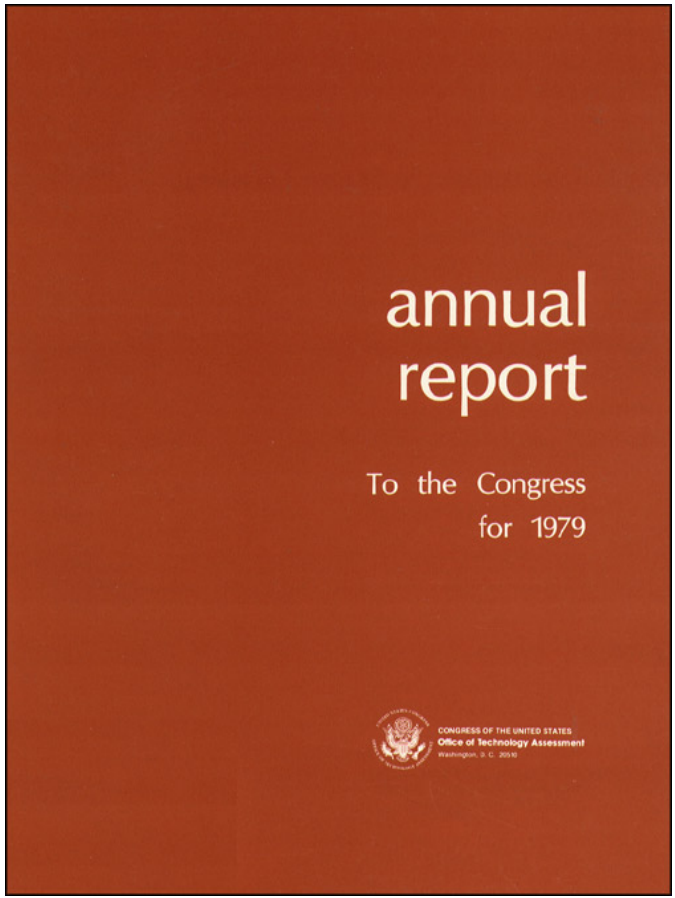
Annual Report to the Congress for 1979

March 1980





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Section I

STATEMENTS BY THE CHAIRMAN AND VICE CHAIRMAN OF THE BOARD AND THE DIRECTOR OF OTA

Section I
STATEMENTS BY THE CHAIRMAN AND VICE CHAIRMAN OF THE BOARD AND THE DIRECTOR OF OTA

Chairman's Statement—Congressman Morris K. Udall

During my tenure on the Board, I have enjoyed watching OTA develop into an effective support agency of Congress—one whose advice is sought and conclusions are heeded. As a result of OTA's success, Congress now has an all-important in-house capability to apply independent analysis to complex policy issues involving technology. OTA provides Congress with a unique and flexible mechanism to reach out and enlist the technical assistance and advice of experts in all sectors of our Nation. In performing this job, OTA receives the respect of the Members of Congress, and the increased interest of congressional committees in obtaining OTA's assistance in evaluating complicated technological issues.

OTA's bicameral and bipartisan Board of Directors strives to ensure that the type and quality of work that emerges from OTA fully merits the Congress' trust and the taxpayer's investment. I am pleased to report for the Board our satisfaction with the year now past and our confidence in OTA's continued service in the year ahead.

I have been privileged to have Senator Stevens of Alaska serve as Vice Chairman of the Board. His support and wisdom have assisted us in achieving many of the Board's goals throughout the year.

We were very fortunate to see Dr. Frederick C. Robbins elected Chairman of the Technology Assessment Advisory Council with Dr. Jerome Weisner as Vice Chairman. In having such distinguished experts to lead our Council, men devoted to the service of Congress and the country, TAAC is in capable hands. We deeply appreciate their continued commitment.

In June 1979, Dr. John H. Gibbons was appointed Director of OTA. I am grateful that we were able to attract to this position a man of his demonstrated leadership, scientific contributions, and nationally recognized expertise on energy and environmental matters. He has brought to OTA a positive, stabilizing influence, and I look forward to having him at OTA's helm as it helps Congress sort out and face up to the technological issues before the country.

Under Dr. Gibbons' direction, OTA has accomplished much. It presented testimony before numerous committees throughout the year and published 26 reports and other work in 1979. We are confident that OTA will continue its fine record of producing high-quality studies in a manner which is responsive to the needs of its many clients in Congress. While the comprehensive OTA reports continue to provide the basis for OTA's advice and assistance to Congress, much value is also derived from such work products of OTA staff as special memoranda, briefings, and testimony. These daily, largely unseen, activities continue to help Congress make better decisions and anticipate issues sooner than might otherwise be possible.

I would also like to extend the gratitude of the Board to Daniel De Simone, Deputy Director, who so ably and willingly served as Acting Director during our selection process. We commend him for his professional achievements and energy in OTA's behalf.

I am proud to serve as Chairman of the OTA Board and look forward with much enthusiasm to the challenges facing us during the 1980's. In this complex world, we continue to need careful and objective analysis of the untold technological impacts facing us; and it appears that OTA is the institution to answer the call.

Vice Chairman's Statement—Senator Ted Stevens

As Vice Chairman, I had the honor to work with the skilled and knowledgeable members of the Technology Assessment Board in 1979. It is my belief that during the year the Board took important steps to improve its working relationship with OTA, and I look forward to the continuation of this valuable work in the second session of Congress.

1979 was a tumultuous year for OTA. Governor Russell W. Peterson, its second Director, resigned in March, and his successor, Dr. John H. Gibbons, had only been at work a short time when he had to deal with a budget crisis which, in combination with other internal problems, threatened to seriously impair OTA's ability to serve Congress. I believe that the worst of these problems is now behind us, and I am encouraged by the efforts being made to prevent similar problems from developing in the future. OTA's resources are too valuable and limited to waste in unproductive controversy.

Working closely with Dr. Gibbons, the Board revised its operations in 1979. The Director's ability to develop proposals for the Board, to respond to short-term congressional requests, and to convey completed assessments to requesters in a timely fashion was enhanced. In addition, new procedures were implemented to ensure that the Board would obtain the information it needed to set policy and oversee operations.

As Chairman, Congressman Udall of Arizona gave essential guidance to the Board throughout the year. His firm leadership, combined with his concern for the views of other members of the Board, made the Board's fine work possible. It was a pleasure to serve with him.

Many interesting issues will be coming up before the Board in the second session. The terms of four members of the Technology Assessment Advisory Council will be up, and the Board will select new members and review the operations of the Council. More efforts will be made to streamline OTA operations. Most importantly, as the backlog of old assessments is reduced, there will be more opportunities to consider new proposals.

In conclusion, I would like to welcome Dr. John Gibbons. In the short time he has been at OTA, our new Director has demonstrated genuine desire and ability to work with Congress. He has made great strides in improving budgeting and planning procedures. I am certain that OTA will continue to benefit from Dr. Gibbons' leadership. We will all work to improve OTA's already impressive record.

Director's Statement—John H. Gibbons

OTA's role is to serve Congress by doing objective, nonpartisan, comprehensive analyses of national issues that involve technology. OTA does that job by linking congressional needs to the best expertise that exists anywhere in the country. Information drawn from those experts (typically in industry, academia, labor, and public interest groups) is further analyzed and integrated at OTA into forms appropriate to the needs of Congress. Thus, OTA's staff must be flexible, analytic, and attuned to working with a broad variety of people.

Since arriving in June to succeed Dr. Peterson, I constantly have been impressed with the capabilities, productivity, and dedication of OTA's staff and with the respect and interest OTA commands among knowledgeable people across the country. It is indeed a privilege to have been chosen to lead this effort.

During 1979, OTA not only completed many formal assessments, but also spent considerable time and effort in translating, summarizing, and communicating the results to meet various specific needs of Congress. One new form of publication, the "technical memorandum, " was introduced to enable us to extract elements of an ongoing assessment and deliver the information to Congress in time for use in legislative deci-

sions. OTA also was called on with increasing frequency to provide testimony, especially with respect to energy issues.

As we pause to consider the status and outlook for science and technology and attendant impacts on our society, it is clear that "interesting times" lie ahead of us. (An old Chinese curse goes something like this: "May you live in interesting times.") The decade of the 1980's will surely witness major changes in energy, telecommunications, genetic engineering, and the like. Exciting new options will become available to apply human ingenuity through technological and institutional innovations to improve the lot of humankind.

At the same time that major technological advances can help us achieve our aspirations they can also frustrate them. One person has aptly described nuclear energy as providing simultaneously the promises of heaven and the perils of hell. Advances in computers and telecommunications can open new vistas in improved productivity of people and resources, but they can also lead to new arms races, invasions of privacy, and the displacement of traditional jobs.

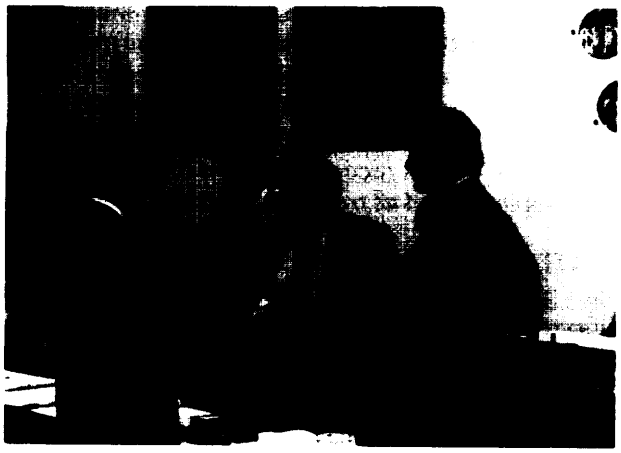
OTA's role is to help Congress and the American people understand a little better and a little sooner the dynamics of technology in our society. We look forward to another interesting year, sobered by events of the recent past, but confident that ingenuity can productively influence our collective social choices.



