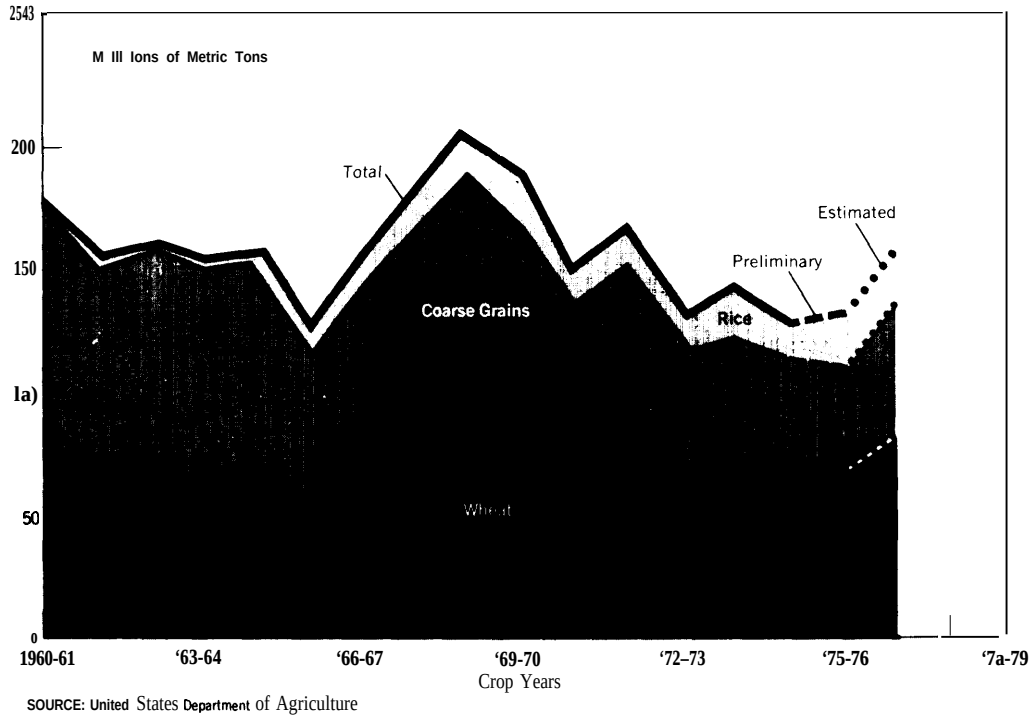
During the course of this study, recommendations for correcting the deficiencies in the existing food information systems were

World production and stocks of major grains 1960-76

World Grain Production



World Inventory of Grain—End of Crop Years



SOURCE: United States Department of Agriculture

irst photo map of the 48 contiguous States of the United States ever assembled from satellite images was produced for NASA by the USDA's Soil Conservation Service. The map was produced from 595 black and white cloud-free images returned from ERTS-1 at an altitude of 560 miles.

NASA Photo.

made to OTA. These recommendations helped OTA develop three options for congressional consideration: relying on existing agencies to initiate improvements; developing a single, integrated world food information system; and improving existing systems.

Relying on existing agencies implies that the events of 1972–73 were unique, and that countries and organizations are rapidly adjusting to them. However, events exacerbating the world food situation have continued to occur. The margin of error in the world's food supply is now less than 5 percent, reserve stocks have been reduced to less than a 30-day supply, and the number of "Most Seriously Affected" countries has increased from 33 to 44. , . ,

Developing a single, integrated world food information system would require a worldwide system in which a congressional unit, linked to a quasi-independent unit within USDA, would serve as the point of contact for the United States, with both tied to a world food information system.

The advantage of this approach is that a "system" would be idealized. However, this option has several disadvantages: the impracticality of its implementation in the near future, the political sensitivities to be encountered in getting such major participants as the Union of Soviet Socialist Republics and the People's Republic of China into the system, and the expected enormous cost of correcting deficiencies in order to make the system effective and efficient.

Due to the fragmented nature of the system, it seems more practical to make improvements in the key existing systems than to try to create a new system. Likewise, suggested improvements to subordinate systems will, in the long run, improve the world food information flow.

OTA found five major areas where improvements might be considered. Within each of these, several specific opportunities exist for action. Some of these improvements would require legislation; others do not. The five areas are: improving the accuracy and timeliness of U.S. food and agriculture information systems; strengthening the U.S. role in a world food information system; increasing congressional staff capabilities; increasing the integration of nutrition information; and accelerating the use of advanced technologies.

Automatic Train Control in Rail Rapid Transit

Rail rapid transit is an old and established part of the national transportation system. It carries large numbers of people at high speeds within central business districts and to and from outlying areas. , . , In cities where there is an existing rail rapid transit system, it is difficult to conceive of how the residents could function properly, or at all, without this mode of transportation. . .

Along with the new attention to rail rapid transit has come an increased concern with technology. The basic technology of rail rapid transit, which derives largely from railway engineering, is quite old. While this technology has been refined and improved over years of operational experience, many transit system planners and engineers believe that new and more sophisticated forms of technology need to be applied in order to achieve systems of. higher safety, performance, and efficiency.

Generally, two avenues of technological innovation are proposed for rail rapid transit: substitution of electronic for electromechanical components and more extensive use of automation. One such application of new technology is in the area of train control. The replacement of men with electronic monitoring and control mechanisms is thought to offer several advantages—greater consistency of performance, safeguarding against human error, more extensive and precise control of train operations, and reduced labor costs in operating the system.

However, some transit engineers have misgivings about the ability of the newer automatic train control systems to perform as safely and efficiently as manual systems. There is also some doubt about the cost/benefit of automation. Automated control systems are more expensive to design and produce, and their complexity may make them less reliable and more costly to maintain. . . .

Complete removal of man from control of transit system operations—even removing him from the central control point—is probably not technically feasible or desirable. For safety and continuity of operation, it will always be necessary to have someone to monitor the system, intervene to restore operations, or assist passengers in an emergency. The number of such supervisors would be only a handful, and it is doubtful they could ever conduct normal operations manually as a backup to automatic systems. . . .

The record of collisions and derailments in Chicago from 1965 to 1974 illustrates the consequences of operating under incomplete signal protection or by manual and procedural methods alone. There were 35 collisions and 52 derailments in this period, an average of about one accident every **6** weeks. Most were minor accidents, but two involved fatalities. An analysis of accident causes shows that human error was a contributing factor in every collision and in almost two-thirds of the derailments. Collisions typically resulted from the train operator misjudging stopping distance or following too closely, Derailments were most often caused by overspeed on curves or by the operator entering an improperly aligned switch while proceeding on hand signals,

Development of Medical Technology

New medical technologies have transformed medical practice in the past several decades by making effective preventive, diagnostic, and therapeutic tools available to the medical care system. Modest, unexamined investments in biomedical research and development can sometimes lead to large, unexpected costs, both human and financial, in the medical care system. . . Some diseases can now be effectively prevented, and medical innovations such as antibiotics have provided effective therapies for a number of other diseases. New diagnostic techniques have frequently made it possible to detect disease in time to apply an appropriate therapy, and even in cases of diseases for which no effective preventive or therapeutic measures are available, relief of pain, amelioration of symptoms, and rehabilitation of individuals affected by chronic conditions have been increasingly feasible.

On the other hand, the accelerating pace of medical technology development has raised a number of troubling issues. Are current R&D efforts directed at developing the most desirable technologies? Does adequate planning precede the introduction of new technologies into the medical care delivery system? Does the introduction of some new medical technologies have indirect or unanticipated social implications?. . . .

The economic burdens imposed by the use of medical technologies cause problems for the patient, for the family, and for society. . . Some require large capital investments. The CAT scanner costs from $350,000 to $700,000, and a modern automated blood chemistry analyzer costs $250,000. Costly followup care is made possible—or even required—by some new technologies. For example, fetal monitoring during labor has led to intervention in the birth process by caesarean section. . . .

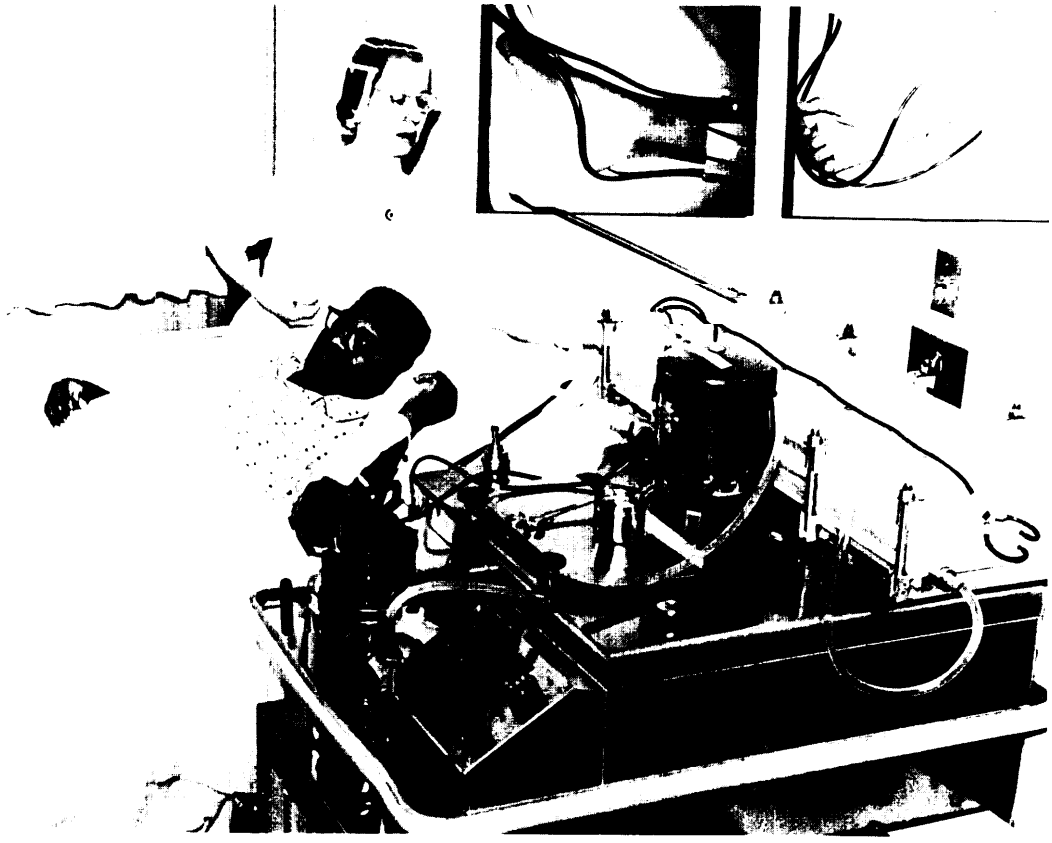
Initial proof of efficacy and reliability of new technologies may lead to overuse. Utilization rates for automated clinical laboratories and CAT scanners are rising rapidly without a documented benefit to the health of either individuals or groups in society. This problem is exacerbated by malpractice suits against doctors, which foster protective ordering of tests. . . .

Medical technologies can also raise troubling social issues unrelated to economic considerations. For example, modern technology has challenged society's traditional view of death and dying. Although these issues are not new, they have been given added significance by new life-extending technologies such as artificial hearts. Modern technology can dehumanize the individual, affect the way people view themselves and others, and give awesome powers to physicians, . . .

Implantation of an artificial heart will permit survival of the patient, and the benefits to the rest of the family will be numerous. On the other hand, unless the cost of implantation of the heart is covered by some third-party payer (a health insurance service), the enormous financial burdens could impoverish the patient's entire family and strain intrafamily relationships. . . .

This artificial heart kept a calf alive for a record 145½ days. The inflow valve of the right heart is removed to show the dark surface of the rubber diaphragm.

Nuclear-powered cardiac packmaker (left) and heart electrode. The electrode normally is in contact with the left ventricle of the heart.



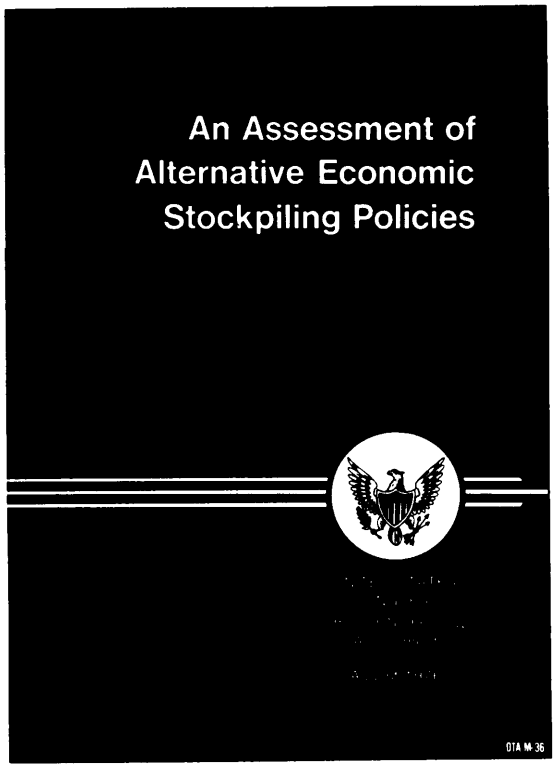
This renal dialysis machine purifies blood through an artificial kidney.

Photos courtesy, Cleveland Clinic, NIH

If the artificial heart works well, the demand for it may be so great that society will find it difficult to supply the device to all who want it. Even assuming an adequate supply, society may be unwilling to supply the device at public expense to all needy patients. Any process of rationing life on the basis of social worth would have a major impact on public values. . . .

As the leading Federal agency involved in biomedical research and the development of medical technology, the National Institutes of Health (NIH) might be considered as a site for assessment programs of medical technologies. The collective administrative and intramural staffs have a wide range of expertise in matters pertaining to medical technologies. This expertise often extends to areas in which NIH is not directing or conducting supporting programs of technology development.

In many cases, NIH supports research on, and thus has knowledge of, new medical technologies that are being developed in clinically useful forms elsewhere. Even if development is occurring exclusively in other agencies or in the private sector, NIH could serve as a central repository of knowledge and informed judgment. Thus, groups at, or supported by, NIH could assess both technologies being developed at NIH or elsewhere with NIH support through the extramural grants and contracts programs, and technologies whose development is supported by other sources of funds.



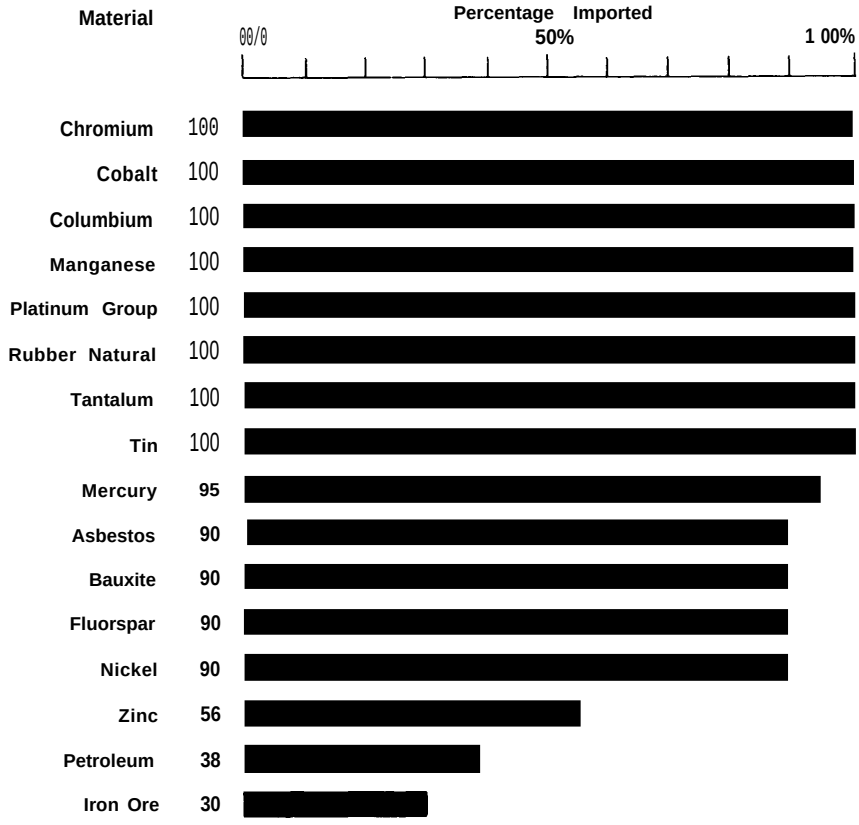
An Assessment of Alternative Economic Stockpiling Policies

There is a real possibility that shortages of materials critical to the U.S. economy will occur suddenly and unexpectedly. This stems largely from the increasing degree of U.S. dependence upon imported materials, as well as from the increasing international competition for materials. Shortages could occur from: 1) cartel or unilateral political actions affecting price or supply, 2) nonpolitical import disruptions, 3) dwindling U.S. sources of scarce materials, 4) fluctuating domestic markets, and 5) fluctuating international markets. . . .

Stockpiling critical materials has long been practiced by the United States to ensure a minimal supply in the event of war, with the marketplace being relied upon as the primary means of correcting temporary shortages and price fluctuations. However, increasing U.S. dependence on materials imports, together with increasing competition among other nations for materials, pose few dangers to the supply required by a healthy economy—dangers which neither the strategic stockpile nor the normal operations of the marketplace have effectively averted or counteracted. . . .

An economic stockpile is similar to insurance in that acquisition and holding costs are paid in anticipation of reducing the costs of possible future problems. A decision to establish an economic stockpile depends on the belief that there will be eventual net benefits, either through deterrence of a problem or through relief if a problem occurs. Because it necessarily involves some marketplace intervention,

U.S. Import Dependence for Selected Materials



Source: Derived by comparison between U.S. imports and usage over a number of years. (Import data from Department of Commerce; usage data from Bureau of Mines and Rubber Manufacturers Association.)

the benefits and costs of economic stockpiles should be delineated to the highest extent possible. . . .

Economic stockpiling will create social and political impacts which must be considered with the economic impact. The implementation of an economic stockpile will also create legal and institutional impacts which are contingent upon the nature of any stockpiling agency established and the oversight mechanisms exercised by Congress.

The benefits and cost of an economic stockpile depend upon specific future actions outside the control of the United States. If undertaken, economic stockpiling should therefore be done on the basis of trend forecasts and possible events, but in a manner flexible enough to permit adjustments to changes. . . .

Alternatives exist which may offer benefits equal to or greater than those of economic stockpiling. These alternatives may require either more or less intervention in the marketplace and many have been used for some time. This experience should be drawn upon in assessing their possible usefulness. Several of the alternatives to economic stockpiling are long-term solutions to materials problems, and as such could be implemented in conjunction with a short-term economic stockpile as an overall strategy of combating such problems. . . .

Labor, business, or other groups will be concerned with the eventual or potential use of the stockpile, regardless of its announced purpose. For labor, stockpiles could blunt the threat of strikes. For business, stockpiles represent intervention in the marketplace.

Alternatives to economic stockpiling policies

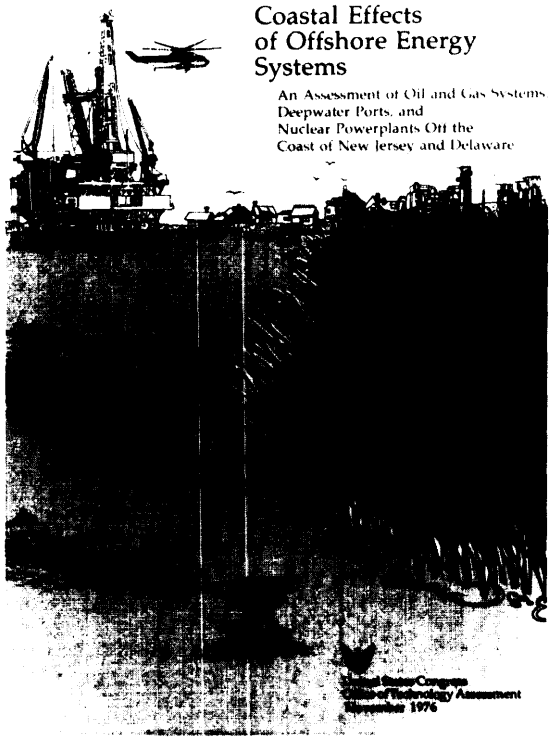
ALTERNATIVES	SP 1—Discourage or Counteract Cartel or Unilateral Political Actions Affecting Price or Supply	SP 2—Cushion the Impact of Non-political Import Disruptions	SP 3—Assist in International Materials Market Stabilization	SP 4—Conserve Scarce Domestic Materials by Reducing Current Consumption	SP 5—Provide a Market for Temporary Surplus and Ease Temporary Shortages
Direct Subsidy	X*	. . .	. . .	X	
Tax Incentives for Capital Investment & Production	X*	. . .	. . .	X	
Research & Development	X*	. . .	. . .	X	
Loans and Investment Guarantees	X*	. . .	X		
Tariff concessions	X*				
Recycling	X*				
Production from Public Lands	X*				
Tax Incentives for Inventory Maintenance	X	X	X	. . .	X
Extended Futures Markets	X	X			
Standby Capacity	X	X	. . .	. . .	X
International Commodity Agreements	X	. . .	X	. . .	X
Conservation	X*				
Substitution	X*	X			
Export Controls	X	X			

● These are long-term alternatives which are not effective in the short run, but which may be effective in the long run

Table VII–2.—Sectors impacted by alternatives to economic stockpiling

Sectors	Sets of alternatives		
	Increase supply	Stabilise supply and price	Redirect distribution
Government	x	×	x
Consumers	x	×	x
Producers—primary materials	x	×	x
Processors-primary materials.	x	×	x
Processors—secondary materials	x	×	x
Scrap collectors.	x	×	. . .
University labs	x	. . .	x
Research labs,	x	. . .	x
Private R&D groups	x	. . .	x
Resource investors	x	. . .	. .
Traders	. . .	×	
Importers.	. . .	×	
Exporters	. . .	×	.

Source: OTA



Coastal Effects of Offshore Energy Systems

No significant damage to the environment or changes in patterns of life in either New Jersey or Delaware is anticipated during operation of the three energy systems [offshore oil and gas exploration, deepwater ports, and floating nuclear powerplants] at presently projected levels. However, careful planning, engineering, and strict operation monitoring are required for each of these complex systems. To a large extent, such planning and monitoring will depend on the quality of oversight by the responsible Federal agency.

Future deployment of ocean technologies on a scale larger than that anticipated at the present time could create serious conflicts among users and impose excessive burdens on ocean and coastal environments. No formal mechanism exists or is planned for resolving conflicts or directing research to discover the cumulative social and environmental consequences of vastly expanded uses of the oceans.

Changes in Federal practices are necessary to reduce the delays in determining offshore oil and gas resources, to provide full attention to State and local needs and potential impacts, and to assure strict enforcement of operating standards to minimize ocean and coastal pollution. Consolidation of authority within the Department of the Interior is essential to supervision of offshore development and coordination of operations with State and local governments.

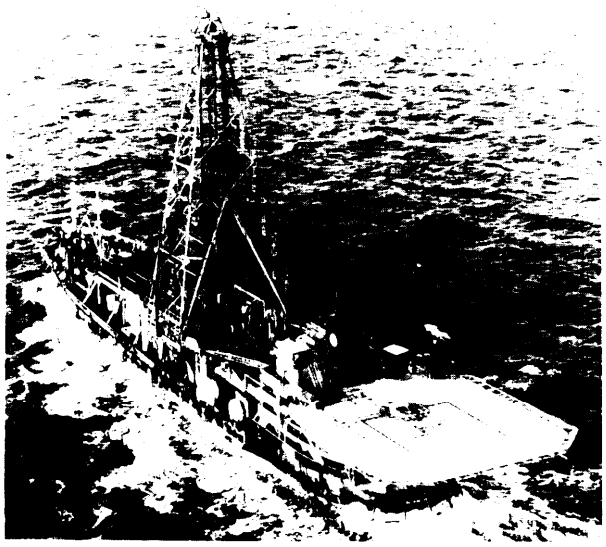
The siting of floating nuclear powerplants, which may offer economic and environmental advantages over land-based nuclear plants, may present unique risks for accidents which have not yet been comprehensively assessed by the Nuclear Regulatory Commission. . . As many as 59 floating nuclear powerplants could be built by a single manufacturer by the year 2000, but no policy analysis of the impacts of deploying that many plants in coastal waters has been done or is contemplated.

Tankers using deepwater ports off New Jersey and Delaware pose a greater pollution and safety threat than the ports themselves. Confining tanker operations to a port several miles from the coast may offer environmental and safety advantages, provided that the tankers using the facility are strictly regulated.

There are specific alternatives which, if substituted for each of the proposed offshore projects, could supply equivalent amounts of energy to the mid-Atlantic region. None, however, offers clear social, environmental, or economic advantages, Increased imports are an alternative to offshore oil and gas development. Onshore nuclear plants and coal-fired plants are alternatives to floating nuclear powerplants. Greater reliance on small tankers is an alternative to deepwater ports. Reduction of energy consumption could offer long-term advantages, but there are no specific plans at the State or national level for an energy conservation program that might eliminate the need for the energy supplies which would come from one or more of the proposed offshore systems. . . .

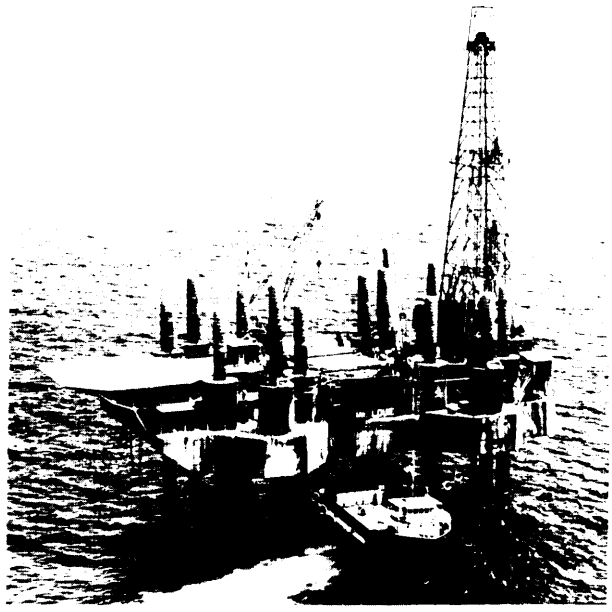
Drastic changes in regional energy prices will not result from offshore development in the mid-Atlantic. . . . A net fiscal benefit to

Three exploratory rigs for possible use in the mid-Atlantic



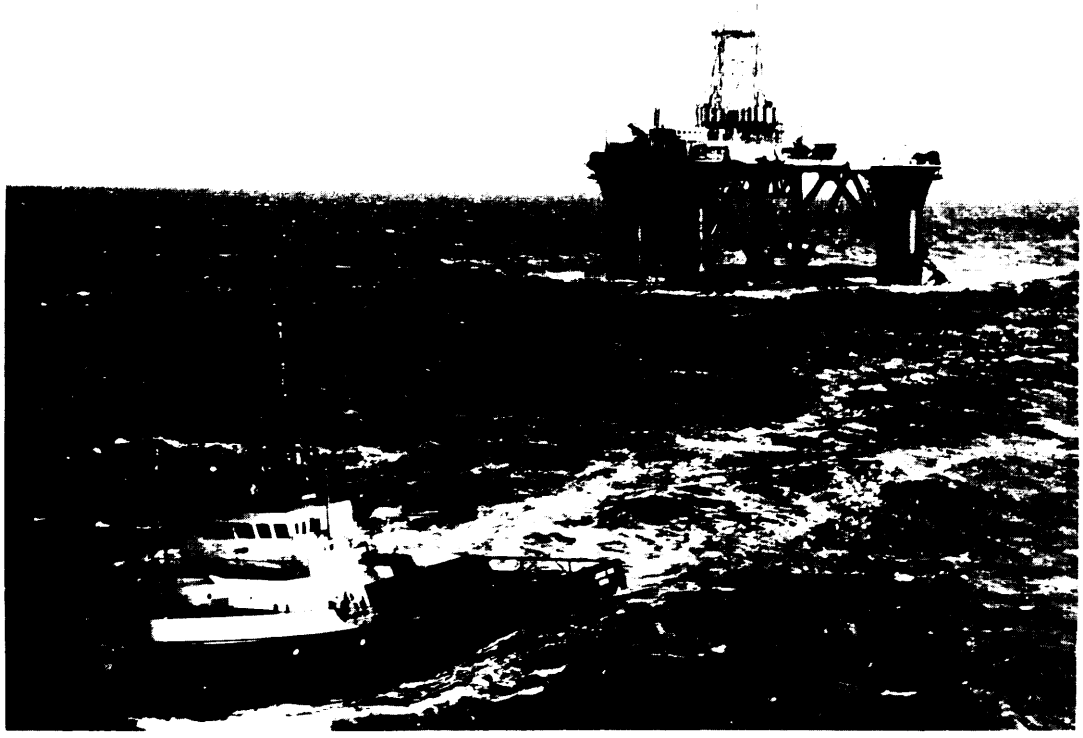
Drill ship

Source Exxon 011 Company,



Jack-up rig

Source Mobil 011 Corporation



Semi-submersible rig

Source: Marine Engineering/Log

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mid-Atlantic State governments probably will result from onshore facilities related to offshore development, but there may be local fiscal problems. The advantage would not occur until after the first 3 years of offshore activity. . . Discovery of offshore oil would not necessarily lead to construction of new onshore refineries in the mid-Atlantic area. In fact, current air quality regulations might prevent construction of new refineries in New Jersey and Delaware. . . .

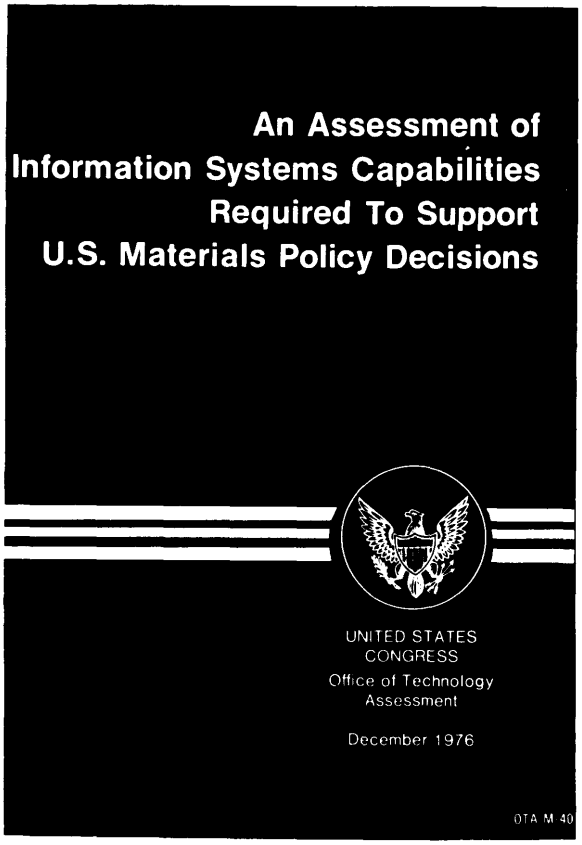
Under some weather conditions, oil spills from a platform as far as 50 miles at sea could reach the New Jersey and Delaware coasts, but predicting the point of impact is not possible at this time. . . Weather, wind, and ocean currents will affect the dispersion, trajectory, chemical composition, and ultimate disposition of oil spills. These conditions vary from season to season, and even from day to day, but research on ocean conditions in OCS areas has a low priority. . . .

Tanker spills are the source of 5 to 15 times as much oil as all offshore drilling and port operations combined, yet pollution-control regulations are far less stringent for tankers than for either deepwater ports or offshore oil and gas operations. . . The use of offshore deepwater ports may reduce the risk of certain oil spills and environmental damage below that of transporting crude oil by small tankers into the congested New York harbor or Delaware Bay. Even the very small risk of a catastrophic spill from a super tanker, however, dictates that stringent pollution control and cleanup systems be used. . . .

A critical review of completed studies of the floating nuclear powerplant discloses little foundation for concluding that either construction or routine operations of the two plants at the Atlantic Generating Station would endanger public health or the environment. . . In the unlikely event of a core-melt accident in a floating plant, the molten core eventually would melt through the bottom of the barge and release radioactive materials directly into the ocean where they could contaminate beaches and be absorbed in the food chain. . . .

The most promising alternatives for stretching out supplies of fossil fuels are programs to improve insulation of homes and offices, changes in automobile design to increase mileage, and use of existing technologies to increase the amount of power generated per unit of fuel. Coal is a potential substitute for every basic fuel in the United States and supplies could last for more than a century even if consumption were to quadruple. However, massive conversion to use of coal would entail major changes in transportation networks, air quality standards, new mining techniques, and new miner-training and safety programs. . . .

No single new technology or change in the way existing" technologies are used is likely to provide more than a small percentage of total energy requirements before the end of the century. Solutions to energy problems will be found in putting together many relatively small conservation and supply programs. Solar energy will not contribute much to energy supplies before the end of the century unless Federal programs to cut solar installation costs and private plans to market solar products are given higher priorities than they now enjoy.



An Assessment of Information Systems Capabilities Required to Support U.S. Materials Policy Decisions

The compatibility of man with his environment is fundamentally linked to his use of materials. Recent materials scarcities, growing concern with environmental degradation, and changing patterns in international supply and demand are among a host of factors creating new materials-related problems for which Congress and the executive branch of Government must fashion effective responses. These factors are inducing a historic shift in national industrial priorities away from energy-intensive, inefficient technologies towards conservation and more efficient use of materials and energy. To accommodate these changes, knowledge of the technological, economic, and social effects of materials management and usage is becoming increasingly important. Achieving a smooth flow of materials information from the laboratory to the designer and manufacturing engineer, developing prudent principles of materials management, establishing sound materials policies in the face of changing priorities—all of these require information services encompassing all functional aspects of the use of materials. . . .

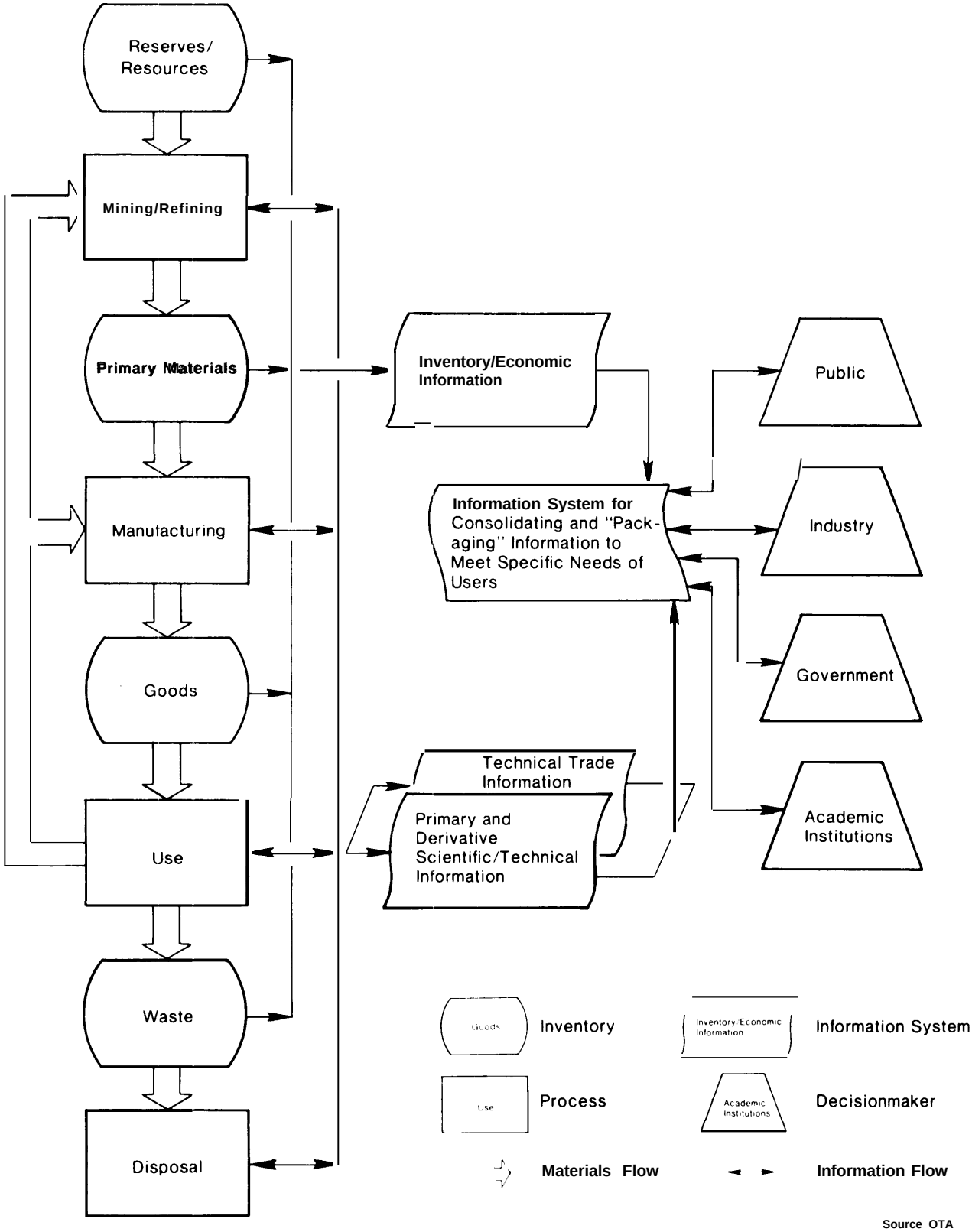
The processing and use of materials accounts for almost 50 percent of the U.S. gross national product, some $576 billion. In 1973, materials-oriented sectors employed more than 34 million workers—45 percent of the full-time work force. In 1973, these sectors consumed more than 80 percent of the total value of all U.S. imports. Significantly, materials imports have been rising since 1967, and there have been periodic scarcity-related situations since the 1950's. But it was not until the 1973 oil embargo that many people realized the United States could, in fact, run short of some vital materials, especially those from foreign sources of supply. , . .

The dominant characteristics of the U.S. materials system is that it is a private system in which supply, demand, and allocations are largely determined by independent decisionmakers working through the market. In the past, Government action to complement the market's response to materials problems was minimal. This condition may be changing; many new pressures on the materials system are national in scope and transcend the decisionmaking capacity of the private sector. For Government materials policy to be effective, it must be based on an up-to-date understanding of the market forces and on timely, accurate information depicting its principal supply and demand parameters.

A wide variety of diffuse and disparate information systems in Government, industry, and academic institutions now guide decisionmakers on all aspects of materials. In contrast to a "national" system—which implies coordination and integration—these separate systems are better regarded as a "nationwide" information resource. . . .

The existing Federal information systems on materials were designed for different purposes, are loosely connected, and do not provide policy makers with adequate information

Flow of information through the materials cycle



Source OTA

to deal with current materials issues. In particular, they cannot be used to forecast possible shortages, judge their impacts and the market's ability to absorb them, or test the effectiveness of alternative policies. More comprehensive and integrated systems capabilities are needed to deal with current materials problems. These capabilities should include techniques for interrelating data regarding the principal supply and demand factors so as to illuminate their effects on the flow of materials. . . .

Review of a limited set of materials information systems currently in use by Federal agencies indicates that they provide a reasonably strong base for developing integrated capabilities. Many of the basic functions are already being performed or are in development, and much of the required data is being generated and collected.

However, since the existing systems were developed by different agencies, for different purposes, and at different times, integrating them to achieve the improved capabilities requires:

- Improving the completeness, currency, and accuracy of their data bases;
- Improving access to them and their ability to interrelate by adopting more uniform usage of terms and developing procedures for ensuring data security; and
- Improving their capabilities for analyzing the data and presenting results to decisionmakers in meaningful formats. . . .

Institutional change is necessary if Congress and the President decide to provide the integrated capabilities. Such capabilities could be located and operated in many institutional settings, including locations within the private and public sectors, and within the legislative and executive branches to support public policymaking.

Section III
PROGRAM DESCRIPTIONS AND ACTIVITIES

OTA assessments are programmatically structured in eight principal areas: energy, food, health, materials, national research and development policies and priorities, oceans, technology and world trade, and transportation. The program areas were established by the OTA Board as a means for organizing congressional requests for assessments. The Technology and World Trade Program is the most recent addition to the scope of OTA activities.

During the report year, more than 40 projects were in progress. Reports on 10 major completed assessments were delivered to the requesting committees of Congress. Forty-three requests for OTA assessments were received from Senate and House committees, bringing to 118 the number the Office has received since its inception.

Section III
PROGRAM DESCRIPTIONS AND ACTIVITIES

Energy Assessment Program

Requests from Congress for OTA assessments of energy-related issues have been organized by the Energy Program into four principal subject areas: energy conservation, fossil fuels, nuclear power issues, and renewable energy sources. OTA projects across these areas comprise a comprehensive program to provide information to assist Congress in selecting among energy options directed toward assuring both adequate supplies and more appropriate uses of energy.

In 1976, the OTA Energy Program completed analyses of the research and development plans and priorities of both the Energy Research and Development Administration (ERDA) and the Environmental Protection Agency (EPA). The Energy Program also undertook a number of projects addressing issues and options concerning both sides of the energy equation—supply and demand.

On the supply side, efforts were initiated to assess the impacts of and constraints on the development of solar energy, direct coal utilization, and improved methods of recovering oil and gas resources. A fourth project is examining the potential for proliferation of nuclear material capable of being used in weapons, as well as the safeguards designed to prevent proliferation. In the demand sector, attention was focused on residential energy conservation, and on an analysis of the policy options for accelerating the realization of its potential.

The Energy Program is working closely with the other OTA program areas on projects of overlapping interest. Accordingly, in the assessment of slurry pipelines to transport coal, the Energy Program is providing support to the Transportation Program. These two program staffs are also cooperating on those projects concerned with the energy demands for transportation. Similarly, the Energy Program is cooperating with the Oceans Program in work examining priorities for energy development on and under the oceans. Further, an interactive relationship has been established with the Food Program on bioconversion projects.

Comparative Analysis of the 1976 ERDA Plan and Program

In this third report on the energy research and development activities of ERDA, OTA responded to a congressional request to determine the effectiveness of ERDA's plans and programs in meeting the goals established in its enabling legislation. In this project, OTA examined ERDA's updated plan and program and assessed the changes made since the earlier OTA analyses. (Excerpts from this report may be found in section II.)

The report provided Congress with substantial background data and analysis for its authorization, appropriations, and oversight functions. Prior to markup of the ERDA authorization bill, OTA briefed the staffs of the Senate Committee on Commerce and House Committee on Science and Technology. Material prepared during the assessment became the basis for recommendations made by the Energy, Research, and Development Subcommittee of the House Committee on Science and Technology on the solar and conservation sections of the authorization bill.

A Review of the U.S. Environmental Protection Agency's Environmental Outlook, FY 1976-80

EPA presented its 5-year research plan to Congress in February 1976. Concerned that its long-term research program may have been unduly influenced by the Agency's regulatory activities, Congress asked OTA to assess

Air pollution: industrial gases belching from a steel plant.

EPA—Documerica Photo.

EPA's ability to anticipate and research emerging environmental problems. To assist in this review and analysis, OTA assembled three panels totaling more than 50 members representing a wide range of disciplines and points of view. One panel addressed EPA's research plans for control and abatement technology, while the second considered research plans for environmental effects and technologies. The third panel reviewed the plan as a whole and examined crosscutting issues. (Excerpts from this report may be found in section 11,)

The report gave Congress a tool with which to analyze the role of research and development within EPA, Following an OTA briefing of the Subcommittee on the Environment and Atmosphere of the House Committee on Science and Technology, the Subcommittee cited the OTA assessment in a report on the organization and management of EPA's Office of Research and Development, In addition, the EPA Assistant Administrator for Research and Development acknowledged that the OTA analyses made a positive contribution to EPA's efforts to revise and improve its program.

Solar Electric Energy

Nearing completion during the report year, this project, requested by the Senate Committee on Aeronautical and Space Sciences, addresses the feasibility and potential of onsite solar energy systems for generating electricity, heating, and cooling. Two methods of generating electricity y by solar means are under study: using solar-heated fluids to drive conventional generators, and converting the sun's energy to electricity in photovoltaic cells. Both methods also produce waste heat which can be used directly for heating and cooling.

One of OTA's major assessments, this work is directed toward analyzing the costs and operations of conventional heating and cooling systems, several modes and levels of various solar technologies, and how solar technologies might be incorporated with existing systems. The examination covers nine types of solar collectors, two types of photovoltaic systems, and associated control, heat . transfer, and storage mechanisms. The levels of use being analyzed range from single-family dwellings, through clusters of buildings and multiunit structures, to small communities. The assessment also is examining the economic, institutional, and environmental impacts of solar energy systems.

The assessment is being performed by OTA staff with the assistance of contractors, consultants, and a citizen's advisory panel. Early drafts of the technical sections of the report were extensively revised and expanded by OTA staff in 1976. In addition, OTA developed independent analytical programs to evaluate technical and economic aspects of each system, both in and of themselves and in comparison with existing or potentially competing energy systems. The project was scheduled for completion in early 1977.

Enhanced Recovery of Oil and Gas

Some of the controversy with regard to energy stems from a lack of complete or reliable information on the extent to which energy resources exist within the United States. An important question underlying this determination is the amount of oil and gas potentially availabl, from known reservoirs through the use of enhanced recovery techniques. Accordingly, OTA is examining data sources about oil and gas and identifying the prospects for their recovery by secondary and tertiary methods, as well as those factors which may encourage or hinder implementation of such methods.

OTA staff and contractors reviewed, analyzed, and correlated the findings of recent reports from a variety of Government and private sources on enhanced oil recovery. This work served as the basis for developing an expanded data base coverin, about 50 percent of the known oil reserves in the United States. This effort was assisted by an advisor, team of specialists from the University of Kansas assembled by OTA to gather technical data for an analysis of reserve sources.

This assessment, proposed by Senator Ted Stevens of the OTA Board, responds to requests from the Senate Committees on Commerce and on Interior and Insular Affairs, and the House Committee on Science and Technology. A report was expected in early **1977.**

Residential Energy Conservation

Several technologies in use or under development can save significant amounts of energy in the heating and cooling of residential buildings. In this project, OTA is evaluating the potential for such conservation over the next 15 years and identifying the impacts of and constraints on achieving that potential. The principal objective of the study is to analyze the policy options that Congress might pursue to accelerate conservation measures.

Undertaken at the request of the Senate Committee on Commerce, the assessment was scheduled for completion in the spring of 1977.

Coal Utilization

As the prices of oil and gas have increased, and as their availability has become increasingly dependent on uncertain foreign sources, Congress has returned attention to coal as an abundant resource. In doing so, Congress faces questions arising from the conflicting

requirements in using coal to meet energy demands while maintaining appropriate environmental standards.

This project is evaluating and comparing the impacts of different methods, available or under development, for burning coal directly (i.e., in contrast to converting it to gas or liquids). An important part of the assessment is focusing on methods, either available or being developed, to increase the burning efficiency of coal, thereby reducing pollutants and other undesirable byproducts.

A second part of the project is examining the technologies for, and environmental and other impacts of, converting coal to gas or liquid forms for combustion. The assessment, undertaken at the request of the Senate Committee on Public Works, is being performed by OTA staff with the assistance of contractors and an advisory panel. It was scheduled for completion in early 1977.

Nuclear Proliferation and Safeguards

Long an international issue, the spectre of a nuclear holocaust has been intensified by the recent spread of nuclear material generated by the growth in nuclear energy development around the world. This proliferation has heightened concern that nuclear material and know-how, provided both by the United States and other countries, could be used to build nuclear weapons by those nations that do not now possess them.

To assist Congress in determining how this trend can be retarded and the potential disaster minimized, OTA is analyzing the problems attendant to proliferation of nuclear materials and the safeguards in use or that might be used to prevent diversion to weapons production. This, in turn, will provide information for the assessment's evaluation of the possibilities for, and the potential of, developing safeguards to prevent the spread of nuclear weapons.

The project is being performed by OTA staff, contractors, and an advisory panel. Efforts on this analysis were forwarded by a workshop held to formulate a work plan, followed by a succession of four panel meetings to review and assist the work of OTA staff. The assessment, requested by the Senate Committee on Government Operations, was expected to be completed in early 1977.

Food Program

In 1972-73, shortages of foods, fuels, and fertilizers disrupted U.S. and world markets and altered public perceptions of availability of these items. Since that time, improvements in the world food outlook have occurred. Instead of shortages, world cereal production in 1976 exceeded that of 1975 by 9 percent, and world carryover stocks (surpluses over that needed immediately) were expected to be the largest in 5 years. In the United States alone, carryover wheat stocks should be the largest since 1963.

At the same time different concerns arose, particularly in the United States. Large sections of the country west of the Mississippi River were experiencing their worst drought in years. Accidents or careless handling of nonbiodegradable chemicals, as well as chemical additives to foods, posed hazards for both livestock and human food sources. State and Federal regulations affecting food production, processing, and marketing have increased sharply in recent years. New regulations may be required to protect the environment and consumers' health; yet some regulations appear excessively burdensome to the food industry in relation to the protection they provide for society.

To assist Congress with these and other related issues, the OTA Food Assessment Program embraces a wide range of issues concerning agriculture, food, and nutrition. Food Program activities are divided into three functional areas: (1) production, from input to the farm gate; (2) marketing, consisting of processing, wholesaling, and retailing; and (3) consumption and nutrition. These activities

address two primary congressional! concerns: better management and use of technologies and resources, and the impact of U.S. food policies on the nutrition and health of consumers at home and abroad.

The need to anticipate changes that affect the U.S. and world food systems has been examined thoroughly in OTA's assessment of food information systems, published during the report year. The study has been used to help apprise Congress of the need and some of the means available for obtaining as much advance notice as possible of national and international food crises.

Yet another project dealing with the overall food situation initiated in 1976 is assessing alternatives in U.S. food policy. This project is intended to provide information and public policy options for Congress to consider in legislating a national food policy.

In the food production area, OTA is examining alternative methods for funding of high-priority U.S. agricultural research. Basic research in the biological sciences that underpin livestock and crop production technology in the United States has been curtailed in recent years. This deficiency, unless corrected in the near future, may limit potential improvements in food production technology in the coming decades. A second project is evaluating the consequences of increasing U.S. support for agricultural research in developing countries.

In the marketing area, OTA projects are addressing issues concerning the transfer of food processing technology to developing countries and the impact of Federal regulation and food grading standards on consumer choices.

In a nutrition-related activity, OTA surveyed so persons knowledgeable in the food and nutrition fields. Analysis of survey results identified five issues of concern: (1) public health problems affected by nutrition, (2) monitoring U.S. and international food consumption and nutrition status, (3) assessing Federal food and nutrition programs, (4) public awareness of nutrition, and (5) the quality, safety, and nutritional value of food. In that these issues correspond to congressional concerns, the survey results are expected to serve as a resource for possible nutrition assessments.