OTA Director's Swearing-In Ceremony

(Above) Dr. Gibbons being sworn in by OTA Board Chairman Rep. Morris K. Udall, as Mike McNulty, **Congressman Udall's staff counsel, holds the Holy** Bible. TAB Members, Representatives John W. Wydler (left) and John D. Dingell are in the foreground. (Top right) Chairman Udall and Dr. Gibbons. (Lower right) Dr. Gibbons chatting with Dr. Alexander Hollaender, Member of the National Academy of Sciences

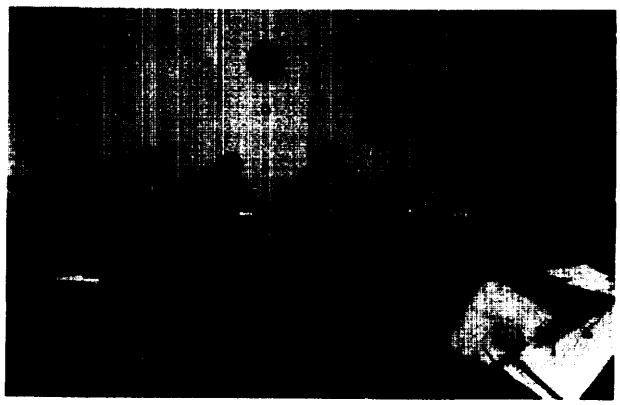
Congressional, Industry, and Academia Interactions



(Left to right) J. Fred Bucy (TAAC); Congressman Clarence E. Miller (TAB); former OTA Director Russell W. Peterson, Jerome Wiesner (TAAC); and Senator Edward M. Kennedy (TAB) in discussion following the joint meeting



Solar Power Satellite Panelist's Meeting



OTA Automobile R&D Seminar—Panel participants conducting a meeting on 1 of the 3 days that the seminar was held. (Left to right) Julius Harwood, Ford Motor Co.; Merton Flemings, M.I.T.; Bob Maxwell, OTA Transportation Program Manager; Robert Shuck, Republic Steel



(Left to right) Congressman Tom Harkin, Iowa; Senator Howard Cannon, Nevada; and Eric Willis, OTA Division Director for Science, Information, and Transportation participating in OTA's Automobile R&D Seminar

Photo credits, Vicki Sibley

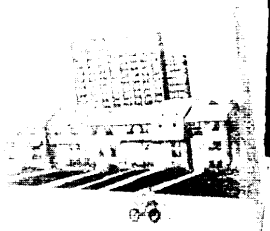
Section II

SUMMARIES OF OTA REPORTS COMPLETED IN 1979

The assessments carried out by OTA cover a wide spectrum of major issues before Congress and the country and examine a broad range of policy options and their potential impacts. To provide examples of the breadth and depth of OTA's work, summaries of reports published by the Office in 1979 are presented in this section.

The reader is cautioned that these are summaries of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.

A REVIEW OF SELECTED FEDERAL VACCINE AND IMMUNIZATION POLICIES



Environmental Contaminants in Food

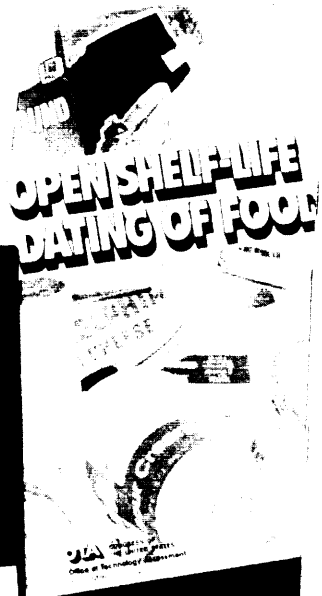
Pest Management Strategies in Crop Protection

SELECTED TOPICS IN FEDERAL HEALTH STATISTICS

COMPUTER TECHNOLOGY IN MEDICAL EDUCATION AND ASSESSMENT

Technical Options for Conservation of Metals

Case Studies of Selected Metals and Products



Drugs in Livestock Feed



materials and energy from municipal waste



Resource Recovery and Recycling From Municipal Solid Waste

age Container Deposit Legisl

The Direct Use of Coal



Management of Fuel and Nonfuel Minerals in Federal Land

Current Status and Issues

Analysis of Laws Govern Access Across Federal La

Options for Access in Alaska



ıe
fects of
uclear War

Technology and East-West Trad



Technology Assessment of

Changes in the Future Use and Characteristics of the

AUTOMOBILE TRANSPORTATION SYSTEM

Summary and Findings

Technology Assessment of

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UTOMOBILE RTATION SY

: Public Participation

RAILROAD SAFETY—

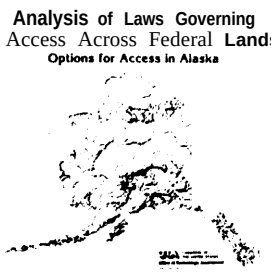
U.S.-CANADIAN COMPARISON



Section II
SUMMARIES OF OTA REPORTS COMPLETED IN 1979

Access Across Federal Lands in Alaska

Rarely has the conflict between resource development and protection of the natural environment been more severe than in Alaska. The largest State is a treasury of natural beauty, wildlife, and wilderness on a scale that does not exist in the rest of the Nation. At the same time, it has an abundance of natural resources that may be needed in the future. For decades, distance, climate, and lack of development combined to enforce de facto preservation of Alaska's natural treasures. The barriers that have protected Alaska's environment have been lowered by technology, by local development, and by an increased demand for resources.



Access across federally owned lands in Alaska is one of the keys to developing mineral and other natural resources in the State. The debate centers on how much mineral development is to be carried out and what is required to protect America's last virgin environment from such development. Resolution may require a combination of several access options—a combination that could be determined on the basis of priorities Congress establishes for the use and preservation of these lands.

OTA conducted a comprehensive analysis of Federal laws, regulations, and policies that currently affect access across federally owned lands to non-Federal lands (including State, Native, or private lands). OTA's report focuses on Federal land management laws, and particularly on those relating to access in Alaska.

Based on information about the location of mineral deposits, projected landownership patterns, and transportation availability, it was found that the need for rights-of-way is a localized problem that is likely to occur infrequently. However, if mineral resources on State, Native, or privately owned lands are to be developed in isolated regions of Alaska, access across Federal land would be required.

Under existing Federal land management laws and policies, access is available across most units of the public lands and national forests, except designated wilderness and wilderness study areas. Access across units of the national wildlife refuge systems is allowed if it does not pose a threat to protected wildlife. Because of the high degree of protective management afforded parks, wild and scenic rivers, and wilderness areas, use of these lands for access to non-Federal areas or for transportation routes is strictly limited. In park and refuge wilderness areas, an act of Congress would be required to allow any significant access. In all systems, but particularly the more protective, the availability of access may well turn on the factual issue of whether alternative routes or means of access exist.

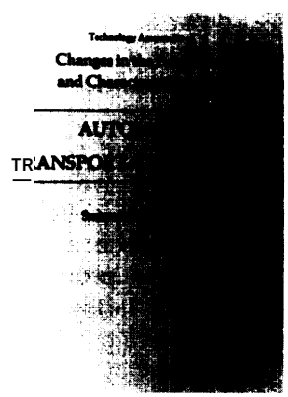
In providing access across federally owned lands, Congress could: 1) apply existing access provisions to Alaska lands; 2) defer action on access until mineral or transportation studies are completed; 3) provide limited right-of-way authority for access to non-Federal lands, or provide for land exchanges or realinement of borders to accommodate access needs; 4) authorize rights-of-way for future transportation systems, designate specific corridors, or establish a new Federal-State commission to review proposed rights-of-way; or 5) protect Alaska lands over and above existing statutes by requiring specific congressional approval for access use.



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The Future Use and Characteristics of Automobiles

If chronic worldwide oil shortages do not intervene, projections show that cars will continue to dominate personal travel in the United States through the year 2000. Cars provide a degree of comfort, convenience, and personal mobility unparalleled in history, and make a major contribution to the U.S. economy. The 100 million private cars now account for more than 90 percent of personal travel. But their use also helps consume dwindling world oil supplies, pollute the atmosphere, congest roads, and kill thousands and injure millions annually.



A shift from petroleum to other energy sources for cars will be necessary sooner or later. Candidates include oil shale, tar sands, gasohol, coal liquids, and electricity from coal, nuclear, or solar energy generating plants. At the present time, all of these alternatives cost more than petroleum, and it is not certain which will prove to be technically or economically best. At least one or two decades will be needed to switch cars from petroleum to alternate energy sources, a process that might be aided by more R&D, tax incentives, or subsidies.

Meanwhile, current Federal programs to reduce gasoline use can keep total consumption at or slightly below present levels. Further reduc-



Photo credit **U.S.** *Department o! Transportation*

. . . automobiles will continue to be the dominant mode of personal transportation through the year 2000 . . .

tions can be achieved through smaller and lighter weight cars, requiring new cars to average 35 miles per gallon by 2000, and more fuel-efficient engines such as turbines or diesels. Increased gas taxes and/or price deregulation would reduce demand, but a several-fold overall price increase would be needed to cut the number of miles driven by 20 to 25 percent.

While auto emissions nationwide are expected to drop sharply from 1975 levels, air quality in many urban areas will be little better by 2000 than it is now because of more cars and congested streets as well as pollution from other sources. Tightening new car emission standards would be costly and reduce auto pollution only marginally. More effective measures might include a nationwide program to inspect and maintain emission control devices, restrict cars in specific areas at certain times, and encourage development of electrically powered cars.

Although the rate of traffic fatalities per mile driven has been cut by nearly 40 percent since 1966, there will be more deaths, injuries, and property damage per year by 2000 than there are now as more people drive more cars more miles. Safety could be further enhanced by strict enforcement of the 55-mph speed limit and programs to reduce drunk driving, improve occupant restraints, and build more crashworthy cars and roads. As a first step, the Federal Government might establish stringent and quantitative safety goals.

The entire automobile system will continue to cost governments, manufacturers, and consumers more—costs the Federal Government may be called on to help defray. State and local governments may need assistance to repair deteriorating roads. Similarly, tax incentives might help the auto and fuel industries meet Federal energy, safety, and environmental standards. Measures that might assist automobile owners include national no-fault insurance, regulation of repair practices to keep costs down, and incentives to manufacturers to build more durable and maintainable cars.

The Future Use and Characteristics of Automobiles: Public Participation

Americans want a transportation policy, not a "car v. transit" policy. Policy should emphasize mobility, not automobility. Popular supposition to the contrary, the American public is not having a "love affair" with the car, rather they "love" the mobility afforded by automobiles. Mobility is a right of the citizenry, not a privilege. These are some of the views expressed by 1,300 citizens who took part in a nationwide public participation program conducted in conjunction with an OTA assessment of "Changes in the Future Use and Characteristics of the Automobile Transportation System."

The participants did not limit their comments to automobiles; they were concerned with personal transportation as a whole. They saw cost as a main constraint to mobility at the household level. At the national level, roadway maintenance and repair were seen as the main transportation costs for the future. Most of the participants viewed further major road construction in the United States as unnecessary.

The "energy crisis" was described as a political dilemma, not a true resource shortage. Conser-



Photo credits Bob Dunsmore and Vicki Sibley

Involving the public—citizens from the east to west coasts provided valuable input to the public participation process

vation is needed, but the Federal Government must provide the impetus, probably through regulations, participants said. They emphasized the need to develop alternative fuels and more fuel-efficient modes and devices.

Environmental protection was seen to be needed, particularly in the areas of air quality, noise, and land use. Existing environmental legislation should be better enforced, and there should be "more room for local initiative" in dealing with environmental problems, participants stated.

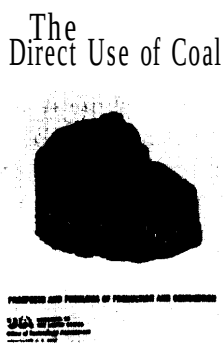
Drivers were described as the chief automobile safety problem, although road and vehicle improvements were judged necessary and desirable. Uniformity of traffic regulations and strict enforcement throughout the country were stressed. The majority of the participants favored the 55-mph speed limit, but they were divided over the issue of federally mandated occupant restraint systems, such as seatbelts.

Mobility problems, such as providing transportation for the handicapped and elderly, are institutional, rather than technical, according to the participants. The Federal Government's credibility—on the energy supply situation, for example—is low, and its management record poor, was a commonly expressed view. On the other hand, many participants described industry as "manipulative of public attitudes, " "profit mongering," and "slow in innovation. "

When asked how they would design the personal transportation system of the future, the composite response was:

- Adequate mobility for everyone at affordable costs.
- A multifaceted system, not heavily dominated by one mode.
- Well-coordinated intermodal connections.
- Energy-efficient, nonpolluting, quiet, comfortable, accessible, safe, and durable modes.

The Direct Use of Coal



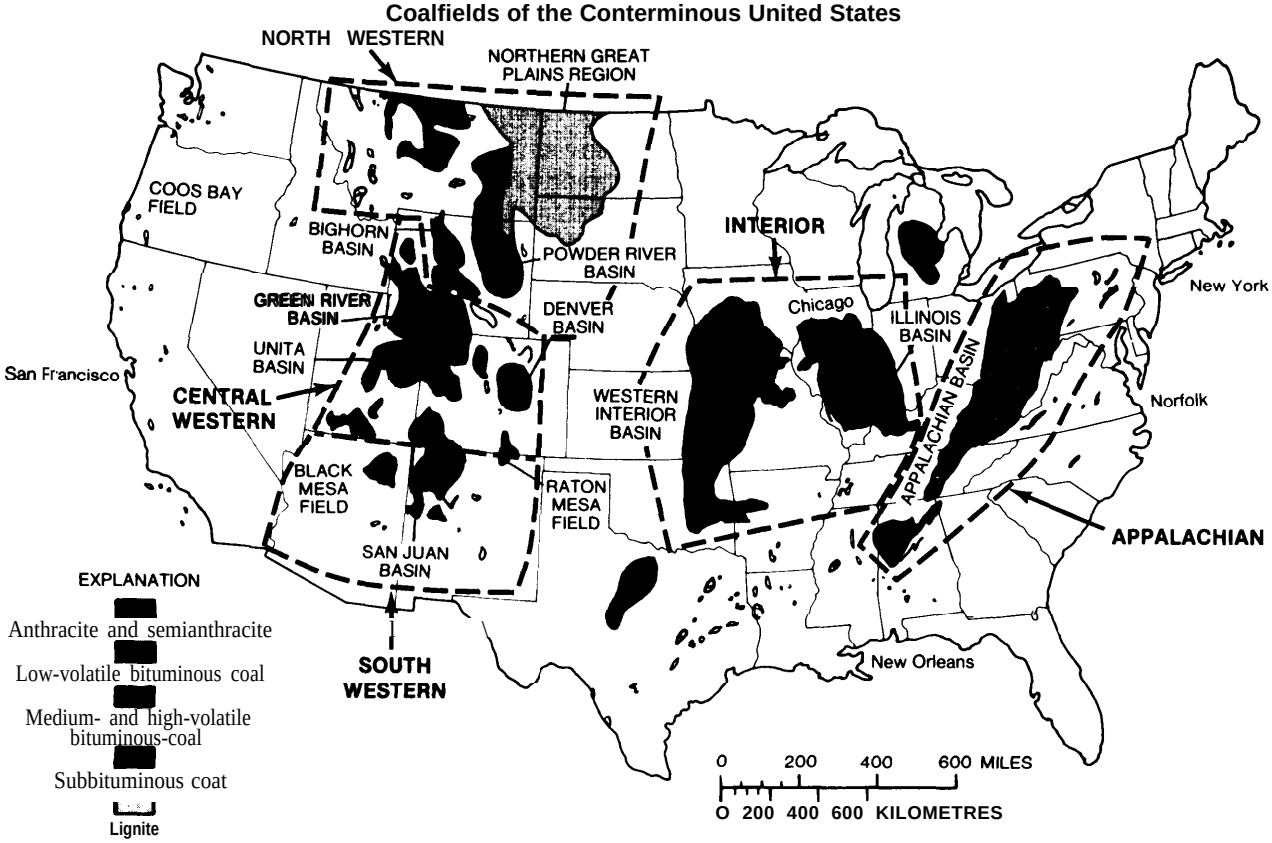
Coal is the only domestic fuel whose use can be greatly expanded with current economics and technology, and known resources. However, no other energy source evokes such memories of environmental and social damage. While many of these problems have been addressed, a number of uncertainties remain about both coal's rate of growth and resulting impacts. If required for national energy purposes, coal production and combustion could be as much as tripled by 2000 without relaxation of environmental, safety, and health standards. However, demand is unlikely to grow at such a pace as long as other fuels are available.

Present or pending measures to mitigate coal's adverse impacts need not directly impede its use, but they will add to its cost and reduce its competitiveness. For example, reducing sulfur emissions may add a half cent to each kilowatthour produced. Policies aimed at increasing coal's use to reduce dependence on other fuels (e.g., imported oil and nuclear power) must therefore involve cost incentives. Technological developments would also allow smaller users (industrial and residential) to turn to coal. Inadequate transportation systems, Federal leasing policies, public opposition, or labor disputes could become supply constraints if policy initiatives lead to a tripling or even greater growth rate of demand.

If coal again becomes the preeminent energy source, it will be in a vastly different manner than before. Recently enacted Federal and State laws and regulations, combined with new technology to prevent pollution, restore strip-mined land, and improve mine and health conditions, should prevent a repeat of at least the worst of coal's past impacts—soot-laden cities, scarred landscapes, ruined waterways, and frequent accidents and disease among miners. The key to minimizing coal's negative impacts lies with strict enforcement of current standards. However, some may be found to be inadequate when gaps in our information are filled.

Three major environmental uncertainties remain. Carbon dioxide, produced when fossil fuels are burned, could cause significant changes in climate. If so, massive increases in coal use may be unacceptable. Second, exposure to low levels of coal-related air pollutants may lead to thousands of premature deaths annually. Finally, acid rain appears to result from air emissions and can cause significant ecological damage. These concerns are the subject of much scientific dispute and warrant further study.

Coalfields of the Conterminous United States



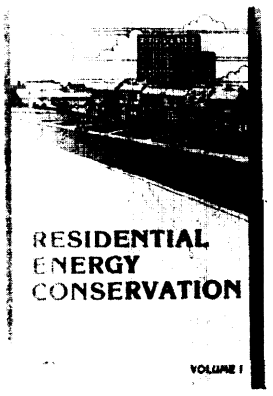
SOURCE P Averitt, *Coal Resources of the United States,* Jan 1, 1974. U S Geological Survey Bull , 1412, at 5 (1975)

Fatal accidents in mines have dropped dramatically since safety laws were enacted in 1969, but the rate of disabling injuries suffered by miners has not declined. As many as 42,000 miners could suffer serious injury annually by 2000. Respiratory diseases (collectively known as "black-lung" disease) are expected to become less prevalent, but the rate of illness is uncertain because the adequacy of current dust standards and the degree of compliance with them are not known.

Coal will also have significant impacts on the communities where it is mined. Increased underground production in Appalachia may require a doubling of the number of miners by 2000, which will further press areas already strained by decades of poverty and inadequate municipal services. Rapid growth of production in the West will create several dozen "boom towns, " but the number of people involved will be less than in the East.

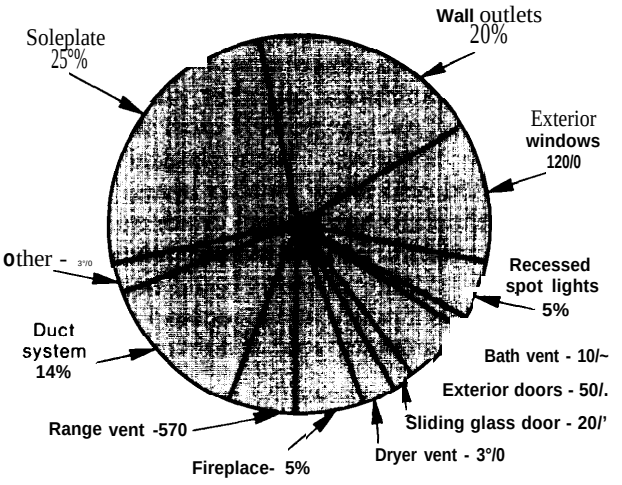
Residential Energy Conservation

Careful use of current technologies can cut energy use in new and existing homes and apartments by 50 percent or more with no loss in personal comfort or change in lifestyle. The equivalent of 19 billion to 29 billion barrels of oil could be saved by 2000 if people invested in their homes to the point of maximum dollar saving. Thus, conservation can effectively combat both rising energy costs and fuel scarcity.



Apparently in response to rising energy prices, Americans have reduced the annual growth rate for residential energy use from 4.6 percent in the 1960's to 2.6 percent in the 1970's. This change has been accomplished through better energy habits, and other improvements that make homes more energy efficient. Residential energy use can be kept at or slightly below current levels over the next two decades if conservation improvements continue.

Air Leakage Test Results for Average Home of 1,780 Sq. Ft. (50 homes tested by Texas Power& Light Co.)



SOURCE: "Reprinted with permission from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

Although requiring an initial investment, conservation will help hold down utility and fuel oil bills. The amount of energy and money saved depends on the skill and ingenuity of homeowners, remodelers, and builders. In some new houses, an investment of $1,500 to $2,000 could reduce the size of the heating and cooling systems required, thus actually lowering the first cost of the house. Substantial savings can also be accomplished in the Nation's 80 million existing residences. For low-income families living in substandard housing, the best approach appears to be subsidizing energy efficiency by upgrading the quality of their housing.

The amount of energy used in a given home depends to a large extent on the attitudes, choices, and behavior of its occupants. Studies show that consumers are motivated more by a desire to save money than by appeals for personal sacrifice, which may be counterproductive. Simply making more specific information available on how energy and money can be saved would help tremendously. One way would be to have trained inspectors point out to people how much energy their homes use. Surveys also show that consumers trust information from State and local authorities and community groups more than that from the Federal Government or large energy companies.

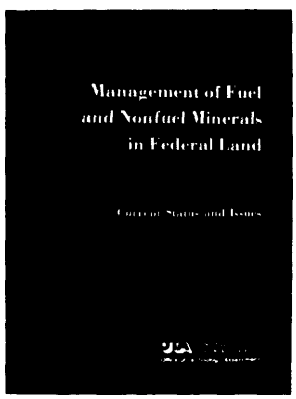
While a variety of Federal programs and incentives already encourage home energy savings, more could be done. Building codes and performance standards can be tightened to encourage the already clear effort of the industry to make homes more energy efficient. Federal home loan and mortgage guarantee programs can induce lenders to review energy costs with prospective buyers. Improved conservation in federally owned and subsidized housing could set an example. expand the market for conservation products, and improve the comfort of residents. To be effective, Federal programs need to be flexible to meet local requirements and variations in climate.

Improving home energy efficiency does have economic, environmental, and institutional impacts. For instance, conservation redirects money from fuel to goods, thus increasing employment. As homes become tighter, they require proper ventilation, without heat loss, to eliminate potentially dangerous concentrations of pollutants inside the house.

Much of the responsibility for making conservation work will fall on State and local governments, which need technical assistance and training programs as well as flexible guidelines from the Federal Government.