In carrying out these projects, the OTA Food Program calls upon the information resources of several executive branch agencies. These include the Department of Agriculture (USDA), the Agency for International Development, the Federal Trade Commission, and the Food and Drug Administration.

Two Food Program assessments under way during the report year complement projects in other OTA program areas, The assessment of needs and alternatives for implementin$_g$ research and development in agriculture is related to the OTA Research and Development Program, while the project concernin$_g$ the transfer of food processing technolog$_y$ to developing countries has themes common to those being developed in OTA's Technology and World Trade Program. In addition, such marketing issues overlap with concerns of OTA's Transportation Program, while nutrition issues correlate with similar issues that are the subjects of OTA Health Program analyses.

Food Information Systems

This report, published in August **1976**, consists of two volumes. The first records four days of public hearings on food information systems held by the OTA Board on September 24 and 25, 1975; December **10**, 1975; and February 4, 1976. The second volume summarizes and analyzes testimony elicited at the hearings and other material submitted by witnesses, OTA staff, and Board members. (Excerpts from this report may be found in section II.)

Requested by the Senate Committee on Agriculture and Forestry, the assessment provided material for four congressional hearings: two were held by the Subcommittee on Foreign Agriculture Policy of the Senate Committee on Agriculture and Forestry, and one each by the Subcommittee on Census and Population of the House Committee on Post Office and Civil Service and the Senate Select Committee on Nutrition and Human Needs. A bill requiring USDA to conduct an agricul~ur-

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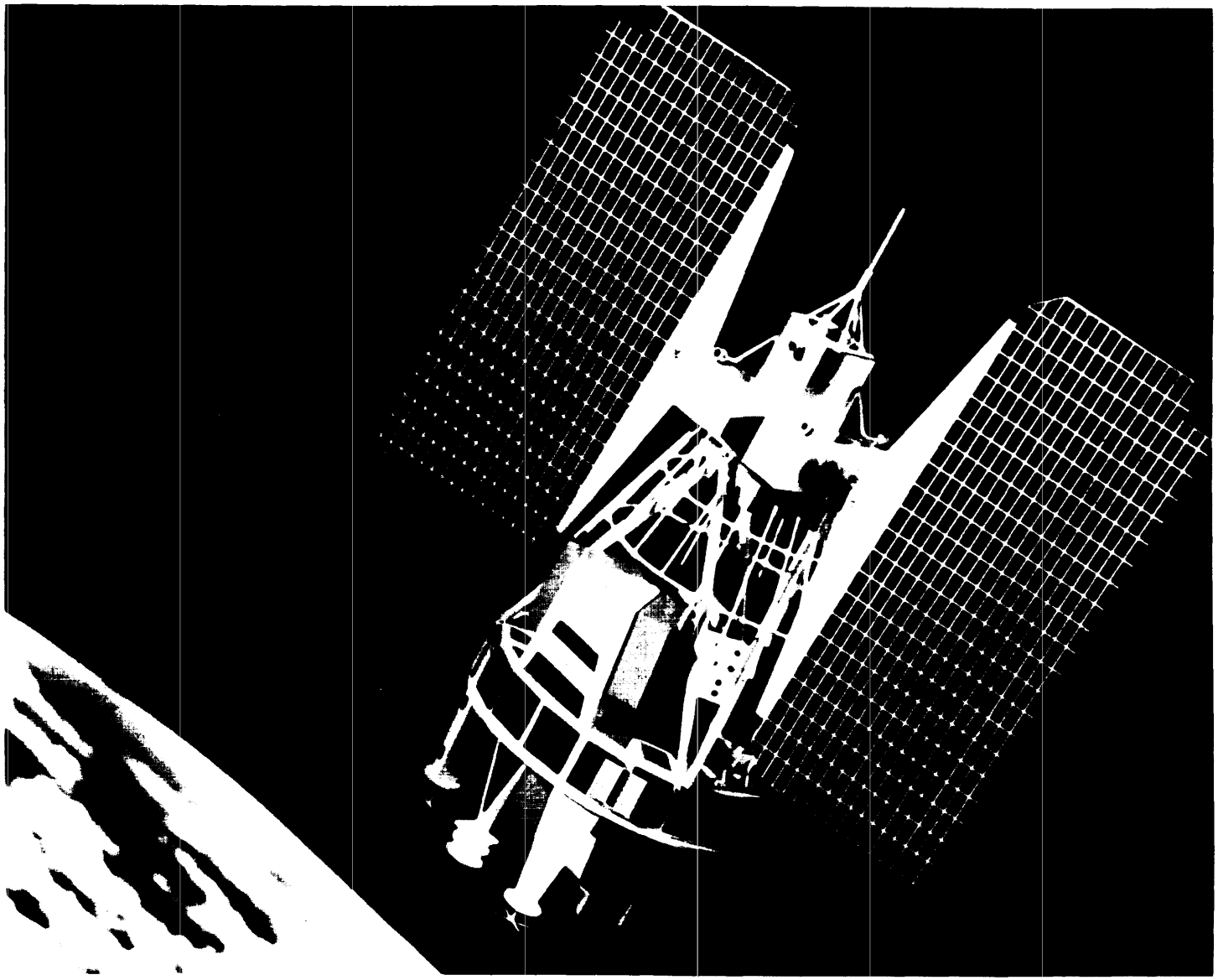
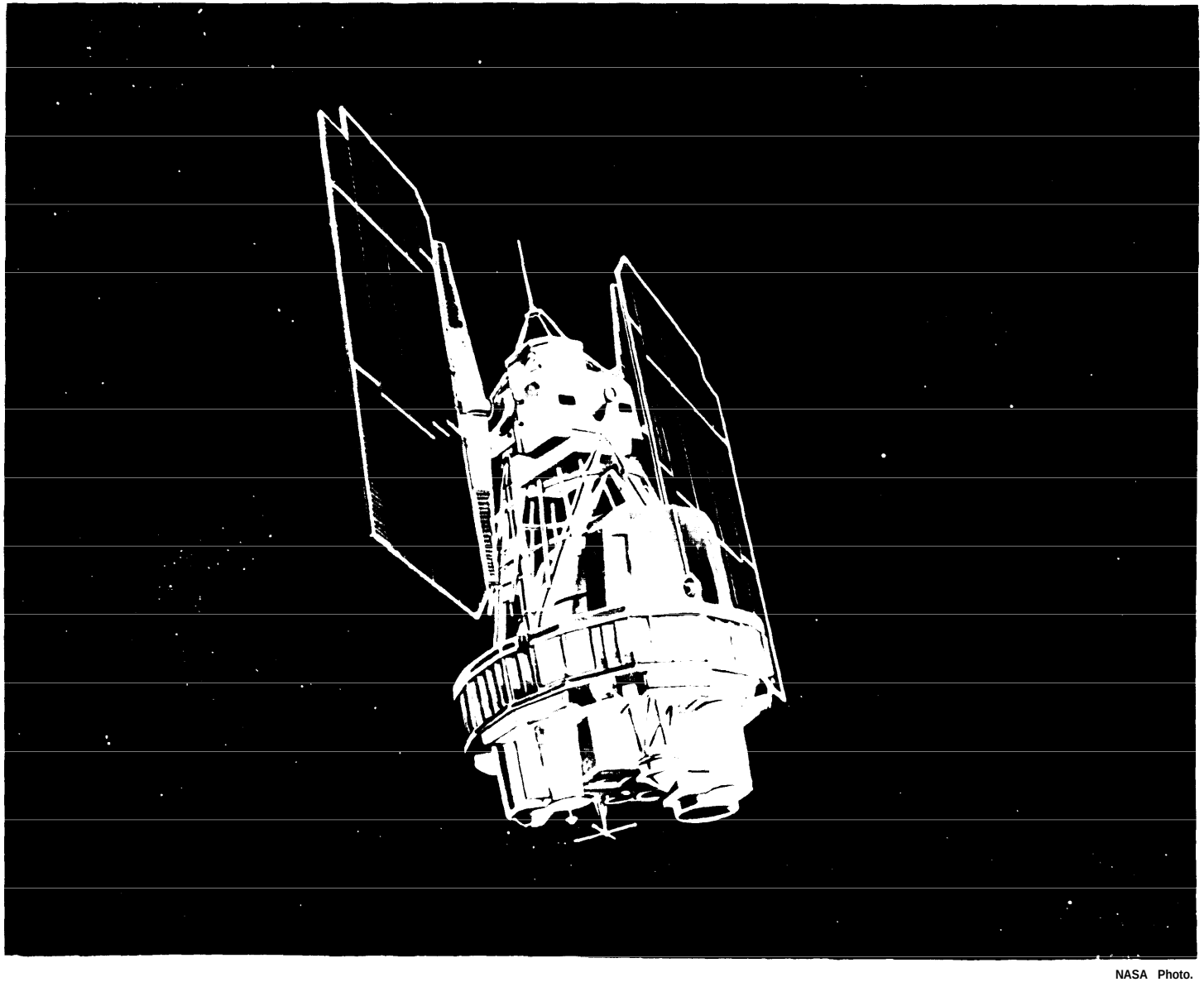


Artist's concept of LANDSAT-2. LANDSAT-2 was launched on January 22, 1975, circular polar orbit at a distance of 568 miles. The Multispectral Scanner System th provides images of the earth in four spectral bands.



NASA Photo.

al census every 5 years was based on material prepared for the OTA hearings.

Agricultural Research and Development

Initiated during the report year, this assessment consists of two separate but related parts: an evaluation of the alternatives for supporting high-priority agricultural research in the United States, and an analysis of the implications which could result from possible increases in U.S. support of agricultural research in developing countries.

Preliminary findings obtained in 1976 aided the staffs of two subcommittees of the House Committee on Science and Technology in hearing preparations, and material developed by OTA was expected to be used in hearings scheduled for early 1977 by the Foreign Assistance Subcommittee of the Senate Committee on Foreign Relations. Requested by the Joint Economic Committee and the House Committee on Science and Technology, a report was expected early in 1977.

Transfer of Food Processing Technology to Developing Countries

The growth in population experienced by many developing countries, in combination with continued drought, has made widespread hunger a grim reality in many parts of the world. Recent uncertainties about U.S. agricultural output have reinforced the argument advanced by many observers that long-range solutions lie in developing nations becoming self-sufficient in food production.

Toward that end, OTA is evaluating the alternatives for and consequences of exporting U.S. food processing technology to such developing countries. As part of this, the project is identifying the quality and range of foods available to such nations, as well as those technologies which would be likely to increase their total food supply, improve its nutritive value, and/or lower the cost of high-quality food.

In addition, OTA is analyzing the effectiveness of institutional channels for, the methods of, and constraints to such transfers, The options available to Congress for stimulating such transfer are also being examined.

Requested by the Joint Economic Committee, the Senate Select Committee on Nutrition and Human Needs, and the House Committee on Agriculture, this assessment was scheduled for completion in early 1978.

Food Grading

Present Federal food grades impart little information to the consumer, whose demands for more information have led Congress to consider changing the standards for U.S. food grades. Current grading criteria are based on sensory characteristics such as taste, flavor, color, or exterior appearance. A more uniform terminology, increased nutritional information, and standardized systems for grading might be of great benefit to consumers.

At the request of the Senate Committee on Agriculture and Forestry and the Senate Select Committee on Nutrition and Human Needs, OTA is examining current standards for food grading to determine if and how changing them will affect consumers. Specifically, the project is evaluating changing the present producer-oriented grading system to a more retail- or consumer-oriented one.

The assessment identifies and analyzes three major issues: (1) changing the criteria or sorting rules used for food grades; (2) changing the present optional Federal grading system to a mandatory system; and (3) determining the adequacy of present grading terminology for consumers. These issues are being evaluated for grading fresh red meat, fresh fruits and vegetables, and processed foods.

The first part of the project was expected to be completed in early 1977.

Alternatives *in U.S. Food* **Policy**

This project integrates results from several different assessments being undertaken by the Food Program, It is assessing technological issues and problems relating to U.S. food policy in the production, marketing, consumption, and nutrition areas.

The OTA Food Program and its Food Advisory Committee have established three objectives for the assessments of alternatives in U.S. food policy. First, a statement was being prepared on the components needed to formulate a national food policy. Second, public policy and technological issues of concern to Congress are being identified and analyzed. Third, emerging issues in the food area are being identified and analyzed.

OTA examined the policies and programs affecting each element of the system, how they relate to one another, and the tradeoffs which result from trying to resolve conflicts that arise between competing goals (such as low prices for consumers and higher incomes for farmers).

The assessment was requested by Senator Hubert Humphrey of the OTA Board, the Senate Committee on Agriculture and Forestry, the Senate Select Committee on Nutrition and Human Needs, and the House Committee on Agriculture. A report was scheduled for completion in early 1978.

Health Program

The purpose of the OTA Health Program is to conduct technology-related research studies on health policy for the committees of Congress. The Health Program has concentrated its initial efforts on issues related to medical technologies, rather than broadening its scope to include other fundamental issues such as behavioral, environmental, and occupational health.

Medical technologies are defined as the set of drugs, devices, and procedures used by medical professionals in delivering medical care to individuals and the organizational systems within which such care is delivered. These applications of scientific knowledge in the health field address a wide range of medical purposes: disease prevention, diagnosis, therapy, rehabilitation, organizational support, and patient care. Such technologies take the form of both hardware (devices and facilities) and software (methods and skills).

Congressional committees are concerned with Federal policies that bear upon many activities in the development and use of medical technologies: determination of need, research and development, validation of research findings, diffusion, use, financing, and measurement of outcome. Throughout all these activities, issues concerning quality, cost control (efficiency), and equity arise.

One assessment completed in 1976 examined the potential benefits to be derived from more fully analyzing new medical technologies with respect to their impact on the patient, the patient's family, the medical care system, and on the legal, social, and political structures in society. A detailed examination of the policy implications of one new technology, the computed tomography (or CT) scanner, is the. subject of a study initiated during the year.

In another assessment undertaken during the year, OTA is examining policies for determining the efficacy and safety of new medical technologies before they are placed into widespread use. In yet another study, OTA is evaluating the benefits and limitations of medical information systems that use computers to process both administrative and medical data. Special emphasis is being given to activities related to clinical medical care. The OTA Health Program is also completing an analysis of alternative policies that might improve the use of prescription drugs.

Policy studies in the Health Program are conducted by OTA staff with the assistance of expert advisory panels, consultants, and, for some specific tasks, outside organizations on contract to OTA. The Health Program Advisory Committee assists in the development of research plans for studies, including definition of issues, scope, and methodology.

In planning and carrying out studies, Health Program staff work closely with congressional committee staff as well as with other legisla-

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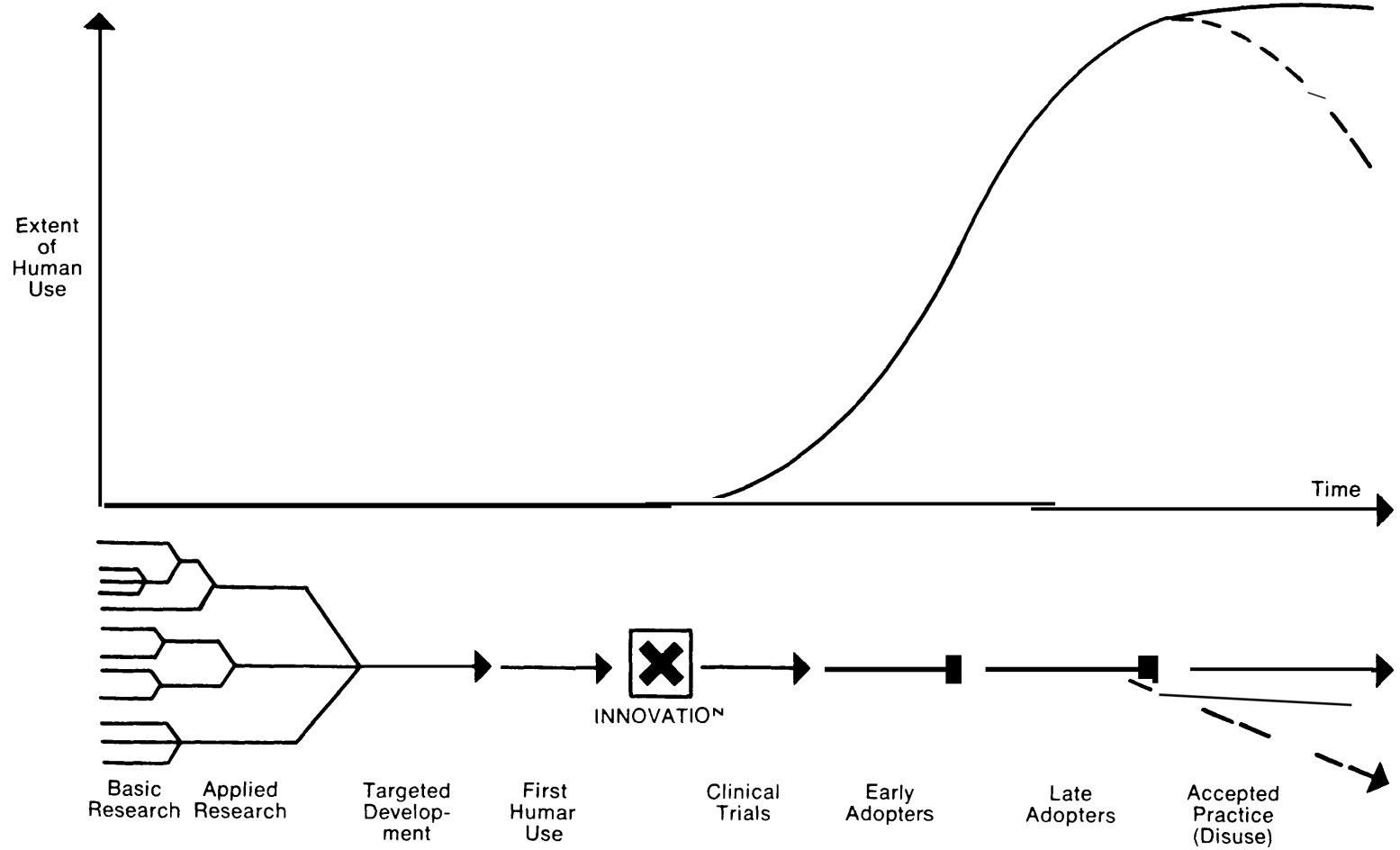
ꝑ scheme for development and diffusion of medical technologies



tive and executive branch agencies, such as the Congressional Research Service, General Accounting Office, Congressional Budget Office, and the Department of Health, Education, and Welfare.

Development of Medical Technology: Opportunities for Assessment

The OTA report examined the need to assess the social impacts of new medical technologies while they are being developed, the kinds of questions that might be asked in such assessments, by whom, and at what point in the development process assessments could most effectively be conducted. The report presented the case histories of nine technologies to illustrate medical technologies, how they are developed, and why assessing their social impacts might be helpful. (Excerpts from this report may be found in the preceding sect ion.)

Requested by the Senate Committee on Labor and Public Welfare, the report was published in August. At year's end, its findings were being used by the committee staff to prepare for hearings planned for spring 1977 concerning the possibility of requiring assessments of new medical technologies developed with the aid of Federal funds.

Policy Implications of Computed Tomography Scanners

The computed tomography (CT) scanner, a new radiological device which combines an online computer with sophisticated X-ray equipment to produce a cross section image, is used to diagnose a wide variety of diseases. Rapidly and enthusiastically accepted by the medical community, CT scanning in the United States is already costing more than **$200** million per year, and is growing rapidly. The Federal Government, through private insurance companies and individual patients, is faced with the problem of paying these bills. The combination of the revolutionary nature of CT technology, the rapidity of its acceptance, and its expense have created many major problems for the medical system.

Because many of these problems are common to a number of new medical technologies, CT scanners provide a case study that highlights several important issues for health policy. These issues include: Federal policy regarding safety and efficacy, the effect of health planning and regulatory policies on diffusion, the relationshi$_p$ between efficacy and patterns of use, and the impact of reimbursement policies on expenditures. The assessment, requested by the Senate Committee on Finance, was expected to be completed in late 1977.

Achieving Safer, More Effective, and Less Costly Use of Therapeutic Drugs

Although Americans spend more than $10 billion annually on drugs, numerous questions concerning the cost, use, and effects of therapeutic drugs remain unanswered. Alleged problems include: errors in administration of drugs, noncompliance by patients, inadequate professional and consumer education, and under- and over-utilization of drugs. Inordinate or inappropriate use of drugs can lead to protracted illness or needless injury, as well as increased costs.

In this study, OTA is analyzing a broad range of factors that limit safer, more effective, and more economical use of drugs. The problem of adverse drug effects is being given particular attention, In addition, a number of strategies designed to improve drug use are being evaluated. The alternatives fall into several categories: information provided to health professionals, review of behavior of health professionals, administration and management of drug use, education and training of health professionals, regulation and control of procedures used by health professionals, and information provided to patients. Systems to monitor adverse drug effects are also being reviewed.

This assessment, which was requested by the House Committee on Ways and Means, is limited to prescription drugs. Completion was expected in late 1977.

Efficacy and Safety of Medical Technologies

Issues of efficacy arise when a new technology is introduced, when a widely used technology is later questioned, or when alternative therapies are compared. Various laws have been enacted to regulate the safety and efficacy of drugs and medical devices.

Determination of safety and efficacy of procedures, however, is widely considered to be a professional responsibility, although some testing is being conducted by various Federal agencies and private groups. However, such widely used technologies as tonsillectomy, appendectomy, and fetal monitoring have not been completely assessed for efficacy and safety. Other widely used procedures, such as mammography, are now being reexamined.

In this study, OTA is using **16** short case studies to illustrate the diverse nature of medical technologies, the difficulties in determining efficacy and safety, and Federal involvement in assessing efficacy before technologies come into widespread use. The OTA Health Program is examining the need for assessing efficacy and safety, the methods and procedures available for such assessment, the types of assessment presently being supported by the Federal Government, and ways to improve existing policies.

The report was undertaken at the request of the Senate Committee on Labor and Public Welfare. Completion was expected in late 1977.

Medical Information Systems

Almost **90** percent of all hospitals in the United States use some form of electronic data processing. For the most part, hospitals have automated only business and administrative functions; few health care facilities presently use computers for activities related to clinical care. Computer systems that process both administrative and medical data, known as medical information systems, have recently been developed and are now being marketed.

This assessment analyzes the benefits and limitations of such systems. Three representative systems are being examined: one designed for use in an acute-care hospital, one designed for ambulatory care, and one that can be used in either setting.

The study is directed toward an examination of the impact of such systems on patient care, the quality of care, medical education, professional roles, research, planning, malpractice litigation, and the confidentiality of patient records. The Health Program is identifying factors, such as cost, transferability, and acceptability, that will influence the implementation and use of medical information systems. Alternative Federal policies are being analyzed regarding more widespread use of such systems.

The assessment was requested by the Senate Committee on Labor and Public Welfare. It was expected to be completed in late 1977.

The processing and use of materials* account for almost 50 percent of the U.S. gross national product. About 45 percent of the full-time work force, some 34 million workers, were employed in the materials sectors of the economy in 1973. Until the 1973 oil embargo, however, the importance of raw and processed materials, and the fact that some were in short supply and/or controlled by foreign sources, was not generally appreciated.

In its requests for OTA assessments, Congress has reflected a concern over the future availability of adequate quantities of materials to maintain current standards of living. Congress is also concerned about whether supplies will be assured by the normal actions of the economic marketplace, or whether some Government action is required.

To meet these concerns, the OTA Materials Program is built around the total materials cycle, from exploration and extraction through production to . use, reuse, and eventual disposal. This approach emphasizes the linkages between issues at one phase of the cycle with those at another. The individual projects address both the supply and demand sides of the materials equation.

During the report year, OTA published two reports addressing separate but related issues involving materials. The first, released in October 1976, examined the possible use of a national stockpile of critical materials for broader purposes than national security in order to avoid future economic dislocations. The second, published in December, analyzed existing and possible institutional means for improving the capabilities of the Federal Government to acquire information on materials needed to support policy decisions.

Work progressed in 1976 on five assessments. One project is examining the issues relating to resource recovery from and the management of municipal solid wastes. Two assessments deal with issues and problems related to access to minerals. The first is examining laws, policies, and practices that affect the exploration for and production of minerals from Federal lands. The second is looking at the effects of Federal land management and ownership on mineral exploration and development on non-Federal lands.

Another project deals with alternative technological approaches for conserving materials in both their manufacture and use. Finally, OTA is assessing the value of past and future mining activity on existing Federal coal leases.