Management of Fuel and Nonfuel Minerals in Federal Land

The Federal Government owns about 30 percent of the land in the United States, almost all of it located in areas in the West and in Alaska that have been and are expected to remain major sources of both fuel and nonfuel minerals. However, large tracts of Federal land have been made unavailable for mining in recent years by Congress and the executive branch to protect wildlife, scenic areas, petroleum reserves, and recreational areas, among others. These withdrawals could cause mineral production to decline in another 10 to 20 years.



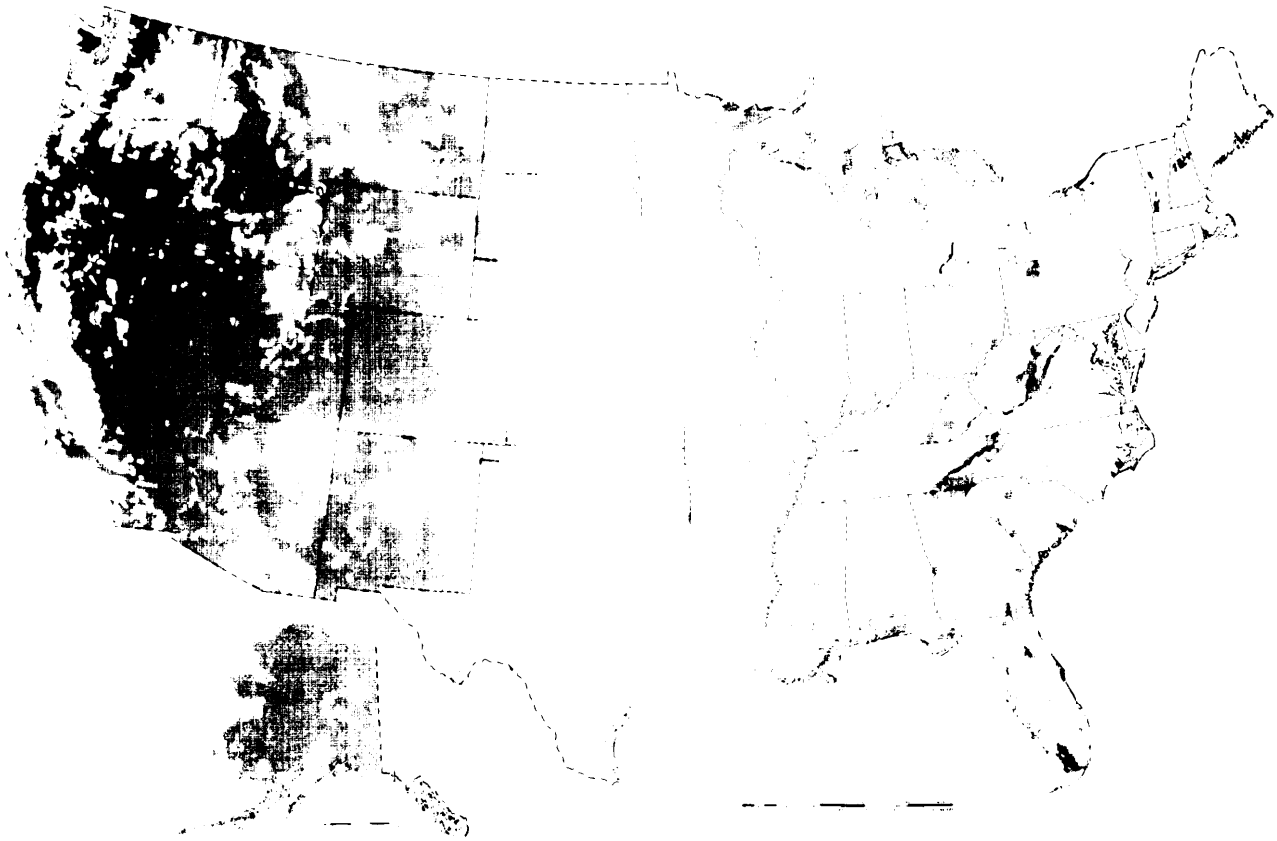
These withdrawals and other restrictions on mining activity in Federal lands have been in response to the fact that mineral rights, once obtained, take precedence over all other land values. Current law lacks incentives or other mechanisms to ensure a balance between mineral and nonmineral values at each stage of mining from exploration through production. Also, those who explore for and develop minerals are not required to pay for most damage to surface land or non mineral resources.

Enacted piecemeal over more than a century, Federal laws pertaining to mining and minerals are ill-suited for modern mining operations as well as for multiple-use concepts of Federal lands. They contain significant gaps in coverage, treat physically similar lands or mineral deposits differently. contain provisions that unnecessarily add to the cost and uncertainty of mining, and impede exploration for and production of more than one mineral. Access to Federal land for mining, as well as continued tenure once access has been obtained, are likewise uncertain. Further, the conditions under which tenure is granted are insufficient to ensure diligent mining activity.

Responsibility for mining and mineral leasing is split among various Federal departments and agencies. This split impedes efficient, integrated management of both mineral and nonmineral resources. For example, the agency responsible for managing surface lands often lacks authority to control the surface impacts of mining. On the other hand, the present division of authority between the Federal and State governments seems to be working well, although further improvements would be helpful.

Although designed to enable mineral-producing States to cope with the social and economic impacts of mining, Federal mineral revenues are made available to the States without their having to make any show of need. These revenues have rarely been used to mitigate the social and economic impacts of mining. The States' own powers to tax minerals are sufficient to deal with mining's impacts. Most States have not created

Principal Federal Landholdings in 1976



SOURCE U.S Geological Survey. Special Maps Branch, 1977
Note: Alaska is shown here at a reduced scale

Includes areas of interspersed ownership containing at least 25-percent Federal land.

mechanisms to ensure that their mineral-derived revenue reaches those areas that need it in a timely manner, particularly during the preproduction stages. Some State taxes are so high as to inhibit mining and cause inefficient use of mineral and nonmineral resources in areas where mining occurs.

A number of options are available to Congress to coordinate mining with other land values, to improve the division of management responsibility for Federal lands, and to encourage efficient mining activities. These range from maintaining the status quo, to making moderate or major changes in each existing mineral law, or to comprehensive revisions of existing management systems.

The Effects of Nuclear War

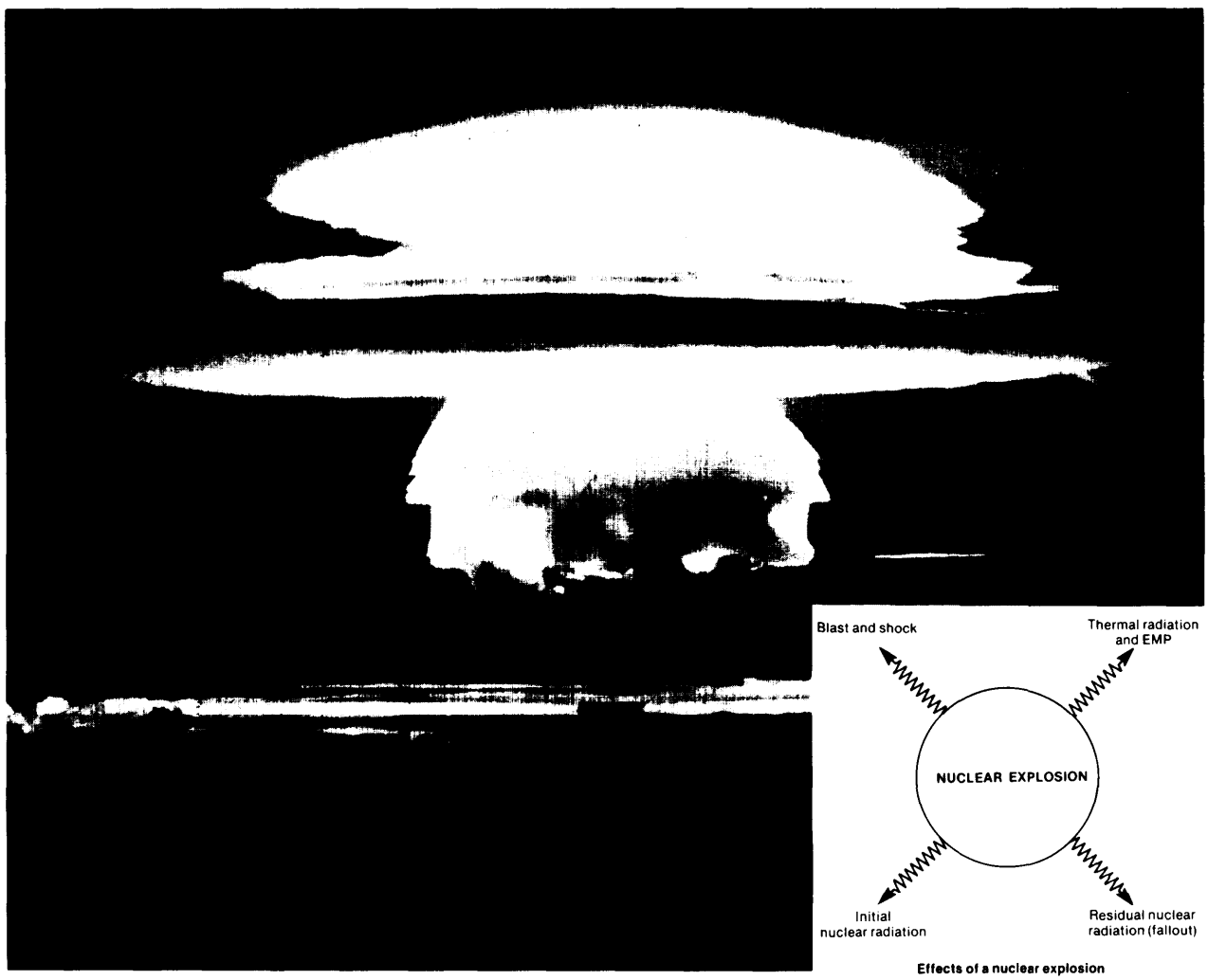
The effects of a nuclear war that can be anticipated but cannot be calculated are at least as Important as those that analysts attempt to quantify. Moreover, there are very large uncertainties regarding the effects that are calculated. Nuclear weapons are usually described by the damage they can inflict even in the most unfavorable circum - stances. In fact, the casualties and economic destruction caused by a nuclear attack would

The Effects of Nuclear War

probably be far greater than most prior estimates have indicated.

In the period following a nuclear attack, conditions could get worse before they started to get better. The Nation would be far weaker—economically, socially, and politically—than a calculation of its assets would seem to indicate. People could live off prewar supplies and habits for awhile, but patterns of behavior would be changed by worsening shortages and the enormous psychological shock a nuclear war would produce. A failure to achieve economic viability (production equaling consumption) before stocks ran out would cause many additional deaths, and further economic, social, and political deterioration.

A large-scale nuclear exchange between the United States and the Soviet Union could kill more than 250 million people in those two countries alone. The numbers killed in the first few days would depend on the exact number of nuclear weapons used and places of detonation, the time of year, extent of warning, and the weather. U.S. deaths would probably range between 70 million and 160 million, while Soviet deaths would be between 50 million and 100 million. Many "survivors" would die later from starvation, exposure, or disease, particularly in areas where the immediate deaths were relatively low.