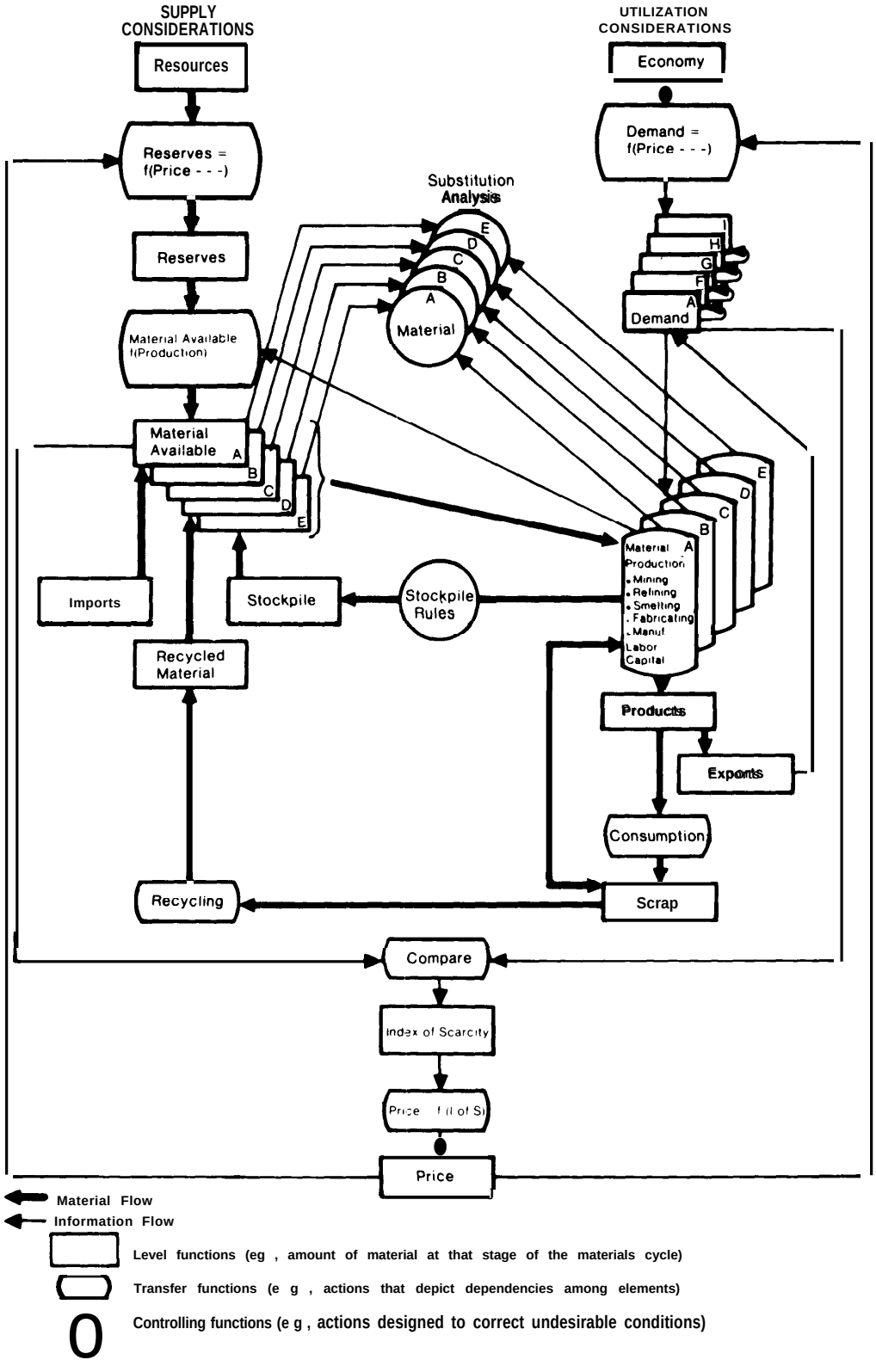
A number of related problems or issues are being looked at by OTA from different angles by several program areas. Coal, for instance, is being assessed by three separate projects in three program areas: (1) the Materials Program is evaluating Federal coal leases; (2) the Energy Program is studying coal utilization; and (3) the Transportation. Program is examining the use of slurry pipelines to transport coal.

Alternative Economic Stockpiling Policies

Undertaken for the House Committee on Science and Technology, the findings of the report have been widely used by Congress and other organizations. OTA briefed the staffs of the Senate Committee on Commerce, the Department of Defense Materials Shortages Steering Committee, the Federal Preparedness Agency, and the Materials Division of the Department of Commerce. In addition, OTA assisted the Subcommittee on Materials Availability of the Joint Committee on Defense Production in preparations for hearings on economic stockpiling held June 8 and 9, 1976. Finally, the National Commission on Supplies and Shortages used the findings to help prepare for its report to the President and to Congress issued in December 1976. (Excerpts from this report may be found in section II.),

* "Materials" has been defined in *Science Policy - A* Working *Glossary* **(1976** edition) as "stuff that things are made of or with, or could be. "

Basic informational framework applied to materials substitution



Materials Information Systems

This report addresses the alternative methods by which policy makers in Congress and elsewhere would receive adequate and timely information about supplies and potential shortages of materials which are critical to the U.S. economy. The project assessed the needs, character, institutional structure, and effects of information systems on the supply, processing, and use of materials. (Excerpts from this report may be found in section II.)

The assessment was requested by the House Committee on Science and Technology. The staffs of four separate congressional committees were briefed at various stages of the project and given copies of the interim report. In 1976, as in 1975, OTA staff testified at hearings conducted by the Senate Committees on Commerce and Interior and Insular Affairs on proposals to establish, among other things, a national energy information system.

Also, the National Commission on Supplies and Shortages has been closely involved with this and other Materials Program projects. OTA briefed the Commission staff in preparation for a conference held April 19 to 23, 1976, and for the Engineering Foundation Conference at Henniker, N. H., held on August 8 to 13, 1976. The OTA Director submitted the major findings of the assessment for insertion into the record of public hearings held by the Commission on October 13, 1976.

Resource Recovery, Recycling, and Reuse

The generation and management of municipal solid wastes present substantial problems for local, State, and Federal governments. Wastes are not only costly to collect, but also need to be disposed of in an economical and environmentally acceptable manner. In addition, the generation of wastes results in a more rapid consumption of natural resources. Accordingly, OTA is studying the potential for, and barriers to, recycling and reusing resources recovered from the waste stream. OTA's purpose is to identify and analyze both the policy options for the resolution of these problems, and the likely impacts of implementing" those options.

The project includes several parts: an evaluation of markets for such recovered goods as paper, aluminum, ferrous metals, glass, and energy; an analysis of the impacts of freight rates on the movement and sale of recovered goods; a study of the economic and technological feasibility of centralized facilities for resource recovery; and an analysis of the implications of mandatory deposits on beverage containers.

The assessment, being performed by OTA staff with the assistance of a subcommittee of the OTA Materials Advisory Committee, was requested by the Senate Committee on Commerce and the House Committee on Science and Technology. OTA worked with congressional staff during deliberations leading to the Resource Conservation and Recovery Act, enacted on October 21,1976.

In addition, OTA staff briefed the Subcommittee on Environment and Atmosphere of the House Committee on Science and Technology. Background material on recycling materials was prepared for the staffs of the Senate Committees on Public Works and Finance. OTA staff also participated as panel members at a symposium held on April 7, 1976, on resource conservation and recovery sponsored by the Subcommittee on Transportation and Commerce of the House Committee on Interstate and Foreign Commerce.

The final report was expected to be completed late in 1977.

Minerals Accessibility on Federal Lands

OTA is assessing the effects of modifying or restructuring State and Federal laws, policies, and practices that significantly affect the exploration for and production of minerals located on Federal lands. The objective of the assessment is to provide alternative approaches to facilitating mineral development in ways that are environmentally acceptable and take nonmineral land uses into account.

The assessment is divided into two parts. The first involves a compilation and analysis of information on the effects of current Federal and State laws, policies, and practices relating to mineral development on Federal lands. The second is analyzing possible adjustments in the existing system for managing the exploitation of minerals on Federal lands, as well as the impacts of those adjustments.

The assessment was requested by Senator Ted Stevens of the OTA Board and the Senate Committee on Interior and Insular Affairs, One report was expected in the fall of 1977, another by the end of 1977.

An interim report was distributed to the Senate and the House Committees on Interior and Insular Affairs and many individual members of those committees, to other interested committees and Members of Congress, to executive agencies, and to the public.

In addition, OTA sponsored an assessment workshop in July that enabled congressional staff to question representatives of executive agencies, private industry, and interest groups on various issues relating to minerals and Federal land management.

Minerals Accessibility on Non-Federal Lands

This project is assessing the various aspects of Federal land management and ownership that influence the exploration for and development of minerals on non-Federal lands, or on Federal lands where the surface and subsurface property rights are severed. The assessment is focusing on situations where the Federal Government owns only the surface land or only the minerals, as well as on access across Federal lands to minerals located on non-Federal lands.

This assessment, which evolved from the minerals accessibility on Federal lands project, was requested by Senator Ted Stevens of the OTA Board. The assessment was expected to produce two reports by the end of 1977.

Conservation Through Reduced Wastage

Since in the manufacture and use of products a large amount of materials might be saved, OTA is analyzing alternative technological approaches to conserving materials. To provide an appropriate focus for a potentially wide-ranging effort, the scope of this assessment is limited to primary metals (chromium, nickel, copper, aluminum, and iron) and certain key products, such as autos and railroad rolling stock, appliances, and military and construction equipment.

The assessment is directed toward the study of the flow of materials from their source to end-use products, examining the cycle to determine the reasons for wastage, and identifying and evaluating alternative approaches to the design and manufacture as well as the conservation of materials. The project is divided into two parts: an engineering analysis to define the state of the technology for conservation, and a public policy analysis of the options for Congress in considering the impacts of the technology.

Requested by the Senate Committee on Commerce, the project was expected to be completed by mid-1978.

Existing *Federal Coal Development*

OTA is analyzing Federal coal leases, permits, and preference-right lease applications with respect to current and future plans for the development of coal reserves. Mandated by Congress in Section 10 of the Federal Coal Leasing Amendments Act of 1975, the assessment is analyzing all mining activities, determining the revenues from those leases, and evaluating the feasibility of using deep mining technology in the leased areas.

This assessment was to be completed by the end of 1977.

Recent years have brought an increased awareness of the impact of the oceans on the well-being of man—the oceans' potential as a source of food, fuel, and hard minerals; their use as avenues of world commerce and communications; and their role in man's research for knowledge about his resources and environment. At the same time, the oceans are increasingly recognized as a finite resource, one to be managed in a way that will strike a balance between immediate use and longer-term viability,

To assist Congress in its deliberations of such matters, the OTA Oceans Program focuses on a broad range of issues involving the use and quality of the oceans and the systems deployed on or in the oceans and along their shores. The program is particularly concerned with examining possible future uses of the oceans.

Early studies by the Oceans Program centered on the potential for, and impacts of, using the oceans to help meet the energy needs of the Nation. In December **1976,** OTA published a report on the impacts of three proposed offshore energy systems on the coastal areas of New Jersey and Delaware. A related project was underway on the implications of various proposed technologies for harnessing the ocean itself as a source of energy. Another project examines the public decisionmaking process for, and the effects of, locating energy facilities in coastal areas. Some aspects of these assessments involve work by other OTA programs, especially the Energy Program.

Work continued on an assessment of technologies for carrying out provisions of the new 200-mile fisheries zone created by Congress. A planning study was initiated to aid Congress in its evaluation of Federal expenditures for marine science and technology.

Coastal Effects of Offshore Energy Systems

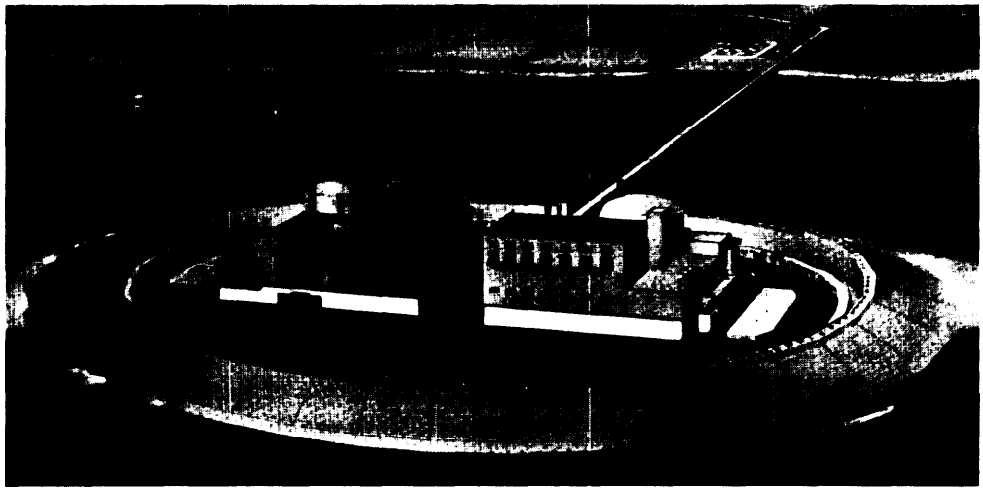
The report on the effects three proposed offshore energy systems might have on the coastal areas of New Jersey and Delaware culminated a 3-year, multifaceted effort by OTA. The three systems are: the exploration for and development of offshore oil and gas, use of deepwater ports for large oil tankers, and generation of electricity by floating nuclear powerplants. (Excerpts from this report may be found in section II.)

As part of this assessment, OTA completed a public participation program which involved more than **15,000** people through workshops, public meetings, interviews, citizen advisory panels, and distribution of questionnaires and brochures. The program was intended to contribute to the public understanding of the technologies being assessed and to insure that the final report reflected the views and concerns of the people who would be affected by the technologies,

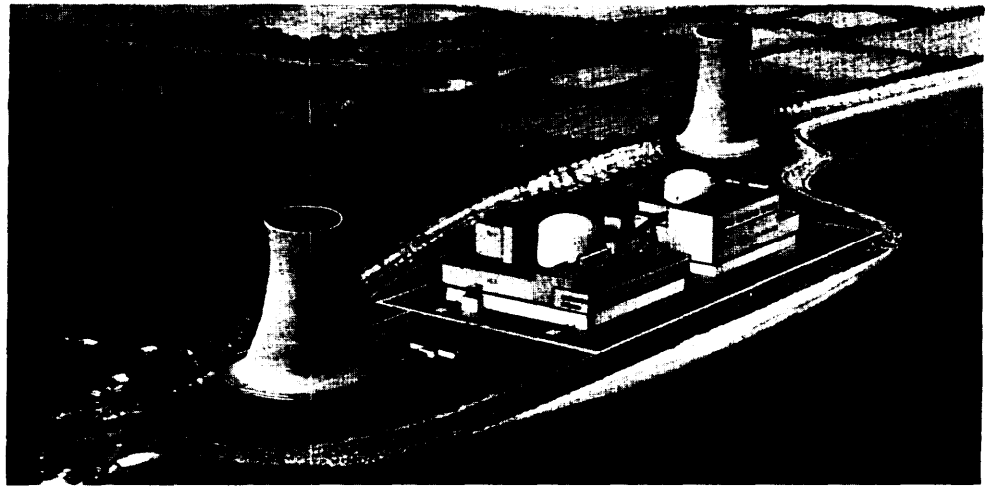
Throughout the year, various sections of the report were used by numerous committees of jurisdiction in both the House of Representatives and the Senate in preparation of legislation dealing with tanker safety, oil spill liability, coastal zone management, and offshore oil and gas leasing. The report served as a resource for public debate centering on the potential licensing of a floating nuclear powerplant off Atlantic City. It was used by both Congress and the Administration in planning reorganization of the U.S. Department of the Interior. The report was expected to continue to serve as a working paper for upcoming OCS legislation throughout the 95th Congress.

Late in 1976, in response to a series of tanker grounding and oil spills, the Oceans Program restated the findings of a 1975 analysis of "Oil Transportation by Tankers." Updated statistics were provided on oil spills, foreign tanker registration, and the status of technology for marine safety and pollution control. This emergency response assisted congressional committees in their inquiries into the tanker accidents, provided support for Senator Edward M. Kennedy at hearings in Boston on December **22, 1976,** relative to the *Argo Merchant* spill, and was to support further hearings on tanker safety scheduled early in 1977 by the Senate Committee on Commerce.

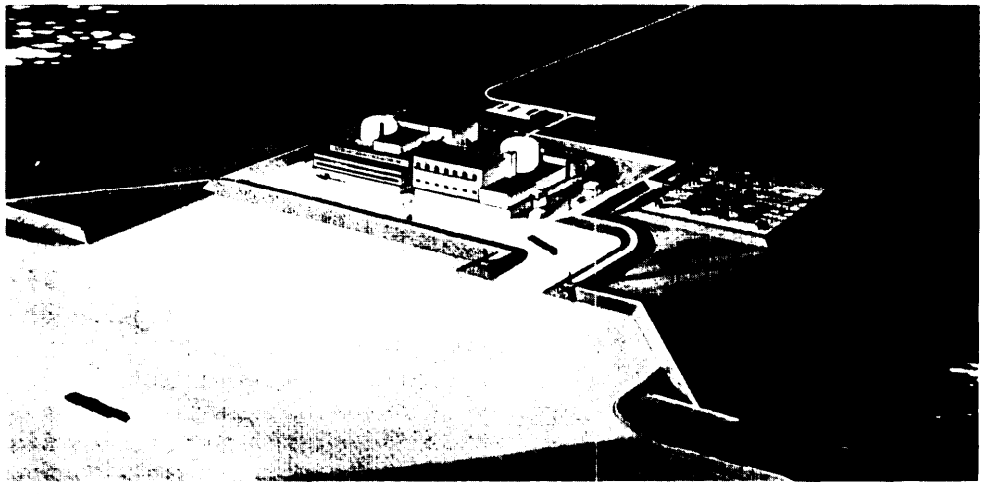
Three siting alternatives for floating nuclear plants



1. Nearshore siting-open-cycle cooling



2. Inshore sitting-cooling towers



3. Riverine siting–open-cycle cooling

Source Offshore Power Systems, Inc.

In addition, work proceeded on the following projects:

Fisheries Technology

In April 1976, Congress established a 200-mile offshore fisheries zone, giving the Nation jurisdiction to limit fishing by foreign nations and to establish regulations which would preserve fish stocks and encourage the U.S. fishing industry to grow and develop new commercial and recreational fisheries. To assist Congress in assessing the impacts of this law, the Oceans Program is studying techniques to be used in enforcing fisheries regulations, management practices to be used in regulating the fisheries, and opportunities which may be created by implementation of the law. The study is identifying changes which are desirable in the Federal structure dealing with fisheries and is analyzing new electronics surveillance systems which may be useful in enforcing regulations.

A report on this assessment, which was requested by the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries, was expected to be released in the spring of 1977.

Renewable Energy From the Oceans

A number of technologies have been proposed to harness the energy of the oceans themselves. These include conversion systems for geothermal energy, tidal and ocean thermal powerplants, salinity gradient and ocean farming systems, and mechanisms to extract wind, wave, and current energy.

The Oceans Program is analyzing each system's potential for meeting energy needs and the adequacy and effectiveness of Federal support and regulatory mechanisms for the systems. A report was expected in spring 1977 for the Senate National Ocean Policy Study.

Marine Science and Technology

The Federal Government has invested large sums of money during the past two decades in research projects involving the oceans and coastal areas. In a planning study directed toward evaluating the progress that has or has not been made as a result of these expenditures, OTA is examining possible alternatives for organizing such Federal research efforts, as well as legislation which may be needed.

During this project, a set of questions was submitted to a wide range of marine specialists in such areas as transportation, fishing, energy, hard minerals, ocean research and engineering, and meteorology. Responses from these specialists were used to outline the status of technology and the research needs in each area.

The planning study, requested by the Senate National Ocean Policy Study, was due to be completed in spring 1977.

Siting of Energy Facilities

Meeting the demand for energy requires new facilities, which, in turn, raises questions and possible conflicts regarding their location. This is particularly the case in the coastal areas where population density is high and industrial, residential, transportation, and recreational users compete for land. In addition, energy facilities are viewed by many as threats to the ecological and environmental balance of the coastal areas.

These factors are all being considered in an OTA project examining the effects of the public decisionmaking process on the geographical location of powerplants, oil refineries, and other energy facilities. The study is analyzing the extent to which Federal laws and policies, such as those regulating air and water quality, influence the location of energy facilities. It also is assessing the long-range impacts of energy facilities on population distribution and economic growth.

A report on this study, requested by the House Committee on Interior and Insular Affairs and the Senate Committee on Commerce, is due in late 1977.

National Research and Development

Policies and Priorities Program

Research and development activities are vital to the economic, social, and technological well being of any country. The significance of research and development goes beyond the dollars involved-–$26.3 billion in the Federal budget for fiscal year **1978,** plus about another $20 billion in the private sector. R&D expenditures can induce rippling effects by stimulating technological innovation and economic activity, and may, in fact, be a prerequisite to innovation.

The Federal Government provides nearly 70 percent of the support for basic research in the United States. In an era of limited resources, Congress often must resolve the conflicting claims for support from advocates of basic versus applied research. However, applied research is often grounded in the discoveries of basic research. The problem is to determine what basic research to support and how best to allocate finite resources among competing demands.

Congress, its committees, and individual Members and their staffs are faced with discerning the effects of Federal R&D priorities, and examining legislative options for getting the most out of federally sponsored R&D. Seven different congressional units-–the Senate and House Committees on the Budget, the Congressional Budget Office, the Joint Economic Committee, the Senate Committees on Commerce and on Aeronautical and Space Sciences, and the House Committee on Science and Technology—plus several members of the OTA Board requested or expressed an interest in assessments relating to the R&D activities of the Federal Government.

As a result, the OTA Board, on the recommendation of the Advisory Council, established the National Research and Development Policies and Priorities Assessment Program in 1975. The R&D Program examines a variety of issues and factors relating to scientific and technological research, as well as the role of Congress regarding decisions on R&D and applications of science and technology. This includes consideration of the institutions and methods for establishing R&D policies and priorities, as well as for evaluating their substantive content. The Advisory Council has created a steering committee, including some of its own members, to guide the OTA R&D activities.

The R&D Program is directed toward fulfilling, in part, the congressional mandate, as expressed in the Technology Assessment Act of 1972, for OTA to provide early warnings of the impacts of technology. It is intended to assist the Congress in moving toward a capability for long-range planning,

In addition, the Program serves as a diverse and important resource for other OTA program areas. The Energy and Food Programs, in particular, have projects under way examining the role of the Federal Government in sponsoring R&D.

With continuing guidance from and oversight by the Advisory Council, the R&D Program has identified three areas for detailed study:

- The health of the scientific and technological enterprise.
- The application of science and technology.
- The decisionmaking process for establishing R&D policies and priorities.

The projects in each of these areas are quite diverse, yet closely interrelated. They are intended to be of a continuing or long-term nature. The projects form a comprehensive analysis of the policies and programs of the Federal Government in sponsoring R&D.

Beginning in 1975, advisory panels were selected and assembled for each of the three areas. As with the areas and the projects in each, the work of the panels is closely interrelated, The 50 persons on these three panels represent a broad array of interests and expertise. The panels met three times each during 1976 to define the issues, suggest specific

projects for study, and approve agendas and plans for action in 1977.

The three panels and their projects are:

Health of the Scientific and Technological Enterprise

Many observers argue that the state of scientific and technical research in the United States has declined in recent years, leading to possibly harmful consequences for the U.S. economy and world trade position. This panel is studying scientific and technological research as a system and is seeking means to define and assess, as well as options to maintain, its health. It is examining recent developments affecting R&D, including the leveling off of funding and the aging of research programs at universities and research institutions. Emphasis is being given to the impact of different means of coupling research and education in science and engineering.

Four major projects are underway in this area. They are: (1) the formulation of definition of the scientific and technical enterprise and criteria for assessing its health; (2) an assessment of the status of basic research and advanced training in science and engineering associated with our academic institutions; (3) an examination of the role of women and minorities in science and engineering and the relationship of this issue to the health of the scientific and technical enterprise; and (4) an evaluation of how to determine the relative emphasis that might be given to various scientific fields, how to facilitate the emergence of significant new fields, and how to assure the quality of effort.

This panel is concerned with maximizing the accessible talent in scientific fields. Another topic which the panel is focusing on is the relationship between Government, universit y, industrial, and national research laboratories and the distinctive roles of each in the scientific and technical enterprise.

Because of the broad nature of these projects, the other two areas of the R&D Program are expected to rely heavily on this panel's conceptualization of the scientific and technical enterprise.

Applications of Science and Technology

The end result of much research consists of products, mechanisms, or procedures that help to generate innovation. The applications panel is studying the process by which the results of research become applied to national or social needs or goals. This panel is pursuing work on three projects: the role of the Federal Government in affecting an innovation process, the international transfer of technology, and the mobilization of scientific and technological resources to solve national needs.

The first project involves issues regarding the appropriate role for the Federal Government and the mechanisms by which it pursues, stimulates, and regulates technological innovation. In particular, the factors that can influence the innovative process are being examined. One aspect of the project is comparing governmental activities in the United States with those of other countries in terms of their effects on all aspects of technological innovation, including R&D. Key laws and Government practices that can affect innovation are being identified.

Second, the issues relating to technology and mechanisms by which it is transferred in the international economic marketplace are being evaluated. Particular attention is being given to issues concerning the role of the Government in assisting the transfer of technology to developing countries.

Finally, insofar as scientific and technological resources—both individual and institutional—can be mobilized to meet national goals and needs, this panel is examining how science and technology have or have not been effectively used in the past. In addition, the range of mechanisms for directing technological resources toward national goals are being analyzed.

Decisionmaking on R&D Policies & Priorities

The decisionmaking panel is evaluatin$_g$ both the process by which the Federal Government sets R&D policies and priorities and the social and economic impacts of R&D. It is compiling

existing knowledge about the decisionmaking process, identifying gaps, and appraising the need for further research. The peer review system is being evaluated as a decision mechanism with particular emphasis on its different roles in basic and applied research.

This panel began four projects in 1976. The first concerns the development of better guidelines for Congress in R&D budgeting.

The second project examines the various options by which Federal science and technology activities might be organized, with particular attention given to proposals to reorganize the departments and agencies of the Federal Government. In this work, the panel is being assisted by the Congressional Research Service of the Library of Congress, which is gathering information and cataloging proposals for reorganization.