Thermonuclear ground burst

Effects of a nuclear explosion

Photo credit U S Department of Energy

A **"limited" nuclear exchange** would have enormous impact as well, even if there were no escalation. An exchange limited to 10 MIRVed missiles aimed at oil refineries, for example, could kill 5 million Americans and destroy 64 percent of the U.S. refining capacity and 73 percent of the Soviet capacity. An attack directed solely at missile silos could kill as many as 20 million Americans. Despite the deaths and destruction of such attacks, their consequences might be endurable and economic recovery possible since they would be on a scale with previous wars and epidemics.

Major differences between the United States and the Soviet Union affect their relative vulnerability to nuclear attacks. People in the United States are more exposed than those in the Soviet Union because the latter are more dispersed geographically, and because U.S. weapons are generally smaller than their Soviet counterparts. Further, the Soviet political system is better able to maintain tight control in emergencies. However, the U.S. economy appears to be less vulnerable than that of the Soviet Union, both because it is bigger and better to begin with, and because Americans are more accustomed to decentralization.

Nuclear war is deterred by the certainty of its enormous effects, and by the uncertainty about just what those effects would be. Even a limited nuclear war could be expected to kill millions of people and inflict damage on a scale unprecedented in U.S. history, while a large-scale nuclear exchange would be a calamity unknown to human history. Because the economic, social, and political effects are literally incalculable, no government could predict with confidence what the consequences of even a limited nuclear attack would be.

Federal Health Statistics

The number and types of Federal data systems for health statistics have increased dramatically in recent years as an outgrowth of the expanded Government role in health care. Indeed, virtually every new Federal program pertaining to health needs data. Hence, there has been a rapid proliferation of data projects that relate to specific health programs.



The fast growth of Federal statistical projects has led to problems of fragmentation, overlap, and duplication. Data systems cannot be easily adapted to issues that cut across jurisdictional responsibilities because they are dispersed among different health programs. The number of health data projects has exacerbated the decentralization of Federal health statistics, thereby making planning and coordination difficult. Too much data are collected on some subjects, too little on others. The inability to link and integrate diverse data files for analyses that require more than one data source makes it difficult to assess program achievements or compare results. Also, data projects designed for specific health programs often do not meet the needs of all potential users.

Most data on health are collected by the Department of Health, Education, and Welfare (HEW), principally by its Public Health Service and the Health Care Financing Administration. The Public Health Service alone operated 153 data projects in 1977—a one-quarter increase over the previous year. Another 13 projects were

run by the Health Care Financing Administration. The total cost of Federal health statistics in fiscal year 1977 has been estimated at $100 million. These estimates are probably low, however. **because many projects go unreported.**

Congress usually does not assess the impact of data requirements mandated by its laws. A single statutory requirement may necessitate a number of costly data projects involving many respondents. However, an agency's resources and internal priorities, rather than legislation, often determine the scope of its data collection activities.

Lacking an overarching set of principles and objectives for health statistics, the Federal Government needs a coherent policy for coordinating health data systems. An administrative unit could be created to coordinate the collection of health data. If created, it should have sufficient authority to plan data systems. improve the collection of information, and ensure that potential users have access to data. **A** number of offices within HEW could provide this function. although additional staff and money would be needed to carry it out. The fundamental requirement in assigning administrative responsibility is an unambiguous mandate to manage health statistics.

As part of the study of Federal health statistics. OTA compiled a directory of laws that authorize HEW to collect health data. The directory provides a listing of existing statutes that can be referred to by Congress before passing new laws that require collecting health data. [t can also assist executive agencies plan and coordinate data projects for health.

Drugs in Livestock Feed

For the past three decades. drugs have routinely been added to livestock feeds to promote animal growth, make feed more efficient. and prevent disease. Forty percent of the antibacterial drugs (antibiotics plus chemicals with similar actions) made in the United States are used in animal feeds or for other nonhuman purposes. Also, most of the meat produced in the United States has been fattened with the aid of drugs



Animals given certain antibacterial in concentrations lower than those used to treat disease have been found to gain weight faster and with less feed than animals not given those drugs. Low levels of antibacterial apparently promote growth and feed efficiency through the prevention of disease or direct metabolic effects. In addition, other drugs. such as the synthetic hormone diethylstilbestrol (DES). are used to promote growth either as feed additives or as implants under the animal's skin.

However. widespread concern has been expressed about the potential health effects from this use of drugs. First. evidence indicates that disease-causing bacteria now resist many antibacterial drugs, including penicillin and tetracycline. Second, use of these antibacterial in animals may contribute to their declining effective-

ness in humans. Third, some drugs used to promote animal growth, particularly DES and furazolidone, an antibacterial drug, have been shown to cause cancer in humans and/or animals.

It is the widespread, continuous use of low doses of antibacterial that favors the growth of drug-resistant bacteria. Resistance can be transferred from one type of bacteria to another, from animal to human bacteria, and from one antibacterial drug to another. As a result, drugs used to treat human illness lose their effectiveness. However, the amount of drug resistance attributable to antibacterial used in animal feed cannot be measured precisely. In addition, residues of drugs used to promote livestock growth may persist in retail meat products, where some could cause cancer when consumed by humans. The extent of the risk is unclear because scientists lack definitive methods to translate laboratory results into the number of people who might contract cancer.

The Food and Drug Administration (FDA) has proposed to ban DES and the nitrofurans, to limit penicillin to treatment of known diseases, and to restrict tetracycline to such treatment if alternatives are available to promote growth and feed efficiency. In fact, FDA-approved alternatives for most of these drugs are already available. The risk of illness to humans posed by continued use of antibacterial, as well as the degree and economic impact of decreased meat production that would occur from restricting or banning these drugs, cannot be measured precisely.

In addressing the problem of drugs in livestock feed, Congress could: 1) allow FDA to regulate drug use, subject to congressional oversight; 2) require FDA to make economic as well as scientific assessments of benefits and risks; 3) modify the special approach required for cancer-causing drugs; 4) require FDA to decrease the use of antibacterial in humans and livestock feed; and/or 5) require that in the future only those drugs that have proven more effective than those now in use be approved.

Materials and Energy From Municipal Waste

Americans now generate more than 135 million tons of municipal solid waste (MSW) every year. Its disposal is a growing problem in those areas of the country where traditional methods such as open dumping, landfill, uncontrolled incineration, and ocean burial are too expensive or environmentally unacceptable.



Yet, these wastes contain materials whose use would help conserve resources. MSW includes more than two-thirds of the national consumption of paper and of glass, over one-fifth of the aluminum, and nearly one-eighth of the iron and steel. Recycling these materials requires less total energy than does the use of new resources. If the combustible portion of MSW were burned, the energy produced would be equivalent to almost 2 percent of the Nation's annual energy use.

Nearly all the materials recovered for recycling from MSW today have been kept separate as they were generated ("source separation"). Source separation programs can produce sizable revenues and energy savings, but have a limited effect on the total solid waste stream. Depending on local conditions, a combination of source separation and centralized resource recovery (see below) may be an optimal approach from an economic point of view.

Materials can also be recovered by separating mixed wastes in a central facility. A limited number of commercial technologies are available for producing energy and recovering materials in such a system. Other technologies are in the developmental stage. Because costs are frequently

higher than revenues, resource recovery has the greatest economic potential where both alternative disposal methods and energy prices are high, such as in the urban Northeast. Relatively small plants appear more economical and easier to provide than larger ones. The Federal Government could help overcome the risks of resource recovery by funding basic research and a limited number of demonstration projects.

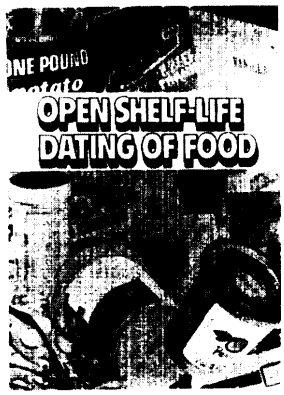
Potential markets exceed anticipated recovery through 1995 for iron and steel, aluminum, paper, and energy. Glass markets are developing rapidly. However, the prices users will pay and the quality they demand could be barriers to sale of large amounts of recovered resources.

A Federal product charge or a Federal recycling allowance could lead to greater recycling and lower waste generation, but pose administrative difficulties. Repeal of virgin material tax preferences, adjustment of railroad freight rates for scrap, a severance tax, and Federal procurement of recycled materials would be less effective. Additional Federal support for R&D on uses of recovered resources would be useful; development of specifications for trade in recovered materials needs only limited additional Federal help.

Federal beverage container deposit legislation would save energy; reduce materials use, solid waste generation, and littering; and protect the environment. It would lead to a net increase in employment, but with a loss of existing jobs in the materials and container industries. Brewers and bottlers would experience higher operating costs, but lower container costs. Wholesalers' and retailers' costs would increase. It is not clear whether net costs or consumer prices of beer and soft drinks would increase or decrease.

Open Shelf-Life Dating of Food

Concerned that the food they buy is not always fresh or nutritious, consumers have advocated in recent years that sellers clearly state on food packages the dates by which a given item should be sold or eaten. Referred to as "open shelf-life dating, " this technique theoretically could help increase consumer confidence in the freshness of food, encourage better handling of food products by retailers, and reduce nutrient loss. To aid with inventory control, the food industry now uses coded dates that consumers cannot understand.



Three types of dates could be placed on food packages: the date of packaging, the date by which products should be sold, and/or the date by which they should be used. While providing little information to consumers, the "pack date" is the easiest and least expensive for the food industry to adopt. The "sell-by date" provides retailers greater control over their inventory, but does not tell consumers when food should be either eaten or discarded. The "best-if-used-by date" gives consumers the most relevant information, but would be the most costly to implement and difficult to scientifically verify. No consensus exists on which type, or combination, of dates would be best.

Currently, nobody knows whether open dating would improve the freshness of foods being sold. Foods are classed as perishable, semiperishable, and long shelf life. Scientific data are adequate to

determine freshness dates for some foods, mainly perishables, but not for all. Food quality is affected by a number of factors, including temperature, humidity, light, and time. Some foods spoil or lose their freshness faster than others; some change appearance with time, but remain nutritious.

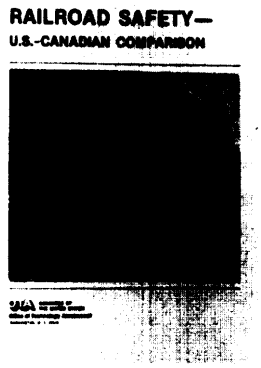
Even though no Federal law mandates it, 21 States and the District of Columbia have adopted some form of open dating. These systems as well as the voluntary ones put into effect by the industry vary widely as to the foods to be dated, what dates are used, and what those dates mean. This lack of a uniform dating system leaves consumers confused. More needs to be known about the effects of dating systems now in use.

Nobody knows exactly how much open dating would cost. OTA estimates the cost to producers of establishing open dates at about $100,000 for each perishable food product and $200,000 for those that remain fresh longer. This startup plus continuing costs might add from one-tenth of a cent to 1 cent to the price of a package on the store shelf. More data are needed to determine the costs of dating specific products.