A third project seeks to identify means by which improvements in methodology for foresight in setting R&D policies and priorities might be accomplished. Finally, the fourth project is assessing methods for evaluating the social and economic impacts of R&D.

Projects for All Three Advisory Panels

In addition, all three panels are engaged in three other projects that complement those listed above. One examines the role, management, and structure of the national research laboratories and centers, as well as their deployment, their possibilities, and problems. Another is evaluating the societal significance of choosing among alternative technologies which fit the needs of specific user groups. The third assesses current and possible roles of the public in the decisionmaking processes in science and technology as well as the impacts of science and technology on the development of public policy.

Technology and World Trade Assessment Program

The relationship of technology to international trade on the one hand and the U.S. economy on the other has become a subject of increasing congressional interest. Many observers believe that the U.S. economy and balance of trade position have suffered from the export of technology, as well as from investment by U.S. companies in foreign industry.

Analyses are cited showing a declining trade surplus in recent years in such technology-intensive industries as chemicals, scientific instruments and controls, nonelectric machinery, and transportation. This decrease has been accompanied by a decline in the growth of both labor and capital productivity in the United States for the years **1965-73.**

A number of factors are said to have contributed to this decline in U.S. technological leadership in international trade. The factors include reduced expenditure on research and development in the United States, sale of licenses and transfer of manufacturing know-how to other countries, and Government policies that are not conducive to industrial innovation or research and development.

Others, however, argue that the United States can remain economically healthy and competitive in the international market only through an open trade policy that encourages innovation and the continuous creation of new technology. This position holds that productivity figures do not show any precipitous decline—only cyclical swings. The adverse trade trends are attributed to price rather than any comparative decline in technological leadership, as evidenced by an increased trade balance for the same technology-intensive industries since 1973.

The critics of the assumption of declining technological competitiveness due to the export of U.S. technology argue that if technological innovation is successfully fostered in the United States, trade statistics will take care of themselves without Government intervention. In other words, the United States should stimulate technological innovation at home rather than attempt to control the export of

technology to prevent other nations from catching up.

To address such issues and to provide a factual base from which accurate evaluations can be made, OTA created the Technology and World Trade Assessment Program in 1976. This program focuses on key issues and assumptions relating to the technological relationships of the United States and its trading partners abroad. The assessments examine the relationship of technology to the competitive position of the United States in international markets and the related effects on the U.S. economy.

The nature of technology and the processes by which it is developed, introduced in the marketplace, and transferred or diffused depends on many factors that generally are poorly understood. These include: the size and sophistication of the market, economic conditions, quality and level of R&D, quality of the labor force, availability and cost of capital, and Government tax, patent, antitrust, and a host of other policies.

Given the uncertainties about the nature of technological development and its relationship to world trade, the lack of data in general, and the specific lack of data on the relationship of technology to trade, OTA is examining the U.S. trading position as reflected in analyses of trade, productivity, and related statistics. Among the factors being examined are the control of technological relations, trade with the Soviet Union, and the promotion of a more satisfactory means for technology transfer to developing nations.

OTA has consulted widely and is tapping the resources of other Federal executive agencies and private institutions with responsibility for or interest in technology and trade. These include the General Accounting Office, National Science Foundation, the Departments of State and Commerce, the Export-Import Bank, and the National Academies of Sciences and Engineering.

During 1976, the Technology and World Trade Program explored the background of the problem, sorted out the issues, and adopted an initial strategy for action in 1977. The Technology and World Trade Advisory Committee met for the first time in December. Further, arrangements were made for adding a full-time program manager, a retired vice president of a major chemical company, early in **1977.** The part-time manager for 1976, a former director for international scientific and technological affairs at the State Department, will become a consultant to the program in 1977.

One project is assessing the state of technology and trade trends in selected industries that are technology intensive and figure prominently in world trade. The chemical industry has been chosen as the target for first study by the Advisory Committee, One longstanding trend—the cross-licensing of technology to support both foreign subsidiary and domestic markets—is being examined to determine how repatriating funds affect the U.S. balance of trade. Using such data, OTA is analyzing the causes of growth and decline in exports. Later studies will be conducted on the steel and electronics industries,

In addition, five functional studies are underway: 1) a comparison of productivity and economic growth rates among leading member nations of the Organization for Economic Cooperation and Development (OECD); 2) an examination of current account trends in recent years, with special emphasis on trade figures for advance technology products; 3) a comparison of technological innovation in several different countries; 4) an evaluation of patterns of technology transfer among OECD countries; and 5) an analysis of R&D trends in different countries.

Finally, the Technology and World Trade Program is drawing on the resources of and developing joint areas of concern with the Food, Materials, and Research and Development Programs of OTA. As experience is gained and data gathered, these and other program areas are expected to make similar uses of the Technology and World Trade Program.

Transportation Program

To assist Congress in its deliberations on transportation issues, the OTA Transportation Program examines the safety, economic, social, energy, and environmental implications of moving people and goods.

Following up the 1975 studies of the relationship of mass transit and automated guideway transit systems to energy and the economy, OTA completed two reports in **1976 on** public transit in urban areas. The first concerned the role of the Federal Government in assisting and encouraging community planning for mass transit, while the second assessed various automatic control systems for rapid transit trains. The Transportation Program began a major assessment of potential short- and long-term changes in the characteristics and use of the automobile as a mode of personal transportation. Another planning study, begun late in 1976, looks at the research and demonstration methods for new urban transit vehicles.

Continuing a series of reports to Congress begun in 1975 on the status of U.S. railroads and proposals directed toward their reorganization and improved efficiency, OTA is assessing the effectiveness of various laws in increasing the safety of railroads. Another project is analyzing the possible use and potential effects of slurry pipelines to transport coal.

For most of **1976,** the Transportation Pro-- gram included a project examining telecommunications technologies for the movement of information. A preliminary report published in April **1976** examined the feasibility of applying communications technologies to provide community services in rural areas. During the summer, this project was transferred to OTA's Exploratory Activity. An OTA workshop was held in November to further explore the Federal executive role in the possible provision of telecommunications services.

Because several projects of the Transportation Program deal with concerns that are broader than transportation alone, there is a need for coordination with other OTA program areas. For example, the recently completed assessment of community planning for mass transit and the current assessment of the automobile have involved cooperation with the OTA Energy Program. Similarly, the coal slurry pipelines project is being performed with the assistance of the Energy and Materials Programs.

Community Planning for Mass Transit

This multivolume report, published in February 1976, was based on a study of mass transit planning in nine U.S. cities: Atlanta, Boston, Chicago, Denver, Los Angeles, Minneapolis-St. Paul, San Francisco, Seattle, and Washington, D.C. The report is made up of separate volumes—consisting of a summary, the nine case studies, and technical and bibliographical appendixes. (Excerpts from this report may be found in section II.)

Requested by the Senate Committee on Appropriations, the interim findings of the assessment were transmitted to the Transportation Subcommittee in **1975** to prepare for congressional hearings. They were used by the Transportation Subcommittee to critique the mass transit investment policy of the Department of Transportation. The report is being used on a continuing basis by the requesting and other committees with transportation oversight to evaluate mass transit planning and development programs.

Automatic Train Control

The OTA report, published in May **1976,** was requested by the Senate Committee on Appropriations on behalf of its Transportation Subcommittee. Used by the House Committee on the District of Columbia in 1975 as background for oversight hearings on the Washington METRO System, the report has been widely distributed to, and reprinted by, the transportation industry. (Excerpts from this report may be found in section 11.)

Broadband Communications in Rural Areas

This report, published in April 1976, began as a preliminary effort to a more detailed study. The report was circulated by the Senate Committee on Agriculture and Forestry to the principal Federal agencies with responsibility for communications and/or rural areas, Many of these responded in favor of further examination of the potential of such systems. The chairman of the Federal Communication Commission, for instance, termed the report "a valuable service by encouraging a systematic and comprehensive look at rural broadband communications." (Excerpts from this report may be found in section II.)

Changes in Use and Characteristics of Automobiles

The private automobile has become the most prevalent form of transportation in the United States. By 1970, 80 percent of American households owned at least one car, and more than 90 percent of the annual passenger miles traveled were by automobile. At the same time, serious questions have emerged regarding the future of the private auto. These include decline in the supply of petroleum, increased costs for materials and labor, rising environmental concerns, and widespread traffic congestion on highways and urban streets.

Consequently, OTA has undertaken a major assessment of potential changes in the use and characteristics of automobiles over the short term (next decade) and long term (into the next century). This assessment, initiated at the request of the Senate Committee on Commerce, was approved by the OTA Board in February 1976 after review of the results of a preliminary planning study carried out by the Transportation Program staff in late 1975. The project examines the auto and supporting industries, road building and management, consumer ownership and *use* of cars, and the role of the Federal Government.

Such factors **as** the future availability of fuels and materials, the need to reduce harmful pollutants and to improve the safety of cars, and possible shifts in public attitudes are being analyzed in connection with public policy alternatives which might affect automobiles and their use. The experience of several foreign countries with their transportation systems is being examined for solutions that could possibly be applied to problems in the United States,

The assessment is being performed by the Transportation Program staff with assistance from the Energy and Materials Programs and the cooperation of the National Science Foundation. A preliminary report was expected in late **1977 and** a final report in late **1978.**

Coal Slurry Pipelines

For many years, coal was replaced by other less expensive and cleaner fuels. With the increased price and uncertain availability of other fuels, however, coal is once again seen by many as an abundant and relatively cheap source of energy.

In view of this, and of alternative proposals for shipping large quantities of coal over long distances, OTA is assessing the use of slurry pipelines to transport coal from its source to where it can be used. In this project, particular emphasis is being given to two key elements of concern: the environmental effects of such pipelines and their impacts on other forms of transportation, especially railroads.

The assessment was requested by the Senate Committees on Commerce and Interior and Insular Affairs, and the House Committee on Interstate and Foreign Commerce. It was due to be completed in 1977.

Railway Safety

The Federal Government has attempted, in recent years, to solve the financial, institutional, and operational problems of U.S. railroads. OTA examined the financial aspects of the reorganization of rail transportation in a series of reports published in 1975. In passing the Railroad Safety Authorization Act of 1976, Congress required OTA to evaluate the effec-

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tiveness of the Railroad Safety Act of 1970 and other Federal laws aimed at improving the safety practices and performance of the railroads. This is one of OTA's two congressionally mandated assessments. The other mandated assessment concerns coal leasing on Federal lands. A report was expected in early 1978.

Section IV

TECHNOLOGY ASSESSMENT METHODS AND APPROACHES

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TECHNOLOGY ASSESSMENT METHODS AND APPROACHES

During 1976, OTA undertook two separate but complementary appraisals of how and by whom technology assessment is practiced. In September and October, OTA conducted five workshops at the request of the Director to examine the lessons learned from the Office's nearly 3 years of performing technology assessments. The participants included the managers of the Office's eight program areas and other senior OTA personnel.

The OTA Board, expressing its continuing interest in the evolution and utility of the concept, held 4 days of public hearings in June on the uses and impacts of technology assessment on decisionmaking in other Government agencies and private sector organizations. The Board had previously held hearings in 1974 on the technology assessment activities of the National Science Foundation.

Both the hearings and the workshops showed that there is no one best method of performing technology assessments. Each assessment is unique. The method employed, the personnel involved, and the skills tapped depend on the technology being assessed, the client for whom the assessment is undertaken, the nature of the issues at stake, and the time available for and the setting of the project.

Because of their more immediate relevance to OTA, the workshops are discussed first in this section, followed by the hearings.

OTA Workshops

Held as the first long-term assessments undertaken by OTA in 1974 were nearing completion, the workshops were aimed at assessing the experience gained in conducting those projects and applying the benefits of the experience to the next generation of comprehensive assessments.

The workshops were centered around the five operational phases of the OTA process: selection, planning, execution, review and reporting, and use. Each workshop was structured around an initial exposition of one program area's experience, followed by a discussion of variations adopted by other program areas. The emphasis was on what worked, what did not, the problems encountered, and what could be changed to improve the process.

Considering both the broad needs of Congress and the vast range of technological issues, as well as the resources available for a study, the workshop participants emphasized the need for a flexible approach to each assessment. All OTA assessments must meet three criteria: timeliness, quality, and credibility. Reports must be delivered on time, be of high professional quality, and be comprehensive yet balanced—that is, free from advocacy or ideological bias.

The selection phase begins when OTA receives a request for an assessment from the chairman of a congressional committee. It proceeds through defining the issues involved in, and the scope of, the potential assessment. Finally, it concludes when the Board, upon reviewing the preliminary efforts of the OTA staff, approves the proposed assessment for act ion.

At this stage, the program managers noted that close interaction with the staff of the requesting committee is vital. This allows both OTA and the committee to better identify the issues, scope the assessment, and arrive at mutual expectations concerning the expected results. Continued cooperation throughout the study permits OTA staff to stay abreast of often fast-changing congressional needs and issues.

The OTA Advisory Council, program advisory committees, and various relevant outside groups aid materially in both defining issues and scoping the assessment, the program managers stressed. They noted that other information sources are checked routinely at this time, to determine both the availability of

relevant data and whether other organizations may have undertaken similar studies which could either provide input to OTA or obviate the need for an OTA assessment. These include specifically, among others, the Congressional Research Service of the Library of Congress, the General Accounting Office, and the Congressional Budget Office.

Workshop participants also examined potential risks in attempting to broaden the scope of a request beyond the original intent during the selection phase. Such broadening could result in a more useful assessment for Congress, but care must be taken to ensure it does not demand a scale of effort either difficult to manage or exceeding available resources.

Once the Board has approved an assessment, the planning phase begins. During this phase, various interested parties to the study are identified and an advisory panel created for each project. A properly constituted advisory panel brings together a diversity of viewpoints, thereby lending credibility to the potential study, widening access to interested communities, and identifying possible conflicts or problems. To best accomplish this, it was agreed that no one person or outlook must be permitted to dominate. Selection of an able panel chairman. can therefore be particularly crucial to the project.

During the planning phase, particular attention is given to determining which assessment activities may best be carried out by contractors and consultants. Contractors are generally used to provide technical information or specific analyses, while OTA staff develop the overall work plan, integrate findings and data, and perform policy analysis. Program managers differed as to how much experience in technology assessment was appropriate for contractors; some stressed the importance of selecting contractors and consultants with known expertise and proven performance, while others noted that those with less expertise or who are new to a project may be good sources of new ideas and fresh approaches.

While not always possible, the workshop participants agreed that the staff member who was responsible for planning the study was generally the best choice to be the project leader. Contractors and consultants generally cannot be effective project leaders, OTA program managers noted, because they are not adequately familiar with the needs, processes, and people of Congress, or how OTA operates. In addition, they are too likely to be distracted by other commitments to give the project the attention its effective direction demands,

Planning also must incorporate, to the extent possible, sufficient time for the gestation of issues, problems, and ideas. The program managers observed that such a deliberate approach, although often at odds with the need to provide a timely assessment, usually promotes efficiency in the long run and results in the delivery of a higher quality product.

While it may seem intuitively correct to await the development of data bases, the program managers stressed that it is of critical importance to analyze the issues early in the execution stage of an assessment so as to relate them to the policy options that will be considered or subsequently developed. They noted that failure to do so at this time can waste time and result in the study becoming little more than a data collection project.

On the other hand, in that new issues and options are quite likely to surface during the course of an assessment, the early identification and analysis activity must be structured so as not to preclude consideration of those issues and options that emerge later.

The participants cautioned that the required guidance of contractors and consultants during the course of a project must come from OTA staff, not the advisory panels. The project leader must therefore clearly inform the staff, contractors, consultants, and advisory panels of their proper roles and of the timing and sequence of their responsibilities. Several program managers noted experience illustrating that while advisory panels are good at conceptualization and critique, they cannot be relied on for the actual work of the study.

Through its public participation activities, OTA has sought to involve the public in technology assessment by various means, including identifying parties interested in or affected by a technology, creating broad-based

citizens' panels, and publicizing various projects and their products. The most extensive effort in public participation involved more than 15,000 persons as part of the assessment of the coastal effects of offshore energy systems. Even though such an extensive effort may not be required or feasible in every project, program managers observed that the appropriate public participation element must be identified and planned for early in any study.

In employing mathematical and computer-assisted models, as many projects have, program managers observed that a thorough understanding of their strengths and weaknesses, of the assumptions upon which the models are based, and of how the outputs relate to those assumptions is absolutely essential. Similar caveats were applied to the use of economic analyses, often vital to future projections and evaluations of options.

To meet interim or fast-rising needs of Congress for information from ongoing assessments for deliberations or hearings, OTA staff place initial emphasis on those issues and data which will facilitate the congressional process. Sharply focused interim reports can be useful in transmitting findings from projects not yet completed, although some program managers preferred informal communications as a more effective means of meeting interim committee needs.

A report—the final product of an OTA assessment—is written concurrently with and as a part of the ongoing study, rather than being left to the last minute. Likewise, the review of OTA reports is a continuing and vital process throughout the project, essential to assure the quality and credibility of OTA reports. Program managers review draft reports prior to their being submitted to outside reviewers to ensure that the issues identified as relevant by the requesting committee have been addressed, and that the report is structured to best meet the needs of Congress.

Advisory panels are particularly useful in reviewing early drafts. However, because they often work so closely with the staff in reviewing the early drafts, review of later drafts is more appropriately accomplished by persons outside of the OTA process. These include people in academia, business and industry, Government, the user community, citizen groups, and often staff of the requesting committee.

In addition, the OTA Director conducts a review through senior Office personnel. Finally, each Member of the OTA Board, either personally or through the staff liaison for the Office, reviews the final draft before approving it for publication.

Program managers noted that several potential problems can arise in the review process. First, because the review process is oftentimes slow, the work plan must allow adequate time to accommodate reviewers. Second, while large numbers of reviewers are often required to ensure that all perspectives have been considered in a report, attempts to incorporate all reviewers' comments creates the potential of producing a bland report.

Finally, distributing drafts to a large number of reviewers risks premature release to the media and public. In that the language of a draft may be revised, entire sections reorganized, or findings modified on the basis of concerns brought forth by reviewers, draft reports may not reflect the final document and premature public release may misrepresent it, However, the program managers felt that striving for utmost quality and credibility through a widespread review process was worth the risk of premature public disclosure.

As an assessment is concluded, its findings are delivered to Congress and the public in a variety of effective and useful ways, often going beyond the delivery of the final report to the committees and Members of Congress. In many cases, OTA's Director, program staff, and advisory personnel are asked to augment the report's findings by testifying at hearings by the requesting committee and several other committees of jurisdiction. Executive agencies and State governments are provided early copies of reports, as appropriate, for their consideration and utility. Affected parties, interests, professions, and business groups are either sent copies of reports or informed of their availability via news releases. In selected cases, a brochure summarizing key elements of a particular report supplements other information about its availability, often effectively

communicating project results in more depth than can other channels of information.

At the conclusion of this series of meetings the participants suggested, as a result of the benefits derived from this workshop, that future sessions might gainfully include discussion of long-range planning, expanded public participation, program management, and model 'building.

OTA Hearings

The hearings showed that whereas a decade ago, when the first technology assessment bill was introduced in Congress, only a very few people had heard of this new study technique, it is now being practiced by a wide variety of Government agencies, academic institutions, and private businesses. Chaired by Congressman George E. Brown, Jr., OTA Board Member, the Board sought to develop a better understanding through the hearings of how technology assessment affects decisionmaking, as well as its operational role in various Government and private sector organizations.

The witnesses represented a broad array of Government agencies, universities and research organizations, and private companies. Among the organizations represented were the Departments of Commerce and Interior, the National Science Foundation, the University of Oklahoma's Science and Public Policy Program, the Jet Propulsion Laboratory of the California Institute of Technology, and the Coca-Cola, Monsanto, and Ford Motor companies.

The testimony elicited at the hearings led to six major findings: (1) technology assessment is an evolving study strategy that is being widely adopted by the public and private sectors; (2) the strategy of any particular assessment should be tailormade to fit the resources, timing, and needs of the decisionmakers; (3) technology assessment, in addition to exploring options and alternatives, can provide early warnings of consequences of the application of technology that might otherwise be unanticipated; (4) both Government and industry have a growing awareness of the value of technology assessment for improving the policymaking process by broadening the information base; (5) technology assessment is being employed by major corporations as a useful planning tool; and **(6)** communication by assessment team members with potential sponsors and users of technology, decisionmakers, and affected groups in the general population is essential for producing an effective assessment.

A consensus emerged during the hearings that although the long-term effects of technology—both beneficial and adverse—are of increasing importance to the public, technology assessment is still an evolving study strategy. It incorporates other kinds of policy analyses, such as environmental impact studies, net assessments, social impact analyses, and future studies. As Selwyn Enzer, Associate Director of the Center for Futures Research at the University of Southern California's Graduate School of Business, noted: "Many government and industrial organizations find themselves having been engaged in technology assessment activities before they had any awareness of technology assessment."

Government and industry policy makers agreed that technology assessment provides a range of options and alternatives on which decisions can be based. Dr. H. Guyford Stever, then Director of the National Science Foundation, said that "technology assessment per se does not make either policy or decisions. It provides information for these activities." Monte Throdahl, Vice President of Monsanto, put it another way: "Technology assessment provides the thought process through which . . . difficult value judgments can be made."

Another major finding of the hearings was that technology assessment is a dynamic process, with no routine or prescribed method for its conduct. As Don Kash, Director of the Science and Public Policy Program at the University of Oklahoma, noted: "Any proposed assessment that is characterized as being primarily dependent on a formal methodology should be rejected." Rather, the approach should be tailored to the resources available and the requirements of those using the results. Technology assessment should be, and, witnesses pointed out, to a large extent

has been, capable of adapting to a wide range of circumstances.

Flexibility is necessary, according to Jack Moore, Vice President for Advanced Engineering for Southern California Edison, because "... it is not possible at the outset to account for all technological advances that will occur during project development, or to forecast those that will be acceptable several years in the future." As Lawrence Day, Assistant Director for Business Planning at Bell Canada, said: "If there is a viable technology assessment technique around, we have used it. One thing I can say is that there is no technique today that has received any sort of universal acceptance."

Viewed by the business sector, technology assessment is an important policy tool for understanding the business environment, thereby improving corporate decisionmaking. The executive and legislative branches of the Federal Government regard TA as a policy tool for understanding the public choices before them, as well as for providing information essential for implementing those choices. The witnesses agreed that technology assessment will gain in importance, especially for predicting consequences of technologies that would otherwise be unanticipated, as it is used more widely.

As with other policy studies, the witnesses generally agreed that technology assessments are of increasing value in the policymaking and planning processes in both business and Government. As W. Dale Compton, Vice President for Research at the Ford Motor Company, said, "We regularly carry out technology assessments, and we believe that the results provide a valuable input to our decision process."

Achieving completeness and balance in a technology assessment requires a diversity of inputs from many disciplines. In addition to scientists, engineers, and technologists, the resources of the social sciences, law, education, public interest groups, affected parties, and many others are frequently tapped. Thus, technology assessment is more of an art than a formal discipline. It depends for success on the resources, talent, and experience of its practitioners.

Another point made during the hearings was that effective technology assessment requires communication with a variety of audiences: potential sponsors and users of technology, decisionmakers, and affected groups in society. One difference, in this regard, was noted between the private and public sectors. In industry, assessments often involve proprietary information, and thus the public is rarely involved and the results may not be released. The opposite is usually the case in Government. Witnesses representing Government agencies told of extensive efforts to involve the public in assessments through public hearings, review panels, and oversight committees. Moreover, there was general agreement among the witnesses that the results of publicly funded assessments should be fully and freely available to the public.

A question raised by several witnesses concerned whether technology assessments should be conducted by in-house staff or whether outside contractors should be used. The decision frequently hinges on the available financial and staff resources, the need for confidentiality, and the question of credibility.

In transmitting the hearings report, Congressman Brown noted that opening and improving communication between the public and private sectors engaged in technology assessment will continue. He added: "Based upon these hearings, and other evidence, I believe that the technology assessment process can help decision makers—in Congress and elsewhere—avoid serious problems that might arise without the availability of such analytic tools. In conclusion, I am satisfied that the utility and acceptance of technology assessment is great enough to warrant our further encouragement of the process both in and out of Government."

Section V

OTA ORGANIZATION AND OPERATIONS

Section V

OTA ORGANIZATION AND OPERATIONS

Created by the Technology Assessment Act of 1972 (86 Stat. 797) to help Congress anticipate and plan for the consequences of uses of technology, OTA received funding in November 1973, and commenced operations with the convening of the second session of the 93d Congress in January 1974.

The statute specifies that OTA shall consist of a bipartisan Congressional Board, Director, Deputy Director, and such other employees and consultants as may be necessary in the conduct of the Office's work. In addition, the Board is assisted by a Technology Assessment Advisory Council comprised of **10** public members eminent in scientific, technological, or educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress.

The Congressional Board sets the policies of the Office and is the sole and exclusive oversight body governing OTA. The OTA Director is the chief executive officer and is responsible solely to the Board, of which he is a nonvoting member. The Council advises the Congressional Board, as maybe requested, on technology assessment matters.

Six Senators and six Representatives, evenly divided by party, serve on the OTA Congressional Board. They are appointed respectively by the President Pro Tempore of the Senate and the Speaker of the House. In **1976**, Congressman Olin E. Teague, D.-Texas, and Senator Clifford P. Case, R.-New Jersey, served as the Chairman and Vice Chairman respectively of the Board. The two posts rotate between the Senate and the House in alternate Congresses. The Board members from each House select their own Chairman or Vice Chairman, as the case may be.

In providing assistance to the Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships; identify alternative technological methods of implementing specific programs; identify alternative programs for achieving requisite goals; make estimates and comparisons of the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be directed.

Initiation, Processing, and flow of Assessments

The Office of Technology Assessment, by statute, is located within and is responsible to the legislative branch of Government. Accordingly, its basic mission is to provide congressional committees-with assessments or studies which identify the range of probable consequences, social as well as physical, of policy alternatives affecting the uses of technology. Requests for OTA assessments may be initiated by:

(1) The chairman of any standing, special, select, or joint committee of the Congress, acting for himself, at the request of the ranking minority member, or a majority of the committee members;
(2) the OTA Board; or
(3) the OTA Director, in consultation with the Board.

The authorization of specific assessment projects and the allocation of funds for their performance is the responsibility of the OTA Board. The Board has established priority areas of study, and has approved individual assessment projects within those areas. In arriving at these decisions, the Board considers recommendations and plans developed by OTA staff, and applies the following general

selection criteria, developed in consultation with the Advisory Council:

- Is this now or likely to become a major national issue ?
- Can OTA make a unique contribution, or could the requested activity be done effectively by the requesting committee or another agency of Congress?
- How significant are the costs and benefits to society of the various policy options involved, and how will they be distributed among various impacted groups?
- Is the technological impact irreversible?
- How imminent is the impact?
- Is there sufficient available knowledge to assess the technology and its consequences?
- Is the assessment of manageable scope—can it be bounded within reasonable limits ?
- What will be the cost of the assessment?
- How much time will be required to do the assessment ?
- What is the likelihood of congressional action in response to the assessment?
- Would this assessment complement or detract from other OTA projects?

Assessments are developed and conducted by OTA program managers and staff who have expertise in the subject under study They are assisted, as appropriate, by citizen. advisory panels of experts, consultants, contractors, and other congressional information' agencies. The approach to a given assessment project may involve exploratory meetings or workshops of advisory panels, staff analyses, and consultant studies. (A more detailed discussion of this process is contained in section **Iv.)**

Completed assessments and studies are transmitted by the OTA Board to the committee which requested the project, as well as to other interested committees, and are printed for public dissemination. The committees of Congress have first access to OTA assessment results and findings. At the direction of the Board, printing and public dissemination of final OTA reports takes place at the earliest possible date in accordance with arrangements worked out with the requesting committee(s).

Staffing and Organizational Structure

The OTA professional staff has been recruited from the academic community, business and industry, and from other Government agencies. With the exception of those officers with overall administrative responsibilities, professional staff members are assigned to specific program areas according to their experience and training. Staff professionals are drawn from a wide variety of disciplines and backgrounds, including the physical sciences and engineering, social sciences, law, and general administration. Skilled professionals from executive branch agencies, detailed to OTA on a temporary basis, have made major contributions, as have participants in several congressional fellowship programs. A chart detailing OTA's organizational structure accompanies this section.

Financial and Administrative Activities

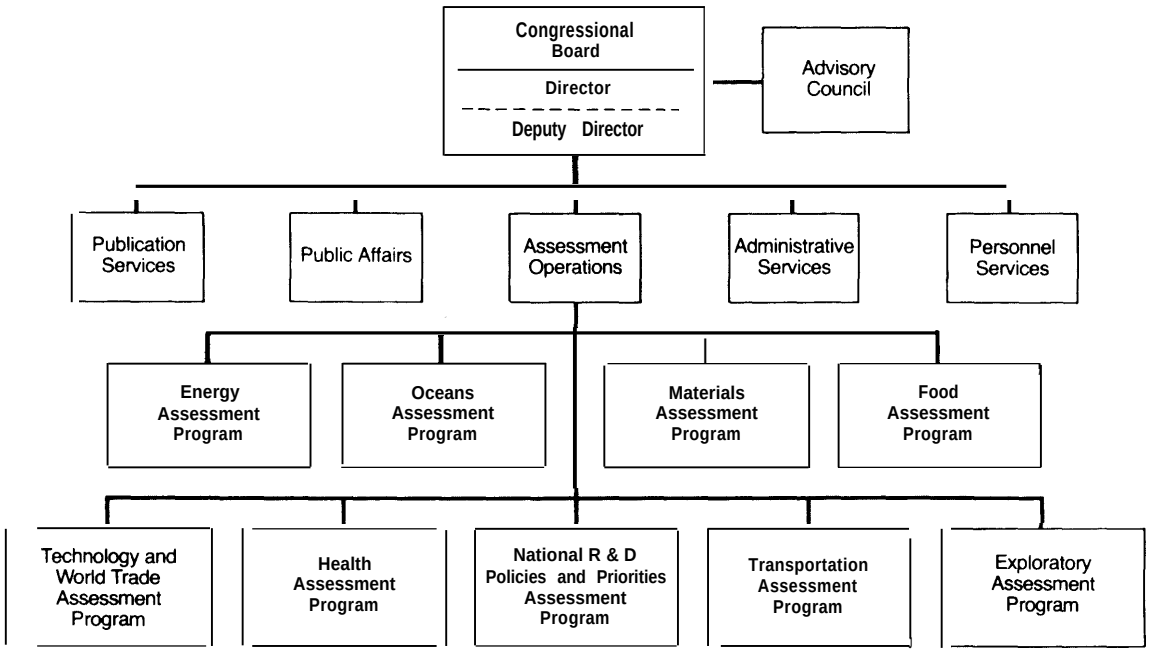
Administrative and financial aspects of OTA operations are overseen by an administrative officer who reports to the Director. These include procurement and contracting, budget and financial accounting and control, payroll, travel, office space, security, accounts payable and receivable, and other miscellaneous administrative support services.

A personnel officer is responsible for all staff support functions for OTA. These include recruitment, select ion, orientation and processing, classification and salary determination, and performance evaluation. The publications officer is responsible for production, editing, layout and design, graphics, printing, and sale of OTA publications and other printed material.

In response to the growth in demand for OTA assessments, the Congressional Board approved submission to the Congress in **1976** of a budget request totaling **$8.5** million for fiscal year 1977. Congress appropriated $6.6 million to OTA for fiscal year 1977. OTA operated with a carryover funding of about $2.9 million from fiscal year **1976.** In addition, a request was made for a fiscal year 1977 supplement of $729,000 to cover two congressionally mandated assessments.

Office of Technology Assessment

Organizational Structure



(In Thousands of Dollars)

Budgetary History	Fiscal Year 1974 actual	Fiscal Year 1975 actual	Fiscal Year 1976 actual*	Fiscal Year 1976 Transition Quarter	Fiscal Year 1977 estimate	Fiscal Year 1978 request
By program:						
Energy	322	432.9	668.3	406	1,836	1,163
Food	16.1	267.7	267,3	16.5	644	678
Health	161.7	69,4	269.5	22.3	478	651
Materials	.4	1,257.4	485.8	11.7	,354	1,201
Oceans	11.6	709.5	360.2	32.2	944	809
Transportation	471.6	402,4	394.5	93.5	,080	724
R&D	—	—	61.6	70.9	,242	1,199
Technology & World Trade	—	55.6	52.1	18	426	347
Exploratory	.7	177.2	285	140.7	429	357
General & Administrative	329.7	650	992.7	121.2	1,282	1,368
TOTAL - OTA (Includes funds available from prior year's appropriations.)	1,345	4,022	3,837	1,333	9,717	8,500

*Including transitional quarter

Reflecting the recommendations of the Congressional Appropriations Committees, as stated in the fiscal year 1977 conference report, OTA reprogramed the activities of the Office on the basis of available funds and the priorities set by the Board. A number of requests for assessments were combined with others or rescheduled in all program areas.

Information Services

OTA technology assessment activities are supported by an Information Services staff, which maintains an in-house library containing basic background materials and current data resources. In addition, this staff maintains liaison with the Library of Congress to facilitate OTA use of its extensive facilities and services.

The Information Services staff also provides online access to several computerized data-retrieval networks including: SCORPIO, a Library of Congress system which provides information on current policy-oriented literature and the status of bills introduced in Congress; TRIS (Transportation Research Information Service), a file operated by Battelle Memorial Institute which yields document citations on transportation-related materials; ATS (Administrative Terminal Service), an IBM program available on the Library of Congress Computer which is used for text editing and report generation; and INFONET, a commercial network through which OTA can generate and operate its own computational and analytical programs.

Public Participation

Public participation is an important part of OTA's technology assessment process. In addition to the wide use of citizen advisory groups and consultants, the Office disseminates information to the various parties at interest in the subject being assessed so they may become more effectively involved in the public decisionmaking process. In keeping with this objective, meetings of OTA's Congressional Board and Advisory Council are open to the public. Also, the OTA Director is advised by an officer for public participation as well as a public affairs officer,

The Office of Public Participation, reporting directly to the Director, coordinates an overall program of activities to facilitate citizen involvement in the technology assessment process, including the establishment of improved communications with business, industry, citizen/consumer, labor, public interest, and professional and impacted groups, the creation of outreach mechanisms, and the instituting of public education programs.

Exploratory Assessment Program

OTA screening procedures for evaluating assessment requests include smaller scale, exploratory projects undertaken to provide a better basis for decisions by the OTA Board as to whether certain major study projects are warranted. The Exploratory Assessment Program involves senior staff personnel and consultants in a systematic mechanism for defining and evaluating specific assessment proposals submitted to OTA which do not fall into other program areas, The technology and world trade assessment originated, for instance, in the Exploratory Program in 1975, and became a separate program area in 1976.

Another planning project begun in 1975 identified some issues and trends involving science and technology for the U.S. educational system. As a result, OTA was asked to assist the Subcommittee on Elementary, Secondary, and Vocational Education of the House Committee on Education and Labor in implementing the foresight provisions with regard to the Elementary and Secondary Education Act of 1965. The preliminary planning effort examined long-range trends and shifts in American society which may influence issues in elementary and secondary education, By year's end, a preliminary working paper was sent to the subcommittee for their review and evaluation of the committee's study needs.

Other Activities

Along with the Congressional Budget Office (CBO), the Congressional Research Service (CRS), and the General Accounting Office (GAO), OTA participates in an interagency research notification system designed

to facilitate the coordination of activities and exchange of information among the four organizations and avoid duplication of effort. Representatives of the four agencies meet regularly and each of the offices submits biweekly status reports on program activity for publication in a central directory of congressional research activity.

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APPENDIXES

Appendix A

STATEMENT OF THE OUTGOING CHAIRMAN, TECHNOLOGY ASSESSMENT BOARD 94TH CONGRESS, DECEMBER 1976

CONTENTS

REPORT OF THE CHAIRMAN, CONGRESSMAN OLIN E. TEAGUE, TECHNOLOGY ASSESSMENT BOARD-94TH CONGRESS

December 1976

Introduction

This report is a summation of observations and commentaries on the operation of the Office of Technology Assessment, primarily during the 94th Congress. Having served as chairman of the Technology Assessment Board during that period, I believe such a report to my colleagues on the Board is appropriate.

It is not my intent to include here a large bundle of data and statistics in order to make a point—or to disprove one. And while I will not attempt to document every statement of fact, it should be clear that each such statement *can* be documented if necessary.

It should also be understood that there are reasons for opening this report with a review of how and why OTA came into being: (a) we have a totally new Administration for the first time in many years; (b) the face of the 95th Congress is quite different from its immediate predecessors; and (c) many members of the Senate and House—veterans and novices alike—are not acquainted with OTA, its history, its mission, or what it offers.

Olin E. Teague

1. Evolution of the Office of Technology Assessment

Early History

OTA evolved, purely and simply, because Congress felt a need for a new and independent source of evaluated information bearing upon technological problems and programs which it faced—or which it might be expected to face in the future. It represented a service not then available to the legislative branch.

That is the "why" of it.

But OTA did not arrive on the scene overnight. The concept required over 6 years to mature and another 2 years to put through the legislative process. It was one of the more thoroughly studied, debated, and molded concepts of our time—and while few contend that it is without flaws (and some question whether it is an innovation), both House and Senate adopted it with enthusiasm and, I believe, are convinced of its value.

Congress described the fundamental need of OTA in these statutory terms:

> it is necessary for the Congress to—
> (1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such [technological] applications; and
> (2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

Congress defined the mission of OTA as follows:

> The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress.

Taken in conjunction with the balance of Public Law 92-484, OTA's organic act, the foregoing constitutes the "how" of it, *

*P.L. 92—484 is included as appendix F of this Annual Report.

Differences From Original Concept

It is important to understand two major organizational facets of OTA which now exist but which, although carefully contemplated, were never recommended or intended by the committee of origin—the (then) House Committee on Science and Astronautics.

The first of these is the current character of the Technology Assessment Board itself, The original legislation reported from the committee included a Board composed of appropriate members of Congress, representatives from the public, the Comptroller General, the Director of the Congressional Research Service, and the Director of OTA. The function of the Board, then as now, was entirely one of setting policies to guide the operation of the office.

The second departure was the creation of the Technology Assessment Advisory Council to serve the Board in an advisory capacity. Of course, the Council or something like it -became necessary when the House, by floor amendment and with only brief discussion, discarded the original Board concept and substituted an all-congressional Board—in which the Senate concurred after making sure that both political parties would be equally represented thereon. This all-congressional format of the Board made patent the need for some new mechanism to maintain adequate liaison with the public. Hence the Technology Assessment Advisory Council, which, again, was formulated with marginal study and consideration.

These observations should not necessarily be construed as critical of the OTA structure as it finally has emerged. On the other hand, there is little doubt that a number of the difficulties which have confronted OTA thus far—certain managerial problems as well as the Board's disposition to think and act on occasion as a joint committee rather than a board of directors—can be directly traced to deviations from the original plan. Of course, the original plan would have produced its own set of hurdles—whether more or less we do not know. Most impartial students of OTA seem to think the original concept offered less chance for polarization, whether *on* the basis of political party or the basis of Senate vs. House, as well as less political motivation in personnel appointments and in the choice and evaluation of assessments. Obviously, this is speculation.

I believe, however, that both institutions—the Board and the Council—should be reexamined at an appropriate time

Budget Background

OTA technically was authorized in October 1972. It received no funding until **late 1973. It became operational,** for practical purposes, in the spring of 1974. It has, in other words, been "operating" for slightly more than 2½ years.

Below is a summary of the annual appropriations to OTA thus far. *

Fiscal 1974—$2,00 million
Fiscal *1975—$4.04* million
Fiscal 1976—$6.14 million
Fiscal 1977—$6.79 million

Assessment Record

According to statutory authority, requests for OTA's services may be made through the chairman of any committee of Congress, or inaugurated by the Board or the Director.

The number of different subjects on which requests for assessment have been made are as follows:

1973— 3
1974—89
1975—43
1976—43

Of these assessments, 15 originated with the Board and almost all the remainder were requested by individual committees. The 178 different subjects presented to OTA for consideration were contained in 116 separate requests for assessment.

The status of those subjects is:

Completed—38
Ongoing—59
Planned—28
No Action—53

Note that "no action" means primarily either no-funds-available or the Board is undecided on approval. It may also indicate that some question of duplication or of relevance exists.

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*Totals do not reflect supplemental or carryover provisions

Any attempt to make a definitive evaluation of OTA at this time would be, to my mind, unproductive. There are many reasons for this, some of which will become evident later in the report. Fundamentally, however, the difficulty of now evaluating OTA rests with the low visibility and the deliberate pace OTA has adopted and which its budget enforces.

I am neither complaining nor excusing in making this point. I am not at all convinced that the chief mode of operation utilized by the Office thus far, mainly a disposition to feel its way, is a bad approach. I am unmoved by some of OTA's critics who allege lack of effectiveness due to unnecessary caution with assessments, overly conservative management, or political timidity by the Board. Such critics, who are not, incidentally, a majority of those studying and observing OTA in depth, seem to be seeking to manufacture controversy or else they are uninformed of the nature of OTA, its purpose, its background, its uniqueness, and its statutory and material limitations.

Evaluation Indicators

Nonetheless, there are some indicators which are useful in making a tentative appraisal of OTA.

One of these is the number of requests for assessments. As we have already seen, the Office is being asked for considerably more help than it has funds to provide. It is true, as some have pointed out, that a lot of the requests came from or were inspired by members of the Technology Assessment Board itself—perhaps as many as two-thirds of them in the first year or so. However, as OTA has become better known the situation has markedly changed. Today only one-third of *all* assessment suggestions received by OTA have been or are related to the Board or any of its members.

A second indicator is the quality of the OTA completed assessment—rarely an easy thing to gauge. Some committee chairmen and members have communicated with OTA following its response to their requests, indicating both appreciation and approbation. Others have merely acknowledged receipt of the assessment. I am disinclined to regard either as a reliable--certainly not a conclusive—standard for judging the quality of OTA's work. Nor is there much to be gained by giving too much weight to outside critics of OTA assessments when few of them possess genuine insight into the technology assessment rationale *as it pertains to Congress.* [There is a difference.] Most do not understand that an assessment is not designed to be the *answer* to any given legislative problem, but is a *tool* to help legislators arrive at an answer—one tool among many. [See Sec. 2(d)(2) P.L. 92-484.]

To me, a much more significant measure of OTA's work quality is the fact that committees which have received OTA assistance the first time are coming back for more. Of all the standing, select, and joint committees of Congress which conceivably could make use of OTA, two-thirds have made requests to the Office in its first 30 months of operation. Of these committees, half have requested new assessments after receiving the results of their first ones—and a number of the remaining initial assessments requested are not yet due.

This, I think, means something.

A third indicator is the growing frequency with which OTA is being brought into the substance of legislation introduced into the Congress and thereby instructed to perform some additional statutory role.

During the 94th Congress alone 35 such bills were introduced and several were enacted into public law, including the Federal Railroad Safety Act and the Federal Coal Leasing Amendments Act. An Appropriations Conference Report also directed an OTA assessment of an auto crash recorder system proposed by the Department of Transportation

Report **of** *the House Commission*

In June 1976, the House Commission on Information and Facilities, pursuant to a resolution directing it to study the organizational framework of OTA, the Congressional Research Service, and the General Accounting Office, released its first report—which dealt with OTA.

For the most part the House Commission followed its legislative mandate and stayed close to organizational problems. It was particularly concerned with relationships with the Advisory Council, contracting arrangements, staff operations and size, personnel procedures, accounting systems, budget administration, delegation of au-

thority, liaison with congressional committees, and the like.

This report—which was critical in a number of ways, laudatory in some, and often perceptive—nonetheless placed its greatest emphasis on identifying *potential* difficulties rather than *existing* ones. The report has proved a valuable aid to the Office, and we are grateful for it. I, personally, have been particularly struck by the Commission's timely observations on the need to maintain the Board's policy role (vis-a-vis an operating one) and toward staff employment and salary practices. The Commission's recommendations for improvement in these areas, among others, deserve continuing attention,

My reservations of the Commission's report are mainly two.

First, the report concerned itself with OTA activities only up to July 1, 1975. At that time OTA had been operational for a total of about 15 months—not very much time on which to base an evaluation. It is to the Commission's credit that it took this circumstance into account throughout most of its study.

Nonetheless, since nearly a year of additional OTA operation had elapsed by the time the report was issued, I felt it would be useful to provide complete information on OTA's work. Thus in July *1976,* the Office prepared at my request a Status Report to supplement the Commission's study. The OTA report, and my introduction to it, was viewed in some quarters as designed to refute the Commission's study. It was not. The intent was to provide as much up-to-date factual information as possible to the Board and the Congress for use in future surveys and budgetary reviews of OTA.

My second reservation stems from the Commission's inquiry into the assessment process itself. There is considerable doubt in my mind whether treatment of the technology assessment concept and the still-developing processes of implementing it—important as they are for a general understanding of OTA's operations—were appropriate areas for findings and recommendations. And while I quite agree with the Commission's suggestion that OTA's organic act should be reviewed in this and other areas, I strongly question certain conclusions suggested by the Commission. I refer particularly to implications that (a) OTA's chief functions are necessarily prognostic in nature and (b) that the term "Technology Assessment" should necessarily be precisely and probably narrowly defined,

In this regard, I should like to point out that these exact questions were the subject of intensive scrutiny, at congressional request, by a number of competent outside study groups as well as the House Committee on Science and Astronautics for years before hearings were ever held on specific legislation. They were by no means uninvestigated issues; their treatment in the Act reflects this part of the legislative history, which is not alluded to in the Commission's study. Moreover, it has been my experience that relative to the art of legislative drafting, the prudent choice is to take the broad course rather than the narrow one when dealing with unknowns or developing and shifting situations. Technology assessment has been and remains in this category.

In any event, as this Congress expires I believe many of the Commission's concerns have been met, corrected, or adjusted. Others will be the subject of intensive study in 1977 and will be described later herein.

Appropriations Conference Commentary

The conference report on the Legislative Appropriations Act for 1977, which included funds for OTA operations for next year, singled out three OTA program areas which "have especially sound plans" and which have been "especially successful in identifying and respondin$_g$to congressional needs." Those cited were the energy, oceans, and transportation programs, The report added that these programs should be fully supported but expressed reservations about "a number of other studies" and suggested they be carefully and critically reviewed as possibl$_y$"nonproductive. " The "other studies" were not identified, nor were certain OTA "weaknesses" to which the report referred.

I commend my colleagues for their insight on such matters and fully concur in their observations, as far as they go.

However, I believe that most Board members would agree with me that OTA's programs in materials and health have been equally productive and useful and that a number of others may have been inadvertently down-graded by the appropriations conference report since they are in the long-range category. This latter point is essential to an understanding of OTA's mission. The fact that more assessments may have been completed in certain program areas can be misleading if that is taken as a criterion of overall utility. Many requests for OTA assessments—including most of those in the categories specified by the conference report—have had early deadlines, forcing concentration in these areas. Others require long leadtimes.

It will be unfortunate indeed if OTA is caught in a bind between such important appraisals as those

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projected by the House Information Commission—preferring emphasis on prognostic, long lead-time endeavors—and the prestigious viewpoints of the Appropriations Committees which seem to regard OTA's slower-paced assessments as "non-productive" or "under-productive. "

For reasons already mentioned, I hesitate to pin a comparative quality rating on any of OTA's work to date. I am sure my appropriations colleagues are not prepared to take that step either. It is essential that we in OTA develop reliable assessment quality control, and I am certain we shall; but it will take time.

III Facilities and Funding

Facilities

On numerous occasions the difficult working facilities in which OTA operates have been brought to the attention of appropriate authorities—but without significant improvement.

I recognize the tight space situation which plagues all of us on the Hill. But I suggest that OTA's archaic quarters, plus its scattering over seven different locations, is particularly burdensome. Inevitably, it reduces the efficiency of the Office staff by a sizable margin. To the best of my knowledge, no more than one or two members of Congress other than myself have ever visited OTA's working quarters. If more members do so in the future, the seriousness of the problem might be recognized.

In addition to the excessively poor environmental quality of most of the workspace, there is far too little of it and virtually no privacy for anyone other than the Director and his Deputy. By way of comparison, General Services Administration standards specify that space available to Federal workers should average across the board at about *150* square feet per person. For OTA's seven locations, the average is about 73 square feet. The statistic speaks for itself.

I believe much can be accomplished if the Office staff, at a minimum, is assembled in one place. I urge my colleagues on the Board to do all they can to induce this transition as rapidly as possible.

Funding

Annual funding for OTA has been summarized earlier in this report. In addition, the reasons for not increasing OTA's basic funding for fiscal year 1977, and my response to that decision, have similarly been discussed. I will add here only the observation that the 30 percent of the requests for assessments which OTA has thus far been unable to field are mostly in that category for budget reasons.

The cost of assessments, the majority of which involve outside contracts, is not great; but neither is it small. Assessment costs have ranged from $11,000 to more than $800,000 —with the average running between $200,000 and $300,000. Administrative costs are normal, particularly for a developing agency—in the 11- to 15-percent range which includes Board, Council, Public Affairs, and informational activities.

If the Congress expects OTA to provide services at the rate it is requesting them, it should also provide an adequate budget to get the job done.

IV. Personnel

Since its inception OTA has been subjected to a variety of pullings and haulings over the size of its in-house staff—which for the present has stabilized at a relatively modest 120. Some think the. in-house staff should be considerably enlarged. Others do not. I am among the latter for these reasons:

(1) The small staff concept with major outside contracting is the basis on which Congress approved OTA.
(2) A 'large in-house staff tends eventually to become inbred and predictably biased in its views.
(3) The variable content of OTA's total task, if performed in-house, would require an excessive technical staff, or excessive turnover of personnel with loss of continuity, or descent to a quasi-technical superficiality.
(4) More varied and superior talent can be obtained more economically by the contract-consultant method.

To date, on the plus side of the personnel picture, OTA has shown itself to be particularly adept at forming good advisory panels to oversee its various assessment tasks. This is also true of its estimates of need for short-term consultants, who have proved to be a critically useful element in the OTA mode of operation.

On the other hand, it seems to me there is, or soon will be, a need for an advanced quality-control system with regard to selection of both in-house staff and nonpanel, individual consultants—especially now that OTA is moving into more sophisticated phases of operation.

It is my impression, after 2 years of personnel endorsement duty as Board chairman, that some OTA staff and consultants are recruited mainly on the basis of paper or political qualifications or the summary judgment of OTA program managers who need somebody in a hurry. These factors may be important at times; they are not a substitute for careful background evaluation, particularly in an organization such as OTA, the staff of which is small but influential and which should be characterized by appropriate training, experience, and proven ability. The number of personnel I am concerned about is not large; the point is the Office cannot afford to harbor misfits or incompetents.