In addressing the issue of food dating, Congress could: 1) take no action, thus allowing the present voluntary system to continue; 2) establish a mandatory system that would specify open dates; or 3) adopt a mix of voluntary and mandatory systems, in which the Federal Government develops guidelines for dating, but allows processors greater flexibility to determine dates and minimize costs. A mandatory system would produce greater uniformity, but would be more difficult and expensive to implement. A mixed system could provide for uniformity and allow industry to decide whether to open date products. The procedure could be varied for different food categories—mandatory dates for perishables and mixed for all others, for example.

Railroad Safety: U.S.-Canadian Comparison

A comparative analysis of U.S. and Canadian railroad derailments, fatalities, and safety practices indicates many similarities and some significant differences between the two systems. The differences result primarily from the larger size and complexity of the U.S. system.



The U.S. fatality rate for the 1966-76 period was an average of 48 percent higher than that of Canada. This large difference, especially at grade crossings and among trespassers, seems to reflect the higher level of U.S. exposure to rail hazards that occurs because the U.S. population and rail system are considerably larger than Canada's.

While derailment rates vary widely among U.S. carriers, the average derailment rates for the nine largest (in ton-miles) U.S. carriers were similar to those of the Canadian railroads for 1976 and 1977. However, the average derailment rates for the second 10 U.S. railroads are significantly higher than the rates for the Canadian railroads for those same years. The financial picture of some U.S. railroads may give rise to their significant derailment rates. Derailments in the United States are continuing to increase, while derailments in Canada have stabilized or declined slightly. The continued rise, particularly among carriers below the top 10, in U.S. derailments appears to result from increased axle loadings on freight equipment and deferred maintenance. U.S. derailment rates will probably continue to increase until the economic condition of some railroads improves. In both countries less than 2 percent of rail-related fatalities occur in derailments.

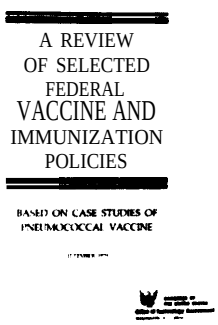
The National Transportation Act of 1967 in Canada changed its Government's economic policy toward transportation modes. As a result, railroads gained greater control over their rate structure. Although no direct correlation could be drawn between this change in economic policy and rail safety in Canada, the change may influence rail safety.

Several Canadian approaches to rail safety may be of interest in the United States. These include:

- emphasis by railroad management on safety accountability, and adoption of a systematic approach to safety;
- creation of a no-fault system of insurance compensation for work-related injuries;
- use of risk analysis in inspections and in allocation of grade-crossings funds;
- Government use of stop orders rather than monetary fines as a means of enforcing safety standards;
- use of a standard Hazardous Information Emergency Response form; and
- encouragement of a nonadversarial relationship between labor and management in the formulation of safety programs.

A Review of Selected Federal Vaccine and Immunization Policies

Since 1967, the number of active vaccine manufacturers has declined 50 percent, and the number of licensed vaccine products has declined 60 percent. For each of 19 types of licensed vaccines, including poliovirus vaccine, the United States is dependent on a single American pharmaceutical company. Some investigators believe the decline in vaccine manufacturers and products is partly the result of Federal policies.



To evaluate the safety and efficacy of newly developed vaccines, the Federal Government relies heavily on data collected from premarketing clinical trials. Government evaluations based on such data can be less than comprehensive. The Government does not require anyone to collect postmarketing data regarding adverse reactions to licensed vaccines.

Medicare cannot pay for vaccinations to prevent infectious diseases, although it does pay for the treatment of such diseases. Thus, Medicare cannot pay for the use of pneumococcal vaccine, even though the Federal Government spent $6.5 million to help develop this vaccine and approved its use among the elderly. According to OTA's cost-effective analysis, vaccination against pneumococcal pneumonia would be more cost-effective among the elderly than among any other age group, and for all age groups would yield health benefits that cannot be obtained from treatment.

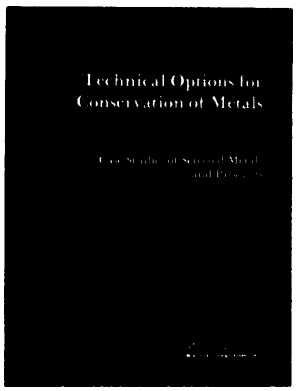
Liability problems may be eroding the commitments of vaccine manufacturers, Congress, and State health departments to public immunization programs. Some courts have ruled that the vaccine manufacturer should compensate injured vaccinees because: 1) the manufacturer was best able to pay and 2) no other applicable compensation mechanism existed in society. In order to warn potential vaccinees about possible vaccine side effects, HEW has developed informed consent forms and guidelines to be used by State and local participants in federally sponsored immunization programs. If HEW and the vaccine manufacturers successfully discharge their "duty to warn" obligations, however, then injured vaccinees may have no legal recourse to compensation.

Some actions Congress could take to help ensure the Federal Government's promotion of safe and effective vaccines include: 1) establishing an interagency body to review comprehensively all Federal policies that affect vaccine development, evaluation, and use; 2) authorizing the Federal Government either to produce or subsidize the production of selected vaccines; 3) requiring the

Government to monitor actively adverse reactions to licensed vaccines; 4) amending the Medicare law to permit Federal reimbursement for vaccinations among the elderly; and 5) developing a Federal program for compensating vaccinees who are seriously injured in public immunization programs.

Conservation of Metals

The United States has experienced shortages in critical metals in recent years and become increasingly dependent on foreign sources of supply. The United States now imports 50 percent or more of such metals as aluminum, chromium, manganese, and tungsten. By cutting the large amounts of loss or waste of metals along the materials cycle—from mining of ore to product disposal–the United States could ease both shortages and the dependency on imports.



Of all the options for cutting metals waste, product recycling—the remanufacturing, reuse, and repair of end products—offers the greatest leverage for saving materials and energy now wasted. Product recycling could save 30 percent or more of the copper, aluminum, iron, and steel now lost. Environmental impacts associated with mining and manufacturing would also be reduced. Product recycling already exists in such areas as auto parts, furniture, typewriters, and aircraft. However, product recycling is currently far below its potential.

The major barrier to more widespread product recycling is economic. To be economically attractive, used products must usually be reworked or remanufactured at a cost that will permit a resale price significantly lower than that of new products. Products for which recycling is likely to be economic are those with higher initial costs, whose appearance or styling is of secondary importance, that can be recycled on a production-line basis, and for which there is a steady, large supply of products for remanufacture. Other major barriers to increased product recycling are the lack of established industries to collect, remanufacture, and resell the product, and the preference of consumers for new products.

Product recycling could be encouraged by a variety of means, including increasing public confidence in recycled products, providing funding to establish a scrap inventory, providing loans to establish an aftermarket business, and encouraging product leasing. Increased use of recycled products could have the short-term effect of reducing net jobs and replacing unskilled jobs with those requiring somewhat greater skill. However, the long-term impact would likely be to increase consumer buying power and net jobs.

The substitution of less critical metals or nonmetals is another important option for saving selected metals. However, several major impediments must be overcome. First, a successful substitution can often take years to implement. Second, many products are manufactured with a highly specialized production process that is costly to change. Third, every substitution involves a risk that will add to the product cost. One option to encourage substitution would be Government R&D to develop practical substitutes for selected metals, with particular emphasis on high-volume usage, nonmetallic coatings for corrosion and wear resistance, and inherently nonrecyclable uses. This option could also encourage private sector R&D.

Computer Technology in Medical Education and Assessment

This background report describes the use of computer technology across a variety of medical education, practice, and evaluation activities and summarizes some of the changes that computers will bring to medicine.

COMPUTER TECHNOLOGY IN MEDICAL EDUCATION AND ASSESSMENT

BACKGROUND REPORT

There have been dramatic reductions in the size and costs of computers. At the same time, advances in medicine have led to a virtual information explosion, making the contemporary medical care system more complex, more information-dependent, and more technology-oriented. Computers can add to the increasing complexity of medicine as well as assist in efforts to more effectively understand, employ, and manage the information and array of technologies used in health care. They have rapidly become integral to teaching and testing in many of our medical schools and have assumed growing importance in patient care, in epidemiologic and clinical research, and in medical administration.

Thus, computers are rapidly changing the nature and function of medical education and practice and the ways in which performance is evaluated. This led to self-paced, independent study programs in the pre-clinical years of medical school, specialty certification examinations which can reflect the patient-physician encounter more accurately than written examinations, and computerized data bases which can improve the physician's diagnostic and therapeutic skills.

The implications arising out of these medical uses of computer technology include changes in the method and content of physician education, improved methods of measuring and validating the quality of medical care, and more individualized testing of physician performance. Individualized testing will accelerate already existing trends to assess competence only in limited areas, which in turn will raise questions concerning whether physicians should have licenses limited to their specialties and concerning the relationships between State licensing boards and the private specialty boards in regulating physician practices.

Pest Management Strategies in Crop Protection

A sharp step-up in the current slow shift to integrated pest management (1PM) for major U.S. agricultural crops can cut pesticide use by as much as 75 percent in some cases, reduce preharvest pest-caused losses by 50 percent, and save a significant amount of the one-third of the world's potential food harvest that is lost to all pests. (The pests include noxious and damaging organisms such as insects, mites, nematodes, plant pathogens, weeds, and vertebrates. Pesticides include insecticides, miticides, nematicides, herbicides, and fungicides.)

Pest Management Strategies in Crop Protection

1PM involves the coordinated use of a variety of control tactics to prevent economic losses from pest damage while minimizing hazards to humans, animals, plants, and the environment. 1PM is the most promising approach to U.S. crop protection over the next 15 years. The international implementation of 1PM requires systems that are adopted to local agricultural conditions,

social customs, political structures, and economic systems.

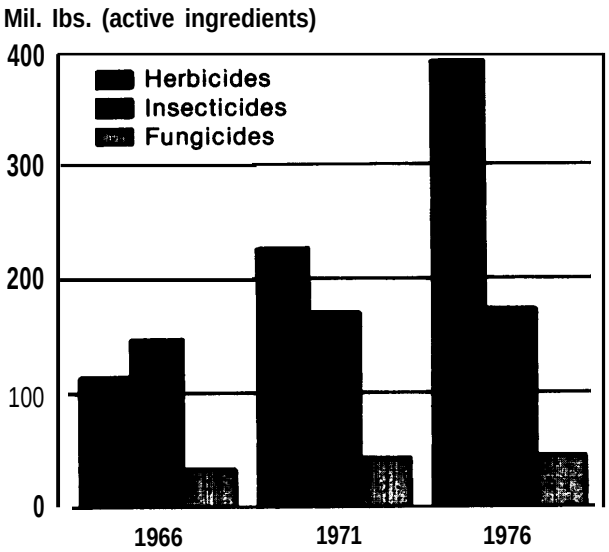
U.S. crops have become increasingly vulnerable to pest damage. The present limited number of pest control tactics within the categories of chemical, cultural, plant resistance, and biological are neither completely effective nor universally applicable. The intensive use of only one or two of these tactics can create hazards to human and environmental health and increase pest resistance to controls. Therefore, American agriculture is gradually shifting to 1PM strategies, which apply the most broadly effective combination of available methods to particular pest problems. However, technological and administrative obstacles block rapid development and use.