Board /evolvement

The foregoing necessarily brings up the question of why Board members, including the chairman, should become involved in personnel matters at all. I cannot think of a rationale, on any theoretical basis, why we should. It seems tome that personnel selections, pursuant to basic *policies* set by the Board, should be the responsibilit$_y$ of the Director in accordance with OTA's organic act.

However, this concept has been largely negated by Rule #12 of the Board's "Rules of Procedure" which says—''The Director shall appoint *with the approval of the Board* . . . certain officers and such additional staff as may be necessary. " The same rule also provides for the appointment of a professional staff member by the chairman and vice chairman of the Board "in each Congress" as well as the ranking Board member of the opposite party in each house. Subsequent to the adoption of this rule the Board agreed, informally, that the same privilege should apply to all Board members.

In the beginning Rule #12 probably made sense since most Board members were not familiar with the Technology Assessment Act and needed specialized assistance. I am, further, realist enough to recognize that members might want staff personnel in OTA whom they knew and whose judgment they valued.

Since that time, however, I believe the rule has come to have little utility. Only 7 of the 16 members who have served on the Technology Assessment Board since it was first created have taken advantage of the rule and/or the informal agreement. At this point, it seems to me, the rule is not only inequitable and obsolete but contains a dangerous potential for creating in-house divisiveness or an unnecessary drag on OTA's budget. I note that the House Commission on Information and Facilities was disturbed by this situation in its report this year. I am by no means suggesting that any personnel appointments already made under the rule or the agreement be rescinded. I *am* suggesting the abolition of Rule #12 in its entirety as currentl$_y$ inappropriate.

I also would like to reiterate the need to intensify OTA's current efforts to develop a more comprehensive and detailed format for assuring quality control of OTA employees, The outline of personnel recruitment set forth in the July 1976 Status Report of the Office provides, as I indicated then, a

good foundation. With some refinement, amplification, and strict adherence it could form a basis for Board approval as general policy—after which implementation should be left to the Director.

Pay Scales

OTA employees are classified as congressional employees. Their pay scales, compared with those of other employees of the legislative branch, are high but not out of line when all factors are considered.

According to information I have requested, OTA's professional staff averages about $27,000 per annum. Its support staff averages about $12,000.

A reasonably close comparison maybe made with the new Congressional Budget Office (CBO) which has 193 employees-its professionals averaging just under $27,000 and its supporting staff about $14,000.

The 60-member staff of the House Science and Technology Committee, which I chair, uses a pay scale that is probably average or a bit above for the House of Representatives. Our professionals [who also must have special experience and qualifications] average just under $28,000, and our supporting staff about $12,400,

The Congressional Research Service professional staff averages about $19,400, its supporting staff about $9,000.

The General Accounting Office professional staff average is also about *$19,400,* its supporting staff about $10,400. [All figures predate the October 1976, pay raise.]

However, the functions, the employee security risks, and the many different levels of professional requirements make these organizations quite different. Also, compared with OTA's 120 employees, CRS has more than 800 and GAO more than 5,300. For the most part, the situations are not comparable.

The major difference in OTA pay philosophy from that of other legislative groups is in the number of professionals receiving the maximum permissible pay. At OTA about *24* percent receive maximum pay, At CBO it is 18 percent. At CRS the figure is 10 percent. At GAO it is 3.3 percent. On the House Science Committee it is less than 2 percent.

I recognize that the OTA percentage is inflated due to the early bandwagon syndrome which seems to accompany most newly formed Government entities. Nonetheless, I suggest a conservative approach in the hiring of future OTA employees at this level until a more even balance is achieved.

V. Board Procedures

I doubt if any member of the Technology Assessment Board is satisfied with the way the Board operates. Undoubtedly the reasons are varied, but I think two can be pinpointed.

(1) Meeting rooms satisfactory to members of both Senate and House are extremely limited. Their availability, in fact, determines when and where the Board can meet and makes a mockery of the supposed authority of the chairman to convene the Board whenever necessary.
(2) An all-congressional Board is not suited for the kind of detailed, often operational considerations which have formed a considerable part of its agenda, Very few Board members have the time or disposition to get into issues which do not involve major policy.

The attendance record at Board meetings (following the first four or five sessions), has not been impressive. In 1974 it was 56 percent; in 1975 it was 57 percent; in 1976 it was 45 percent. And these figures create a false impression since many members who attended did so for only a few minutes or only for the duration of the discussion with which they had special concern. A more accurate figure for sustained attendance during the 94th Congress is probably *25* percent or less. Rarely has a quorum been present—and then usually for a very short time due to floor action requiring the presence of Board members in their respective chambers.

Certainly this observation is not intended in a pejorative sense. My own attendance record is far from exemplary, and I well understand the pres-

sures on Board members which make it impossible for them to give full attention to the Board throughout its scheduled meetings.

But I see no reason why we must continue to follow a format which is largely ineffective and wasteful. I believe it is time to revise some of our procedures and wish to offer a few suggestions for the Board to think about.

Rules Revision

The Board's Rules of Procedure were drafted at a time when the Board had no choice other than to establish rather quickly some basic foundation for its operations. Adequate and useful at the time, those rules, I believe, are now outmoded in some ways. I have already suggested that Rule 12 be abolished. I believe others should be modified and possibly new ones added.

For example, I believe serious thought should be given to a revision of language in Rules 1 and 4 and to the elimination of Rule 13. [See attachment.]

With regard to Rule 1, there seems to be an anomaly inherent in the language since the rules of the two houses are frequently different. In Rule 4, I dislike use of the word "hearings" since this tends to accentuate the idea, already too widely held, that the Board is *de facto* a joint committee. Further, I doubt the need for a Board vote in this matter as we have known it so far; it might more effectively be subject to the approval of the chairman or an executive committee—discussed later. Rule 13 seems superfluous. The Act provides this authority and it can easily be carried out according to administrative instructions by the chairman. And, again, it seems cumbersome and unnecessary to bring the entire Board into this area for whatever reason.

I would point out that with regard to Rules 4 and 13, experience has shown that 99 percent of the time the Board does not want to be bothered. When it does want to concern itself, or when any single member so desires, the chairman and the Director are available and have always proved responsive to such interest.

Now I should like to offer some additional procedural suggestions based on OTA's experience to date as I perceive it.

(1) In view of general attendance difficulties and the scarcity of available quarters suitable for Board meetings, the Board should consider the possibility of establishing a TAB executive committee to handle most of the matters which heretofore have been placed before the full Board. There area variety of forms such a committee could assume. I believe a workable model might consist of five members: two members from each house, one from each party, selected by the chairman and vice chairman, plus the Director, the chairman of the committee to be designated by the chairman of the Board. Meetings of the executive committee could be either scheduled or called as needed with far fewer limitations imposed by meeting space or conflicting schedules of members. The chairman of the Board might well serve as the chairman of the executive committee. Any Board member should be able to participate in executive committee meetings if desired.

(2) If the foregoing were to be adopted, there could be fewer full Board meetings. The chairman could and should retain the option of calling meetings of the full Board at any time, as well as a majority of the members themselves. But the format to date of having frequent regularly scheduled meetings has been, I think, unproductive in many ways and a serious drag on the efficiency of OTA's staff which must expend much time and effort in preparation for formal public meetings. The problem is compounded for those staff members who must make presentations at such meetings, since it means a lot of time away from their substantive work. Even when the Board meets only once a month that loss can be substantial.

(3) If an executive committee or some similar group should be established, one of its functions should be to review for approval the preliminary or interim phases of assessments. It should further determine routine policies—administrative, interagency, and those of a liaison nature with the congressional committees. It should identify issues and subjects to be considered by the full Board.

(4) The executive committee concept should carry with it, I think, a brief but complete monthly report from the Director to all Board members summarizing the substance of committee meetings and/or actions taken or contemplated.

(5) I suggest that the Board not be asked to consider the approval or transmittal of any final assessment which has not been available to members at least 3 working days in advance,

(6) I suggest that considerable attention be given by the Board to the concept of "hearings." There is no question that authority for such proceedings exists, but I doubt the wisdom of employing them except in very unusual

circumstances. The reason is that Board "hearings" tend to be brief one-man shows, instigated and presided over by the member of immediate interest. They do little to foster the Board's reputation or status among either public or peers. It would seem to me that in lieu thereof, the chairman or the executive committee should be authorized to approve "inquiries" or "investigations" by one or more members acting as temporary task groups for the Board—but that any full-scale "hearings," however labeled, be permitted only by majority vote of the Board and that such proceedings require the presence of a quorum to sit. In this way we can be sure that any "hearings" are germane to the interests of more than one or two members without restricting such members from pursuing their other legitimate objectives, as representatives of the Board, in a less pretentious forum.

(7) At present, Board meetings take place in area-s which are cramped, poorly ventilated, with poor acoustics, and vulnerable to a variety of disruptions. A big part of the cause is that there is much public interest in OTA—which I choose to interpret as a symbol of growing awareness and influence of the Office—and seating space is quite limited. I therefore suggest that, in the absence of better meeting places and/or something like an executive committee, which would have a wider option of meeting places and could conduct its business more rapidly, the Board give serious consideration to an alternate system of handling at least minor and routine business. If some method of this kind is not worked out and if OTA's activities continue to accelerate along with public interest therein, the Board may well be forced into closed meetings—with all the political ramifications that entails,

Whatever attention the Board may or may not give to these observations, I sincerely hope it will appoint a review group of some kind to take a new look at its Rules of Procedure. We need a set of rules which is brief, flexible, and, above all, realistic. Our experiences to date indicate that some changes must be made if such criteria are to be met.

VI. The Technology Assessment Advisory Council

Earlier in this report there is a brief citation to the manner in which the TAAC was formed. In effect, it was something of an afterthought, an entity not extensively planned.

Moreover, the Technology Assessment Advisory Council received very little attention, in its formative stages, with regard to a capability of working well together as a team. Although hewing technically to the Rules of Procedure, the Board in fact chose TAAC members according to its personal predilections and with much emphasis on geographical distribution. I was as parochial in my approach to TAAC as any other member of the Board—and hence share whatever praise or blame may attach to the Council as presently constituted,

I am not, however, convinced that our method of selection was necessarily wrong. The Council is made up of some very excellent people and has performed some very useful services. So far it has been involved in five substantive programs where it has had considerable responsibility—and has provided advice, critiques, recommendations, etc., in half a dozen other areas.

The cost of the Council is moderate and is currently running at less than **$100,000** a year.

Effectiveness

While not prepared to say that the Board's mode of selection of TAAC members was wrong, neither am I prepared to say it was right. This is something our House committee of OTA jurisdiction may wish to study next year.

Certainly the Council has not been as coordinated, focused, or effective as one might wish in its performances during the 94th Congress. I believe there are two main reasons for this.

First, there has been some misunderstanding as to the Council's relationship to OTA and regarding its appropriate functions. TAAC is not technically a part of OTA. It is a statutory body advisory to the Board but not to the Director. This maybe viewed as legalistic quibbling, but I consider it a major segment of whatever the Council's problems have been or are. On some occasions, and on the part of all parties concerned, there seems to have been an assumption that TAAC should become involved with operational and administrative matters as well as policy or substantive issues. Such is not the case—unless the Board invites operational involve-

ment, and even then I am uncertain of the Board's authority to so act.

Second, the Board in my view, and in part during my chairmanship, has failed to provide the Council with adequate guidance. We have too often left the Council to shift for itself; we have frequently left the Director in an awkward situation for the same reason, putting his office in the untenable position of acting as surrogate for us; in short, the Board has not developed a cohesive program—even in general terms—for the Council and requested TAAC to carry it out. What could be an even more serious error would be our sanction for the Council to coordinate and be responsible for a major OTA program activity—a situation which is approximated in the national R&D programs and priorities area, even though most of the staffing is OTA's. I was among those who raised no objection at the time, but, on reflection, I believe that move had a potential for setting a bad precedent and should not be repeated. The Council should not be expected to be responsible in any significant way for a specific OTA operation requested by a congressional committee or committees. This is not its function.

Future Role

At the same time, I do not regard the situation as insolvable or, at this stage, even abnormal.

It is axiomatic in the industrial world that entrepreneurs into new business areas must have assurance of sufficient capital to carry them for 5 or 6 years without profit, if they want eventually to succeed. This is because they must (a) build a market, and (b) overcome early mistakes that are bound to occur.

The same is true, I think, for OTA. We have troubles, but we are straightening them out—including those with TAAC, which are particularly tricky due to the nature of the Council itself and the limited time its members can afford to give to OTA activities.

A year ago I addressed a letter to the then chairman of the Council, Dr. Harold Brown, president of the California Institute of Technology, in which I outlined five areas where I felt TAAC could make real contributions. * I believe those same needs exist, but I would like to add 'a sixth.

That is a Council review and determination of criteria necessary to an effective quality control of assessments.

It should be made clear that the intent here would not be to put the Council in the role of a judge or censor regarding assessments prior to or after such action as the Board may take, Neither does it imply preemption of this duty vis-a-vis the Director's office—which I believe must exercise this function regularly and in a carefully fashioned and rigorous way.

What I am recommending is the formation of a set of indicators against which completed assessments can be thoroughly reviewed as to method, content, and responsiveness—and eventually rated on a scale of quality to be formulated by OTA on an empirical basis. The conclusions and the reasons for them should be fed through the Director's office as an important input toward improving his total quality-control system for future assessments,

The foregoing are some possible facets of the Council and the issues surrounding it which the Board may wish to study in the future. In any event, the OTA advisory system is another subject which now seems appropriate for legislative reappraisal as well.

See* **the 1976 OTA **Annual Report.**

VII. Legislative Review, 1977

The Technology Assessment Act creating OTA is now in its fifth year. To date that Act and OTA's operations have been reviewed only by the House Commission on Information and Facilities and the Commission on the Operation of the Senate; the report of the latter is not yet available.

Neither Commission has had a part in the original formulation or in the functioning of OTA; but I am mindful that the House Commission, in its report on OTA, recommended several times that the Act be reviewed with an eye to possible improvements.

Most of us who have served both as Board members and as members of the House Committee on Science and Technology (formerly Science and Astronautics), which was the principle originator of the Technology Assessment 'Act, agree with this recommendation. I had, in fact, determined independently that the House science committee, which I chair, or one of its subcommittees, should make

such a review in 1977. As the committee of legislative jurisdiction of OTA in the House, this is one of our responsibilities. I had not wanted to initiate such a review earlier since the Office had little operational experience; nor did I wish to undertake the task while serving simultaneously as the OTA Board chairman. But I believe a useful survey by the committee can be started by this spring or summer—or earlier if necessary.

Potential Subjects for Review

In considering the basic Act, we shall need to determine (a) what changes may be in order, and (b) whether they can better be effected with legislative revision or without such revision,

The topics for review cannot now be definitively identified, but I should think they might include:

(1) The composition and duties of the Technology Assessment Board.
(2) The nature, particular needs for, and appropriate functions of the Technology Assessment Advisory Council.
(3) Methods of staff appointments and personnel selection, whether for the Director's office, the Board, or the Council.
(4) Organization of the Director's office and what statutory requirements, if any, may need to be applied.
(5) OTA's relationship with the General Accounting Office and the Congressional Research Service.
(6) Quality control systems affecting assessments and personnel placement.
(7) Liaison between the Director's office and congressional committees, committee staffs, and with Board members and their staffs.
(8) Types of recommendations which may or should be made by the Board.
(9) Cost-benefit implications reassessments completed.
(10) Budget and auditing systems.
(11) Assessments or other duties mandated by legislation.
(12) The definition of "technology assessment" and whether it should be narrowed or, on the contrary, increased in scope—or left alone.

May I make it clear to my colleagues on the Board that we will not be approaching any OTA review in the belief that we are under an injunction to go forth and right various calamitous wrongs. There is no such feeling prevalent. Our goal is simply a careful inquiry into the OTA endeavor, what seems to be working well, what is not, and how to smooth out the wrinkles.

Note

In the foregoing commentary there is a mention of the report of the Commission on the Operation of the Senate, which contains certain observations and recommendations regarding OTA. That report, "Toward a Modern Senate," became available December 19, 1976, after this one was completed. However, it is expected that the Commission's recommendations will also be considered in the review process.

VIII. Attachment: Rules of Procedure, Technology Assessment Board

Rule 1. The rules of the Senate and the House of Representatives, insofar as they are applicable, shall govern the Board.

Rule 2. The meetings of the Board shall be held at such times and in such places as the Chairman may designate, or as a majority of the Board may request in writing, with adequate advance notice provided to all Members of the Board.

Rule 3. The Chairman shall preside over meetings of the Board. In his absence, the Vice Chairman or other Board Member as the, Chairman may designate shall preside.

Rule 4. Hearings before the Board maybe convened by the Chairman or by a majority of the voting Members of the Board: *Provided.* That the Board shall not require by subpena or otherwise the attendance of any witness, the administering of any oath or affirmation, or the production of any book, paper, or document unless a majority of all the voting Members of the Board assent. The Chairman may designate any Member of the Board to preside over a particular hearing.

Rule 5. No recommendation shall be reported from the Board to either House of Congress, to any committee thereof, or to any Government agency or official unless a majority of the Board is present and a majority of all the voting Members of the Board assent: *Provided.* That any Member of the Board may make a recommendation supplementary to or dissentin, from the majority recommendation.

Rule 6. The Board shall not appoint any person as Director of the Office of Technology Assessment, nor shall the Board remove any person from said position,

unless a majority of all the voting Members of the Board assent: *Provided.* A vote to remove the Director shall not be taken in less than *20* calendar days after a written motion for such a vote, signed by at least three Members of the Board, shall have been provided to each Member of the Board.

Rule 7. The Board shall not appoint any person as a member of the Technolog, Assessment Advisory Council unless a majority of all the voting Members of the Board assent.

Rule 8. Proposals for adopting, eliminating, amending, or modifying rules of the Board shall be sent to all Members of the Board at least two weeks before the final action is taken thereon, unless said action is taken by unanimous consent of all Board Members. No rules of the Board shall be adopted, eliminated, amended, or modified in any way unless a majority of all the voting Members of the Board assent.

Rule 9. Except as otherwise provided by any other Rule of the Technology Assessment Board, six of the voting Members of the Board actually present shall constitute a quorum, provided that such Members shall include at least one Member of each party and at least one Member of each House.

Rule **10.** Proxy voting shall be permitted on all matters before the Board, provided that the absent Member has been informed of the matter on which he is being recorded and has affirmatively requested that he be so recorded; but provided further that no proxy shall be used at the first Board meeting of each Congress, or for the purpose of establishing or maintaining a quorum.

Rule 11. The vote on any matter before the Board shall be conducted as a rollcall vote when so requested by any Member of the Board, The result of each rollcall vote in any meeting of the Board shall be made available for inspection by the public at reasonable times in the Board offices. The information shall include a description of the motion or other proposition voted on, the name of each Member voting for and each Member voting against such motion or proposition, and the name of each Member present but not voting.

Rule 12. The Director shall appoint with the approval of the Board a Deputy Director, a General Counsel, and such Assistant Directors and additional staff as may be necessary. In addition, the Director shall appoint an Executive Secretary to the Technology Assessment Advisory Council upon the recommendation of the Chairman of the Council and with the approval of the Board. In each Congress, the Director shall appoint an immediate staff to the Board, including a professional staff member designated by the Chairman; a professional staff member designated by the Vice Chairman; a professional staff member designated by the ranking Senator of the party other than that of the Chairman in each odd-numbered Congress, and other than that of the Vice Chairman in each even-numbered Congress; a professional staff member designated by the ranking House Member of the party other than that of the Vice Chairman in each odd-numbered Congress, and other than that of the Chairman in each even-numbered Congress; and such other personnel as the Board may deem necessary.

Rule 13. In order to supplement the Advisory Council and provide the Board with expert advice in special assessment areas or with respect to special assessment problems, Advisory Panels may be established and qualified individuals may be appointed as consultants by the Chairman or the Director with the approval of the Board, or by a majority vote of the Board.

Rule 14. There shall be kept a complete record of all Board proceedings and action. The Clerk of the Board or an alternate Member of the Board staff designated by the Chairman shall act as recording secretary of all proceedings before the Board and shall prepare and circulate to all Members of the Board the minutes of such proceedings. Minutes circulated will be considered approved unless objection is registered prior to the next Board meeting. The records of the Board shall be open to all Members of the Board.

Rule 15. The order of business before the Board and any interpretation of the Rules of Procedure shall be decided by the Chairman, subject always to a vote on an appeal of his decision by a majority of the voting Members of the Board.

Appendix B

TECHNOLOGY ASSESSMENT ADVISORY COUNCIL ACTIVITIES

Appendix B

LETTER OF CHAIRMAN WIESNER, TECHNOLOGY ASSESSMENT ADVISORY COUNCIL, TO SENATOR KENNEDY, CHAIRMAN, TECHNOLOGY ASSESSMENT BOARD

January 4, 1977

The Honorable Edward M. Kennedy
Chairman, Technology Assessment Board
Russell Senate Office Building
Washington, D.C.

Dear Mr. Chairman:

The OTA Advisory Council continued to work with the OTA Board and staff in 1976 to develop and refine ways in which the Council might best contribute to OTA activities. As a general advisory body, the Council presented observations and recommendations to the Board, gave special guidance and assistance to a number of OTA programs and activities, helped develop and extend the theory and methods of technology assessment, and attempted to promote consideration of long-term trends and impacts of technologies. Throughout the year, the Council placed special emphasis on OTA assessment priorities, methodologies, emerging issues, and public participation mechanisms. And, in response to concerns expressed by the Council's first Chairman, Harold Brown (See appendix F to the 1976 Annual Report), the Council worked to improve its commitment, cooperation, and communication with the Board and OTA staff.

During 1976, regular Advisory Council activities included meetings of the full membership, joint meetings with the Technology Assessment Board, and special subcommittee and panel meetings. The six regularly scheduled business meetings of the full council membership in 1976 included briefings from OTA staff on the following programs and projects: Technology and World Trade, Oceans (offshore energy systems), Transportation (coal slurry pipelines), Energy (nuclear proliferation), Emerging Technologies, and National Research and Development Policies and Priorities. During such briefings, the Council was able to give advice and guidance to ongoing and proposed assessment projects. In addition, regular meetings with the Technology Assessment Board and one working session with OTA staff provided opportunities for the Council to advise on more general issues involving OTA operations and approaches. Two OTA activities in which the Advisory Council played a major role in 1976 are the assessment program on National Research and Development Policies and Priorities and the Planning Study on Emerging Technologies. Both activities are designed to provide the Congress with better understanding with which to shape and evaluate the Nation's technical research and development programs.

National Research and Development Policies and Priorities Assessment

As you know, the Research and Development Program covers not only Federal R&D, but also the impacts of Federal legislation, regulation, and other actions on the utilization of science and technology in the private sector. At the request of the OTA Board and after extensive deliberations, the Advisory Council agreed to play a continuing role in guiding this program. A Research and Development Program Steering Committee was established under the chairmanship of Harold Brown, myself, and the chairmen of the three advisory panels serving as members: Harvey Brooks, chairman of the Panel on the Health of the Scientific and Technical Enterprise; Lewis Branscomb, chairman of the Panel on the Applications of Science and Technology; and Edward Wenk, Jr., chairman of the Panel on Decisionmaking on Research and Development Policies and Priorities.

Each of the three program panels held three or four meetings during the period of the annual report. Based on the deliberations of these panels, the Steering Committee approved a program consisting of the following projects:

. Health of the Scientific and Technical Enterprise Panel:
(1) Definition of the scientific and technical enterprise and the criteria for evaluating its health, (2) consideration of the special problems confronting the academic science and engineering communities; (3) expanding opportunities for women and minorities in science and engineering; and (4) setting priorities for national effort among fields of science and engineering.

- Applications Panel:
(1) Consideration of possible governmental actions to enhance the processes of technological innovation in our society; (2) international technology transfer issues with emphasis on the less developed countries; and (3) how the Nation can better mobilize its scientific and technical resources to meet national goals or solve social problems.

- Decisionmaking Panel:
(1) Development of guidelines for congressional evaluation of R&D; (2) Federal reorganization of its science and technology activities; (3) methodology for evaluating the economic and social impact of research and development; and (4) methods for improving foresight in R&D decisionmaking.

- Projects in which all three panels will be involved:
(1) The role of the national laboratories; (2) “appropriate technology”; and (3) public participation in science and technology.

Specific projects have been launched in various of these areas through the OTA staff, consultants, and contractors. Examples are a study of the impact of zero-based budgeting on research programs; a contract to delineate key Government policy issues in influencing technological innovation; and a consultant study of national laboratories.

Planning Study on Emerging Technologies

The Advisory Council has become heavily involved in the newly initiated Emerging Technologies Planning Study. This project will emphasize larger, long-term issues and alternative approaches to important technological developments of needs. Initiated at the request of the OTA Board in the summer of 1976, the activity was seen by the Council as an opportunity to merge its own expertise and interest in priorities and wide-impact technologies with studies that would attempt to develop

methods for identifying potential large-impact and long-term technologies as they emerge.

In September, the Council agreed to work with the Emerging Technologies study by assigning this task to the Priorities Subcommittee (now a committee-of-the-whole). Since then, members of the planning staff have worked closely with the Council to identify objectives, approaches, scope, and specific issues the program will address. At the end of the year, the staff expanded their planning study to look into the feasibility of evaluating the influence of society upon technology. It is anticipated that the planning study will be completed by April 1977 and presented to the Council and the Board at that time.