Among the obstacles to rapid adoption of 1PM strategies are:

- inadequate knowledge in basic biology, interactions of crop pests, and the economics of pest management,
- the lack of an adequate system for disseminating the information needed to make sound pest management decisions,
- a shortage of trained personnel to conduct research, develop 1PM programs, and deliver the needed information,
- the lack of coordination and cooperation among Federal and State agencies, and
- the lack of a clear and common commitment to and agenda for future 1PM activities by agencies involved in the funding of research and extension activities, the regulation of pesticide use, and the marketing of farm products.

The basic option before Congress is whether or not to commit the additional resources needed to speed up the current evolutionary movement toward adopting 1PM crop protection systems. Congress can: 1) support the status quo for U.S. pest control which, although including 1PM, continues to rely heavily on chemicals or 2) develop a strategy for accelerating the shift to 1PM. With a modest increase in resources, 1PM could replace most unilateral pest control programs over the next 20 to 30 years. With a major effort to remove the obstacles to 1PM, the shift could be made within 15 years.

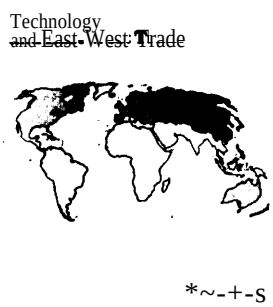
Volume of Pesticides Used on U.S. Farms



SOURCE Adapted from 1978 *Handbook of Agricultural Charts,* USDA Agriculture Handbook #551

Technology and East-West Trade

Although Western technology contained in civilian products sold to the Soviet Union has contributed to its military potential, it is unlikely that any unilateral action of the' United States could have prevented this—or could do so in the future. Almost any high technology, even though its purpose and function is civilian, may have some military use. U.S. export controls do a good job of preventing the transfer of primarily military technologies to the Communist world, 'but a conclusive determination of the degree of military risk entailed in the sale of these so-called "dual-use" technologies is probably impossible. Existing multilateral arrangements designed to minimize that risk work reasonably well.



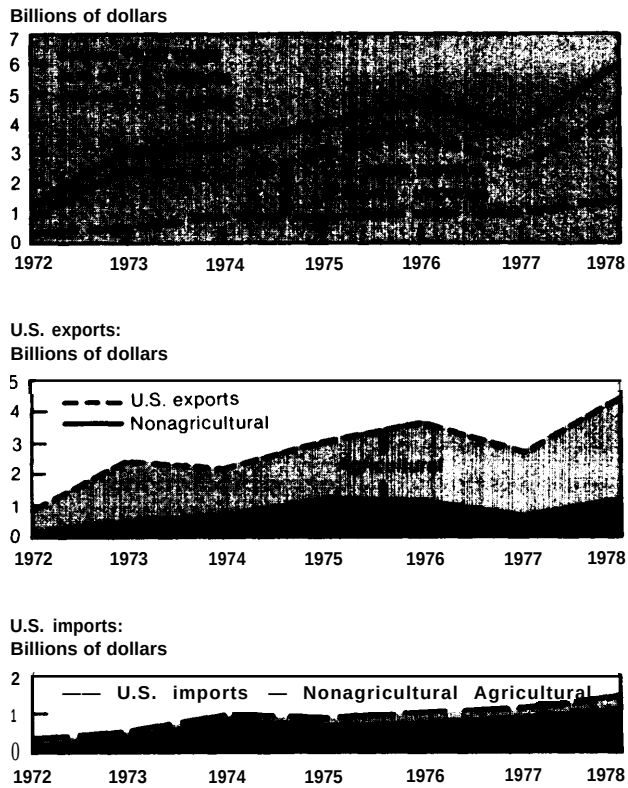
These are among the conclusions of a new OTA report Technology *and* East-West *Trade*. The report looks not only **at** the military, but also the political and economic costs and benefits to the United States of trading-especially in technology—with the Communist world. It reviews the controversy over whether such trade can or should be used to obtain foreign policy leverage. It also examines the East-West trade policies of four of America's major allies—West Germany, France, Great Britain, and Japan—and finds them significantly different from that of the United States. Finally, it provides background information on existing U.S. export policies and regulations, and on the use which Communist nations have made of Western technology.

Trade with the Communist world plays a relatively small part in U.S. foreign trade. The absolute value of Communist trade with Western nations is low and the United States has captured only a minor share of that limited market. The policy most likely to increase the U.S. share of trade with Eastern-bloc countries is the extension of official credits to those Communist nations currently ineligible for them. In the long run, however, dramatic growth in the total volume of East-West trade is contingent on an increase in the ability of the East to export to the West.

East-West trade has always been economically more important for Western Europe and Japan than for the United States. While our allies do not deny the basic necessity of withholding items of direct military relevance from Communist nations, they generally do not share the concerns expressed in the United States over the political, military, and strategic implications of transferring dual-use technologies. In Japan, West Germany, France, and Great Britain, the sale of technology is seen as primarily an economic issue and any use of export controls for political purposes is largely eschewed.

Because of its position of leadership in a number of technologies of critical military significance, the United States may legitimately feel it has a special responsibility to ensure their safekeeping. If it can play this role with intelligence and integrity, the United States may be able to initiate and maintain a strong and unified Western-bloc position on the transfer of military technologies.

U.S.-Eastern* Trade, 1972-78**



● Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, U. S. S. R., and PRC.
••1978 trade estimated imports do not include U.S. imports of nonmonetary gold from U.S.S.R.

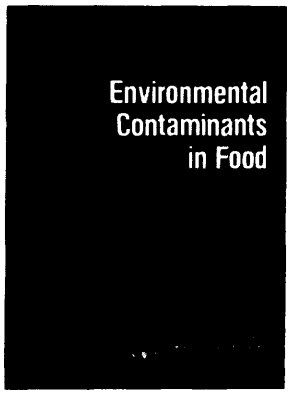
SOURCE *Selected Trade and Economic Data for the Centrally Planned Economies,* **U S. Department of Commerce, 1979**

However, the United States is not the sole source of most of the dual-use technologies desired by Communist nations and this foreign availability constrains its unilateral influence over their transfer.

In sum, it appears most unlikely that actions taken by the United States alone could lead to: 1) a dramatic increase in our trade with the East, 2) a dramatic decrease in the military risks associated with existing trade, or 3) a significant reduction in the technologies the East can purchase, given the existing attitudes of other Western nations.

Environmental Contaminants in Food

Environmental contaminants in food have become a nationwide problem. Between 1968 and 1978, according to an OTA survey, 243 food-contamination incidents were reported in this country. (Environmental contaminants include organic chemicals, metals and their derivatives, and radioactive substances, that inadvertently enter the human food supply through agriculture, mining, industrial operations, or energy production.)



Although the United States has escaped mass poisonings such as have occurred in other industrialized nations, nearly all U.S. residents carry detectable residues of some environmental contaminant in their bodies. Studies indicate that some contaminants present at low levels in U.S. food cause physiological changes in humans, but the long-term significance of these changes is uncertain. Between 1968 and 1978, at least $282 million in food was lost to contamination. This conservative estimate only includes 30 percent of the known incidents and ignores hidden costs such as medical expenses and lost workdays.

Although the Federal Food, Drug, and Cosmetic Act (FFDCA) contains no specific provisions for environmental contaminants, FDA has set permissible levels (either "action levels" or "tolerances") for all known contaminants. FDA relies on informal action levels more than formal tolerances because tolerances can only be set through complex, time-consuming procedures. FDA is not required to review these informal judgments, nor to commission new toxicological studies even when available data are inadequate. When setting regulations FDA attempts to balance the cost of the food lost against the degree of public health protection gained.

Federal and State monitoring of food is primarily regulatory, designed to ensure that environmental contaminants do not exceed prescribed action levels or tolerances. Consequently, contamination involving unregulated substances is rarely identified before it becomes a major problem. None of the major environmental contamination incidents in this country (PBB, PCB, kepone, and mercury) were initially discovered by ongoing monitoring programs. In each case, actual human or animal poisonings—either at home or abroad—alerted authorities to the danger.

Managing contamination incidents can be difficult because the Federal and State agencies involved sometimes do not coordinate their activities. Efforts are hindered further by the complexity of the American food system and the rapidity with which food is moved through the system.

In light of these findings, Congress could: 1) allow the present system to continue; 2) amend FFDCA to require the establishment of tolerances, simplify administrative procedures through which tolerances are set, clarify the weight economic criteria can have, and/or grant FDA authority to set regional tolerances; 3) establish a national monitoring system to detect unregulated chemicals in food; and/or 4) designate a lead agency to establish a center to orchestrate the delivery of Federal assistance to affected areas.

Section III
WORK IN PROGRESS

OTA's work is structured along three broad divisional lines: energy, materials, and international security; health and life sciences; and science, information, and transportation. Within those broad divisions, OTA conducts studies in energy, international security and commerce, materials, food and renewable resources, genetics and population, health, telecommunication and information systems, oceans, R&D priorities and policies, space technology, and transportation.

More than 57 projects were in progress during the year, including 22 new studies.

In this section, the broad concerns and current work of each OTA program are described.

Section III
WORK IN PROGRESS

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Energy Program

During 1979, the Nation experienced painful reminders that the energy crisis remains as threatening as ever. The gasoline shortages, a rapid rise in petroleum prices, and new questions about the safety of nuclear power were severe jolts to the Nation's well-being. Even though our energy demand growth had slowed considerably since the 1973 oil embargo, we were still dangerously dependent on imported petroleum, and the experience of the last half of 1979 showed just how foolhardy this dependence is. To deal with this problem, Congress and the President initiated several strong measures centering around two approaches. The first involved production of synthetic fuels with proposed targets ranging from several hundred thousand to over 2 million barrels of oil equivalent per day by 1990. The second was an expanded conservation effort, particularly for residential and commercial buildings. There was general agreement about the need for these measures, but considerable debate developed about their nature and the balance between the two approaches. In addition, other issues concerning the future of nuclear power, the potential contribution of solar energy, and the availability and price of conventional petroleum resources absorbed considerable congressional attention.

OTA was able to provide substantial assistance to Congress as it addressed these issues. The OTA report on residential energy conservation and subsequent analysis provided the basis for many of the conservation initiatives before Congress, and for efforts to determine a rational balance between conservation and production approaches. In addition, OTA's work on coal and biomass, particularly gasohol, aided congressional consideration of the issues surrounding these fuel sources. These studies form part of the effort the Energy Program initiated in 1975 to build a sound understanding of the major energy supply and demand technologies and their implications for society. OTA has been able to draw on this basic groundwork to meet immediate congressional needs through testimony and other short-term responses to critical energy policy questions.

Currently, the Energy Program is shifting the emphasis of its work from individual supply and demand technologies to more comprehensive energy issues. Foremost among these new efforts is the alternative energy futures study which is exploring the various energy paths the Nation might take. In the coming year, the Energy Program will examine issues concerning energy and the cities, energy policy perspectives, global trends in energy supply and demand, decentralized electric energy systems, and industrial energy use as part of the energy futures study. In addition, the Program will continue work on specific technologies by examining synthetic fuels for transportation and solar power satellite systems. Finally, reports will be completed this year on assessments of energy from biological processes and liquefied natural gas policy.