The Advisory Council believes that both the Research and Development Policies and Priorities Program and the Emerging Technologies Planning Study hold great promise for helping Congress improve its authorization, appropriation, and oversight of science and technology programs, and the Council is ready to continue its guiding role in these assessments at the request of the OTA Board.

During 1976, the Advisory Council continued its subcommittee activities. The activities of the former Priorities Subcommittee were merged into the work of the Emerging Technologies study: Also, the Council reestablished the Methodology Subcommittee under the chairmanship of John McAlister; this subcommittee has focused on approaches that have been. used, and those which might appropriately be used, in OTA's assessments.

To accomplish this task of a broad examination of methods used by OTA in its first few years of operation, the Methodology Subcommittee is comparing the accomplishments of OTA with the methods used to achieve them. Members of the subcommittee have participated in the series of workshops on program management convened by Mr. Daddario in the fall of 1976, and have formulated a study approach which goes beyond the self-examination that is to be summarized in the proceedings of the workshops. A final report, due in 1977, should provide opportunities to improve OTA's capabilities for quality control in its assessments.

Throughout 1976, individual Council members continued to be involved in various OTA program advisory positions based upon their own interests and expertise. J. M. Leathers, Vice President of the Dow Chemical Corporation, is a member of the OTA Energy Advisory Committee; Frederick C. Robbins, Dean of the School of Medicine at Case Western Reserve University, plays a leading role in planning OTA's program of health assessment by chairing the Health Advisory Committee; Hazel Henderson, Co-Director of the Princeton Center for Alternative Futures, provides advice on public participation methods, particularly those employed by OTA's Oceans Assessment Program; and J. Fred Bucy, President of Texas Instruments, Inc., serves on the Advisory Committee to the Assessment of Technology and World Trade.

At the end of 1976, some changes in the Council membership were expected, and made. As he was appointed Director of the Congressional Research Service, the Honorable Gilbert Gude replaced Norman Beckman as the Council member from the CRS of the Library of Congress. The Council also expected a replacement for Harold Brown, who was appointed Secretary of Defense at the beginning of 1977, and reappointment of John McAlister, Jr., and J. Fred Bucy to the Council.

As a summary note, the activities of individual Council members and those of the Council as a whole over the past year might be examined in light of the correspondence between former Chairman Harold Brown and former Board Chairman Olin E. Teague in December 1975. In his letter of resignation as

chairman, Dr. Brown pointed out three areas in which the operation of the Council could be improved: (1) communication and coordination with the OTA Board; (2) communication and guidance of OTA program areas; and (3) commitment of Council members to improving OTA products and processes. At the end of **1976**, the Advisory Council still faces the need for improvement in each of these areas.

Over the past year, the Council planned to send representatives to regular Board meetings as a means of improving communications between the two bodies. Often, it was not possible to do this. Similarly, the Advisory Council discussed the need for more frequent and meaningful contact with OTA program staff and their products. But, except for certain programs described previously, and the commitments of certain individual Council members to program areas, improvements can be made here as well. Finally, since Council members have other obligations which must frequently take precedence over OTA activities, the time spent by many members in connection with Council and OTA matters has been insufficient to provide the level of guidance and oversight a body such as the Advisory Council could give.

Suggestions for improvements in all these areas might not only include renewed commitments on the part of Council members, but also the addition of new Council members or associate members. With increased membership, and more frequent scheduling of regular meetings, the Council as a whole might be able to spend more time in contact with the Board, OTA programs, and other Council activities. The Council sees opportunities to learn from its strengths, successes, and shortcomings in order to improve both the Council and OTA operations. We are ready to assist the Board in any wise and considered course for doing so.

Sincerely yours,

JEROME B. WIESNER

Appendix C

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Executive Vice President
Gould Incorporated

Dr. Charles J. Hitch
President
Resources for the Future, Inc.

Dr. C. Lester Hogan
President and Chief Executive Officer
Fairchild Camera and Instrument Corporation

Dr. Roy D. Hudson
Director, Research Planning and Coordination
Parke Davis and Company

Mr. Sol M. Linowitz
Senior Partner
Coudert Brothers

Ms. Alice Tepper Marlin
Executive Director
Council on Economic Priorities

Dr. Claire Nader
Independent Consultant

Dr. Arthur S. Obermayer
President and Chairman of the Board
Moleculon Research Corporation

Dr. **Philip H. Trezise**
Senior Fellow
The Brookings Institution

Dr. Herbert F. York
Professor of Physics
University of California at San Diego

Panel on Decisionmaking on R&D Policies and Priorities

Dr. Gilbert F. White, *Co-chairman,*
Director
Institute of Behavioral Science
University of Colorado

Mr. Adam Yarmolinsky, *Co-chairman*
Ralph Waldo Emerson
Professor of the University
University of Massachusetts

Mr. Robert S. Browne
Executive Director and President of the Board
Black Economic Research Center

Dr. Robert A. Charpie
President
Cabot Corporation

Mr. Martin Goland
President
Southwest Research Institute

Dr. Jerry Grey
Research and Engineering Consultant

Mr. Gerald B. Grinstein
Preston, Thorgrimson, Ellis, Holman, and Fletcher

Dr. Walter W. Heller
Regents Professor
Department of Economics
University of Minnesota

Dr. Frederic A. L. Holloway
Vice President for Science and Technology
EXXON Corporation

Dr. Edward B. Lindaman
President
Whitworth College

Dr. Richard R. Nelson
Professor of Economics
Institute for Social and Public Studies
Yale University

Dr. Thomas O. Paine
President
Northrop Corporation

Mr. Don K. Price
Dean
JFK School of Government
Harvard University

Ms. Lola Redford
Director
Consumer Action Now

Dr. Donald B. Rice, Jr.
President
The Rand Corporation

Dr. Robert F. Rushmer
Professor
Center for Bioengineering
University of Washington

Panel on Health of the Scientific and Technical Enterprise

Dr. Harvey Brooks, *Chairman*
Benjamin Peirce Professor of Technology and Public Policy
Harvard University

Dr. R. Stephen Berry
Professor, Department of Chemistry
University of Chicago

Dr. Solomon J. Buchsbaum
Vice President
Network Planning and Customer Service
Bell Telephone Laboratories, Inc.

Dr. James F. Childress
Joseph P. Kennedy, Sr. Professor of Christian Ethics
Kennedy Center for Bioethics
Georgetown University

Dr. Jewel P. Cobb
Dean, Douglass College
Rutgers State University

Dr. Donald W. Collier
Vice President for Research
Borg-Warner Corporation

Dr. Richard B. Freeman
Associate Professor
Department of Economics
Harvard University

Dr. Leo Goldberg
Director
Kitt Peak National Observatory

Dr. Donald F. Hornig
President
Brown University

Dr. Richard M. Krause
Director
National Institute of Allergy and Infectious Diseases
National Institutes of Health

Dr. William J. McGill
President
Columbia University

Dr. David Z. Robinson
Vice President
Carnegie Corporation

Dr. Jurgen Schmandt
Professor
Lyndon B. Johnson School of Public Affairs
University of Texas at Austin

OTA Conference on Communications and Rural America

Panel One—Rural Development and Communications

Dr. John A. Gronouski, Chairman
Professor of Public Affairs
Lyndon B. Johnson School of Public Affairs
University of Texas

Mr. Ray Marshall, *Rapporteur*
President, National Rural Center

Mr. Charles Bannerman
Executive Director, Mississippi Action for Community Education and Delta Foundation

Mr. Calvin Beale
Economic Research Service
U.S. Department of Agriculture

Dr. Charles E. Bishop
President
University of Arkansas

Mr. Samuel A. Carradine
Cable Communications Resource Center
Booker T. Washington Foundation

Ms. Marie Cirillo
Department of Rural Development
Catholic Diocese of Nashville

Mr. Robert Cooper
Executive Director
Community Antenna Television Association

Mr. Aaron Fleischman
Fleischman and Walsh

Mr. David Lambert
Director of Rural Development
National Grange

Mr. Gary K. Madson
Deputy Administrator
Rural Development Service
U.S. Department of Agriculture

Mr. John Madden
Director General of Technology and Systems, Research and Development
Department of Communications
Canada

Mr. Thomas McRae
Winthrop Rockefeller Foundation

Mr. Alex Mercure
Vice President
Regional and Community Affairs
University of New Mexico

Mr. William Motes
Rural Development Subcommittee
Senate Committee on Agriculture and Forestry

Mr. William Murray
Legislative Director
National Rural Electric Cooperative Association

Dr. Louis A. Ploch
Department of Rural Sociology
University of Maine

Mr. Kenneth Rainey
Academy for Contemporary Problems

Mr. Victor K. Ray
Director of Planning and Development
National Farmers Union

Mr. Shelby Southard
Director of Public Affairs
Cooperative League of the U.S.A.

Mr. Frank Tsutras
Director, Congressional Rural Caucus

Mr. William Urban
Superintendent of Blair High School

Panel Two—Technology, Economics and Services

Dr. Leland Johnson, Chairman
Director, Communications Policy Program
Rand Corporation

Dr. William Lucas, *Rapporteur*
Senior Social Scientist
Rand Corporation

Mr. C. Ray Ballard
Assistant Administrator, Telephone Rural Electrification Administration
U.S. Department of Agriculture

Mr. Rex Bradley, President
Telecable Corporation

Ms. Red Burns
Executive Director, Alternate Media Center
New York University

Mr. John Dimling
Director of. Research
National Association of Broadcasters

Mr. Herbert S. Dordick
Associate Director, Center for Communications Policy Research
Annenberg School of Communications
University of Southern California

Mr. Albert Feiner
Director, Technology, Management, and Evaluation
Practical Concepts, Inc.

Mr. Bud H. Gibbs
Attorney at Law

Dr. Dean Gillette
Executive Director, Systems Research Division
Bell Laboratories

Dr. Peter C. Goldmark
President
Goldmark Communications Corporation

Mr. Edward Z. Gray
Assistant Administrator for Industry Affairs and Technology Utilization
National Aeronautics and Space Administration

Mr. Dale Hatfield
Chief, Office of Plans and Policy
Federal Communications Commission

Dr. Joseph A. Hull
Associate Director, Institute for Telecommunications Sciences Systems, Technology and Standards
Office of Telecommunications
U.S. Department of Commerce

Mr. Russell Karp
President, Teleprompter Corporation

Ms. Peg Kay
Fellow, Office of Telecommunications Policy

Mr. Ira Kaye
Consultant

Mr. C. Raymond Kraus
President, Consulting Communications Engineers, Inc.

Dr. Katherine C. Lyall
Director, Lyall Associates

Dr. Roman V. Mrozinski
Committee on Telecommunications
National Academy of Sciences

Mr. Robert Mullins
Legislative Assistant
National Farmers Union

Mr. Jack O'Neill
Associate Department Head
Telecommunications Systems Department
MITRE Corporation

Dr. Alan Pearce
Subcommittee on Communications
Committee on Interstate and Foreign Commerce
U.S. House of Representatives

Mr. Richard Spelic
Director of Planning
East Arkansas Planning and Development District

Mr. Israel Switzer
Switzer Engineering Services, Ltd.

Dr. Louis Tamblyn
Executive Director
Rural/Regional Education Association

Dr. William J. Thaler
Chief Scientist and Acting Deputy Director
Office of Telecommunications Policy

Dr. Harry L. Van Trees
Assistant Vice President
Advanced Systems—Research and Engineering
Communications Satellite Corporation

Panel Three—Federal Policy

Mr. Glen Robinson, Chairman
Aspen Institute
Program on Communications and Society

Mr. Henry Goldberg, *Rapporteur*
Verner, Liipfert, Bernhard, McPherson, and Alexander

Mr. John A. Baker
Executive Vice President
Green Thumb, Inc.

Mr. Paul I. Bortz
Division Head
Industrial Economics Division
Denver Research Institute
University of Denver

Mr. Robert A. Brooks
Senior Vice President
Telecom Engineering, Inc.

Mr. Anthony Radspieler
Senior Policy Analyst
Office of Assistant Secretary for Policy
U.S. Department of Commerce

Dr. Alfred J. Eggers, Jr.
Assistant Director
Directorate for Research Applications
National Science Foundation

Mr. David C. Fullarton
Executive Vice President
National Telephone Cooperative Association

Mr. Henry Geller
Aspen Institute
Program on Communications and Society

Mr. Sidney Goldman
Assistant Director
Office of Planning and Policy
Office of Telecommunications Policy

Mr. David A. Hamil
Administrator, Rural Electrification Administration
U.S. Department of Agriculture

Mr. Amos B. Hostetter, Jr.
Executive Vice President
Continental Cablevision, Inc.

Mr. Howard Hupe
Acting Director, Office of Telecommunications Policy
Department of Health, Education, and Welfare

Ms. Sheila Mahoney
Executive Director
Cable Television Information Center

Mr. Nick Miller
Staff Counsel
Senate Committee on Commerce

Mr. Harold E. Morse, Director
Appalachian Education Satellite Project
Appalachian Regional Commission

Ms. Collette Moser
Director, Rural Manpower Research Corporation

Mr. Joe N. Nay
Senior Research Associate
Program Evaluation Research Group
The Urban Institute

Mr. Vincent Sardella
Director of Research
Office of Telecommunications Policy

Mr. Harry M. Shooshan, III
Chief Counsel
Subcommittee on Communications
Committee on Interstate and Foreign Commerce
U.S. House of Representatives

Mr. Charles Tate
Vice President, Cable Communications Resource Center
Booker T. Washington Foundation

Commissioner Abbott Washburn
Federal Communications Commission

Mr. John P. Witherspoon
President
Public Service Satellite Consortium

Honorable Richard E. Wiley
Chairman, Federal Communications Commission

Overview Panel

Mr. Roland S. Hornet, Jr., *Chairman*
Director, Program on Communications and Society
Aspen Institute

Dr. John A. Gronouski

Mr. Ray Marshall

Dr. Leland Johnson

Dr. William Lucas

Mr. Glen Robinson

Mr. Henry Goldberg

Appendix D

LIST OF PUBLISHED OTA REPORTS

			Available Through: U.S. Government Printing Office Stock Number	Price	National Technical information Service Stock Number	Price
1.	OTA-A-1	Annual Report, March 15,1974.			PB 246191	$3.75
2.	OTA- A-2	Technology Assessment Activities of the National Science Foundation, June 12 and 13,1974. (Hearings before the OTA Congressional Board.)			PB 248382	
3.	OTA-H-3	Drug Bioequivalence, July 1974.	052-003 -00037-7	$ .95	PB 244862	$4.75
4.	OTA-M-4	Requirements for Fulfilling a National Materials Policy, August 1974.			PB 250631	$7.75
5.	OTA-T-5	Automobile Collision Data - Assessment of Needs and Methods of Acquisition.			PB 244861	$8.50
6.	1	•An Analysis of the Department of the Interior's Proposed Acceleration of Development of Oil and Gas on the Outer Continental Shelf, March 1975.[1]			PB 252202	$4.00
7.	2	An Analysis Identifying Issues in the Fiscal Year 1976 ERDA Budget, March 1975.[2]			PB 244863	$5.25
8.	OTA-A-6	Annual Report, March 15,1975.	052-070 -03050-3	$1.15	PB 244833	$4.25
9.	OTA-O-7	An Analysis of the Feasibility of Separating Exploration From Production of Oil and Gas on the Outer Continental Shelf, May 1975.	052-003 -00095-4	$2.80	PB 248381	
10.	OTA-T-8	Automated Guideway Transit: An Assessment of PRT and Other New Systems, June 1975.	052-002 -00020-6	$3.65	PB 244854	$10.25
11.	OTA-O-9	Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures, July 1975.	052-070 -03091-7	$2.80	PB 244457	$9.25
12.	3	Analyses of Effects of Limited Nuclear Warfare, September 1975.[3]				
13.	OTA-T- 10	The Financial Liability of Conrail, September 1975.			PB 250630	$5.00
l-l	OTA-T- 11	A Review of Alternative Approaches to Federal Funding of Rail Rehabilitation, September 1975.			PB 250632	$5.00
15.	OTA-E-12	An Analysis of the ERDA Plan and Program, October 1975.	052-010 -00457-3	$3.85	PB 250636	$10.00

[1] Published as Committee Print, Senate Committee on Commerce.
[2] Published as Joint Committee Print, House Committee on Science and Technology, Senate Committee on Interior and Insular Affairs, and Joint Committee on Atomic Energy.
[3] Published as Committee Print, Senate Foreign Relations Committee.
•Included in appendix in publication OTA-O-7.

16.	**OTA-E- 1.3**	An Analysis of the Impacts of the Projected Natural Gas Curtailments for the Winter 1975-76; November 1975.			PB 250623 $4.00
17.	**OTA-T-1 4**	A Review of National Railroad Issues, December 1975.			PB 250622 $5.50
18.	**OTA-T-1 5**	Energy, the Economy, and Mass Transit, December 1975.	052-003 -00132-2	$2.00	PB 250624 $6.75
19.	**OTA-T-16**	An Assessment of Community Planning for Mass Transit, February 1976. Volume 1: Summary	052-003 -00133-1	$1.80	PB 253679 $5.00
20.	OTA-T-17	Volume 2: Atlanta Case Study	052-003 -00138-1	$1.15	PB 253680 $4.00
21.	**OTA-T-18**	Volume 3: Boston Case Study	052-003 -00140-4	$1.15	PB 253681 $4.00
22.	**OTA-T-1'}**	Volume 4: Chicago Case Stud,	052-003 -00141-1	$ .95	PB 253682 $4.5o
23.	**OTA-T-20**	Volume 5: Denver Case Study	052-003 -00143-8	$1.05	PB 253683 $4.00
24.	**OTA-T-21**	Volume 6: Los Angeles Case Study	052-003 -00145-4	$1.45	PB 253684 $4.50
25.	OTA-T-22	Volume 7: Minneapolis-St. Paul Case Study	052-003 -00146-2	$ .85	PB 253685 $4.00
26.	**OTA-T-23**	Volume 8: San Francisco Case Study	052-003 -00148-9	$1.35	PB 253686 $4.50
27.	**OTA-T-24**	Volume 9: Seattle Case Study	052-003 -00149-7	$1.15	PB 253687 $4.00
28.	OTA-T-25	Volume 10: Washington, D.C. Case Study	052-003 -00136-5	$1.05	PB 253688 $4.00
29.	**OTA-T-26**	Volume 11: Technical Report			PB 253641 $7.50
30,	**OTA-T-27**	Volume 12: Bibliography			PB 253642 $6.00
31.	OTA-E-28	Comparative Analysis of the 1976 ERDA Plan and Program, May 1976.	052-070 -03404-1	$2.80	PB 254794 $7.75
32.	OTA-F-29	OTA Board Hearings. Food Information Hearings. (See OTA-F -35.)			PB 258171 $11.00
33.	**OTA-T-30**	Automatic Train Control in Rail Rapid Transit, May 1976.	052-070 -03479-3	$3.15	PB 254738 $8.00

34.	OTA-A-31	Annual Report, March 15, 1976,	052-003 -00152-7 $1.55	PB 253989 $5.50
35.	OTA-E-32	A Review of the U.S. Environmental Protection Agency Environmental Research Outlook FY 1976 through 1980, August 1976.	052-003 -00200-1 $2.45	PB 258191 $5.50
36.	OTA-T-33	The Feasibility and Value of Broadband Communications in Rural Areas: A Preliminary Evaluation, April 1976.		PB 258095 $10.OO
37.	OTA-H-34	Development of Medical Technology: Opportunities for Assessment, August 1976.	052-003 -00217-5 $1.80	PB 258117 $5.50
38.	OTA-F-35	FoodInformation Systems: Summary and Analysis, August 1976.	052-003 -00219-1 $1.55	PB 258172 $5.50
39.	OTA-M-36	An Assessment of Alternative Stockpiling Policies, August 1 976.	052-003 -00230-2 $3.10	
40.	OTA-O-37	Coastal Effects of Offshore Energy Systems, November 1976.	052-003 -00245-1 $4.45	
41.	OTA-O-38	Volume II - Working Papers	052-003 -00240-Q $12.00	
42	OTA-O-39	Coastal Effects of Offshore Energy Systems (Pamphlet), December 1976.		
43.	OTA-M-40	An Assessment of Information Systems Capabilities Required to Support U.S. Materials Policy Decisions, January 1977	052-003 -00263-9 $3.25	
44.	OTA-X-41	Technology Assessment Activities in the Industrial, Academic, and Governmental Communities (Hearings before the OTA Congressional Board), December 1976.	052-003 -00295-7 $3.50	

Except where othet-wise noted, OTA reports may be obtained by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or to the National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22151.

Appendix E

ROSTER OF OTA PERSONNEL

OFFICE OF TECHNOLOGY ASSESSMENT
Emilio Q. Daddario, Director
Daniel V. DeSimone, *Deputy Director*

Abrams, Nancy
Adams, Mary
Adler, Prudence
Andrulis, Dennis
Angerman, Judith
Arntsen, Andrea
Bacon, Barbara
Balbiani, Barbara
Banta, H. David
Barrington, L. F. Barry
Beil, Kathleen
Bell, John
Birdsall, William
Boisclair, Suzanne
Boss, Kathie
Carroll, Emily
Chick, Mona
Chinni, Andy
Coates, Joseph F.
Cohn, Jeffrey P.
Cordaro, J. B.
Cornett, Sanford H.
Cotton, Tom
Crane, Alan
Craw, Lola
Crawford, Renee
Crossen, Reita P.
Daly, Robert F.
Datcher, Debra
Davis, Evelyn
Davis, Bill
Dent, Harriet
Dighton, Catherine
Digilio, V. Rodger
Donahue, Dale
Drohan, Carol
Ehrenhaft, Polly
Fitzgerald, Joe
Fitzhugh, Marion
Fullerton, JoAnnalynn
Furber, John
Garcia, Linda
Gavert, Ray
George, Jaime
Gomer, Patti
Govan, Emilia
Hallas, Goldie
Halley, Pat
Ham, Liz
Harwood, Ellen
Hill, Chris
Hoehle, Ray
Holmes, John C.
Holt, James
Jacobson, Lisa
Jenney, Larry L.
Jennings, Thomas
Jenrette, Rita
Johns, Lionel S.
Johnson, Beverly S.
Johnson, Peter
Johnson, Robin Winters
Kelly, Henry
Koffler, Ogechee
Kolsrud, Gretchen S.
Lukas, Theresa
Manning, Mary Jo
Maslan, Frank
Mason, Jane
Mason, Kathy
Massell, Benton F.
Maxwell, Robert
Matthews, Suzann
McBee, Carolee
McGurn, Thomas P.
Miles, Marese A.
Miller, Dennis F.
Mills, William
Mottur, Ellis
Nash, Carl
Nevas, Linda
Niblock, Robert
Norelli, Deborah
O'Connor, Cathy
Paladino, Albert E.
Parker, Linda
Peterson, Marshall
Phillips, Michael
Potts, Charles A., Jr.
Poulton, Patricia
Puglisi, Mary Margaret
Roales, Judith
Robinson, Jacqueline
Ross, Aileen
Rowberg, Richard
Russell, Judith C.
Sedor, Joanne
Sibley, Vicki L.
Smith, Robert L., Jr.
Smythers, Jackueline
Stevenson, Carole
Sullivan, Cheryl
Taylor, Carl
Turnbull, Lucia
Ulinski, Carol
Vallianatos, Evan
Wallace, Lynn
Watkins, Geneva
Willems, Jane
Wixom, Charles W.
Wobber, Frank
Woodbridge, Ann
Wooten, Ivy
Wright, Richard
Young, John

Supplemental Staff*

Baham, Gary
Behney, Clyde
Bourbon, Dick
Brady, Jerry
Burby, Jack
Buyrn, Audrey
Campbell, Doug
Claridge, David
Dugan, Mary Kate
Fitzgerald, Bill
Ford, Renee
Gabrielson, Rodger
Goldenberg, Leo
Hutchinson, David
Kaplan, Robert
Kesterke, Don
Logan, Doug
MacNaughton, Marcia
Mayio, Albert
Mintzes, Joseph
Ott, Marvin
Polack, Herman
Raymond, Richard
Richardson, Bill
Robel, Bob
Schmalz, Anton
Schweinfurth, Stan
Silverstein, Ben
Soffer, Ben
Speigel, Chariklia
Terselic, Richard
Torrey, Ray
West, Howard
Wilcox, Walter
Wright, Christopher

Core Staff	**117**
Supplemental Staff	**34**
Total OTA Staff (as of December 31, 1976)	**152**

● (Consultants, fellows, **and personnel on loan from other agencies.)**

Appendix F

TECHNOLOGY ASSESSMENT ACT OF 1972

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

86 STAT. 797

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessment Act of 1972".

Technology Assessment Act of 1972.

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

Technology Assessment Board.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

Duties.

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;
(3) identify alternative technological methods of implementing specific programs;
(4) identify alternative programs for achieving requisite goals;
(5) make estimates and comparisons of the impacts of alternative methods and programs;
(6) present findings of completed analyses to the appropriate legislative authorities;
(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and
(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:
(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;
(2) the Board; or
(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where—
(1) to do so would violate security statutes; or
(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

SEC. 4. (a) The Board shall consist of thirteen members as follows:
(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;
(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and
(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

Meetings.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses.

Subpena.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

Compensation.

83 Stat. 863.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

Employment restriction.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act.

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—
(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

Contracts.

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory,

or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

80 Stat. 499; 83 Stat. 190.

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

Agency cooperation.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

Membership.

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall—

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

80 Stat. 498; 83 Stat. 190. 5 Usc 5701.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf

of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing. 82 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156; 82 Stat. 365. 42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,000,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept.22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.