Alternative Energy Futures

The debate over America's energy policy increasingly revolves around the nature of American society in the future. Advocates of varying policy choices argue that their choices will provide the best economic situation, the maximum amount of individual freedom and choice, the most desirable environment, and the strongest national security position. Although Congress does not explicitly act to "choose" a future, the series of incremental actions taken on various bills and proposals do, in the aggregate, move the country closer to, or farther from, different alternative futures.

OTA was asked to evaluate different combinations of energy supply and demand which are often proposed as possible and desirable. The re-

quest (signed by 54 Members of the House and Senate) asked that the Office analyze various levels of energy consumption and fuel mixes (high-demand high-coal, low-demand high-solar, etc.) and identify the likely impacts of those combinations on the country.

After initial work on the comprehensive approach, a decision was made, reinforced by budgetary and related constraints, to begin the work through a set of closely related projects. Each study will be complete in itself, but will form part of a base for an overall analysis to be completed in fiscal year 1981 or later. Those studies are as follows:

1. Industrial Energy Conservation—A new look at the macroeconomic relationships between industrial production, energy consumption, and gross national product. Industry has actually cut gross energy consumption over the past 5 years, while increasing product output. How has this been possible, and can this trend be expected to continue? One or two of the most energy-intensive industries will be examined in detail.
2. Energy in the *City* —This study will focus on the various options for providing energy in the city in the future: improved conservation, transition to renewable, differing forms of decisionmaking and management. The impacts of the energy choices, and of the financing mechanisms selected to implement them, will be analyzed for their likely impact on the shape of cities, as compared to suburban and rural systems. Substantial emphasis will be placed on social and institutional barriers to implementation.
3. Energy *Policy Forum* —A careful analysis of the major differences and agreements characterizing the energy debate at this time, and the evolution of these views over the decade of the 1970's. Principal areas of difference over fact and impact will be identified, thus suggesting research priorities and helping to determine which portions of the debate hinge on philosophical differences that are not likely to be resolved. This project will be completed by a series of workshops, interviews, and in-house analyses.

Energy From Biological Processes

In the search for domestic, renewable sources of energy, many experts see a potential for obtaining energy from plants and from plant and animal wastes. Commonly referred to as biomass, these biological processes represent a renewable source of solid, liquid, and gaseous fuels as well as of chemical feedstocks. On balance, biomass may be less polluting than domestic fossil fuels. In addition, biomass has the potential for contributing to energy self-sufficiency in agriculture and in the forest products industries, and appears to be especially appropriate for developing countries.

Although the resource base for biomass is theoretically very large, there are many established nonenergy demands for those resources. The resource base can be expanded by altering forest and agricultural management, by exploiting marginal lands with specially adapted plants, and by cultivating aquatic plants. There are, however, many practical problems associated with such an expansion of the resource base.

At the request of the Senate Committee on Commerce, Science, and Transportation, OTA is analyzing the potential for and impacts of biomass energy. This project will describe in detail the conversion processes that could become commercial in the near term, analyze policies for accelerating commercialization and their implications, and examine R&D needs for longer term conversion processes. The economics and net energy balances of selected conversion processes will be investigated, particularly for the production of liquid fuels. OTA also is examining the end uses of biomass-derived fuels and chemicals. The possible uses of liquids and the technical, economic, environmental, and systems tradeoffs between possible uses will be emphasized.

In connection with this investigation of liquid fuels from biomass, OTA has carried out an extensive analysis of alcohol fuels from agricultural products and processing wastes. The results of this analysis are presented in a technical memorandum on gasohol in response to congressional interest in synthetic fuels.

Finally, because little is known about the environmental and social impacts of developing bio-

mass energy sources, OTA will summarize the state-of-the-art knowledge and lay the groundwork for anyone planning to assess these impacts. This assessment is scheduled for completion early in 1980.

Decentralized Electric Energy Generation Systems

The possibility of using solar energy in all its direct and indirect forms and the rapidly escalating economic and environmental costs of large energy facilities have stimulated considerable interest in small, decentralized energy systems. In particular, problems faced by the electric utility industry, such as rapidly rising capital costs, long leadtimes for construction, and difficulty in finding suitable sites, make the introduction of decentralized electric energy systems appear attractive. Last year, Congress provided for the establishment of rules encouraging decentralized electric energy systems in the Public Utility Regulatory Policies Act.

This study, requested by the House Committee on Banking, Finance, and Urban Affairs, will examine the role that small energy conversion equipment could play in meeting the country's needs for electric energy. It will review the economic, environmental, social, and institutional consequences of decentralized electric systems, and their effect on the electric utility industry. Finally, it will analyze policy options that Congress may wish to consider.

The assessment will begin by examining the technical features of decentralized systems using a variety of small electric-generating equipment. Then, employing models developed for the earlier OTA study on onsite solar systems, the assessment will analyze the economic and technical effects of such systems on utilities. Concurrently, changes in utility structure will be evaluated on the basis of planning and decision models. Finally, a series of issues about the effects on society (e.g., employment, risks, etc.) of decentralized systems will be examined, including public perception of small-scale, onsite energy facilities. The study is scheduled for completion in the late summer of 1980.

Global Energy Trends

Energy shortages and high prices will create serious economic and political difficulties during the next three decades. As a result, the Senate Foreign Relations Committee requested that OTA perform an assessment of the future energy situation to determine the effects of these possible shortages and high prices and the foreign policy options that are available to the United States to mitigate these negative effects.

This study is proceeding in two stages. The first stage assesses future global energy supplies and the construction of credible scenarios governing future energy supplies and demands. Because of its central importance, future world petroleum availability is being assessed first. The preliminary results of this study have been used as a basis for OTA testimony before the House Select Committee on Intelligence. The second stage of this study, to be carried out primarily by the International Security and Commerce Program, will examine the implications of these scenarios on the United States and the world. This analysis will cover the economic, political, and national security impacts of these scenarios. U.S. foreign policy responses, including U.S. assistance in energy technologies to other nations, will be analyzed.

An analysis of world oil-production prospects will be completed in the spring of 1980.

Liquefied Natural Gas

Public debate has focused on both safety and economic aspects of liquefied natural gas (LNG) imports. An OTA report, *Transportation of Liquefied Natural Gas*, published in September 1977, describes the technology, reviews critically the physical and institutional components of the LNG import system, and explores public awareness and concerns.

Partly in response to questions raised in that study, the Senate Committee on Finance requested OTA to examine LNG import policy in the context of other energy alternatives, with emphasis on economic costs and benefits. The request arrived after President Carter, through the National Energy Plan, had relaxed a policy of the

previous administration to limit LNG imports, and after the General Accounting Office (GAO) had suggested in a report to Congress that this new policy required reevaluation and further improvement, essentially because insufficient rationale appeared in the plan.

In response to the Senate Finance Committee's inquiry, this assessment mainly looks at the economic and energy supply implications of the technology. Safety of LNG facilities has been excluded from the study, in order not to duplicate the recent effort of GAO.

The purpose of the project is to aid Congress and Federal and State regulatory bodies in establishing or reevaluating the circumstances under which LNG imports are in the public interest. Seven separate but related analytical tasks contribute to meeting the objective:

1. a compilation of the history of Government LNG import policy;
2. a review of U.S. gas demand projections under alternative price and policy assumptions;
3. a survey of North American gas and oil resource estimates;
4. an investigation into the availability and cost of LNG in world markets;
5. a description of the cost and structure of LNG import projects, including financing and the distribution of risk among the public and other participants;
6. an analysis of the distribution of costs and benefits of imported LNG in domestic gas markets; and,
7. a brief discussion of the broader social and environmental impacts of LNG imports.

The report is scheduled for completion in early 1980.

Solar Power Satellites

Solar power satellites are viewed as the most promising solar source of baseload electricity by proponents, while opponents believe that their development would be a huge waste of Federal R&D money. While expenditures on the concept have thus far totaled less than $25 million, several estimates place development and demonstration costs in the $40 billion to $80 billion range. The potential impacts of these satellite systems on the environment and on society are the object of considerable debate as is the ultimate cost of the energy produced. There is considerable congressional support for a more aggressive approach to investigation and development of the concept (the House passed **a** bill last year to initiate a 5-year program expected to cost $275 million).

A number of very different concepts for solar power satellites have been proposed. The most familiar would place giant arrays of photovoltaic cells in orbit to convert sunlight to electricity and transmit it to Earth by a microwave beam. Other concepts include the use of giant orbiting reflectors to create solar farms on Earth where sunlight would be available around the clock, or the use of sunlight to directly excite a laser that would beam energy to Earth. The concepts are technically diverse and may have significantly different economic prospects. Perhaps equally important, their environmental and institutional impacts, which are likely to influence public acceptability, would be substantially different.

This study will address key uncertainties in a balanced treatment of both positive and negative impacts of proposed satellite power systems. Major topic areas will include: 1) the feasibility and cost of alternative satellite systems; 2) factors affecting public and institutional acceptance of these systems; and 3) the energy systems context within which development and implementation of satellite power systems must be viewed. Within these categories, particular attention will be devoted to the health effects of microwave radiation, the implications of highly centralized electric-generation systems, the expanded role of the Federal Government in energy production that may be required, and the implications for national security and international relations. Strengths, weaknesses, and uncertainties associated with solar satellite concepts will be contrasted with those of other future energy sources such as nuclear fusion and terrestrial photovoltaics.

The study was requested by the Chairman and ranking minority members of the House Committee on Science and Technology and its Subcom-

mittee on Space Science and Applications. Completion is scheduled for the fall of 1980.

Synthetic Fuels for Transportation

The U.S. automotive transportation system is becoming increasingly dependent on imported petroleum. The rapidly escalating cost of imported oil and the apparent willingness of some oil producers to use oil as a political weapon have created a strong concern both for the U.S. economy and for our continued freedom from outside coercion. The manufacture of synthetic fuels and the improved efficiency of the automobile are two major pathways for reducing U.S. oil dependence and its effects.

The Energy Program is cooperating with the Transportation Program in **a** study of synthetic fuel production, automotive fuel-efficiency improvements, and the tradeoffs between them. The Energy Program will be responsible for the portion of the study dealing with synfuels. A major purpose of the study will be to examine the total costs and benefits of synfuels, including the costs and benefits of moving synfuels into the marketplace (refining and distributing them as well as adapting the automobile to use them, if necessary). OTA will also carefully examine the time necessary to develop a synfuels industry under different deployment conditions, and will attempt to determine what additional costs would have to be borne if an emergency deployment schedule were adopted. This analysis should establish the possibilities for using a synfuels commercialization capability as an emergency "escape valve" to combat the effects of an externally imposed oil shortage. Finally, OTA will attempt to identify those critical issues that must be resolved before the next major steps towards commercialization are made, and to identify instances where the current Federal program may fail to resolve these issues in time.

This assessment has been requested by the Senate Committee on Commerce, Science, and Transportation. The House Committees on Science and Technology and on Interstate and Foreign Commerce have also expressed strong interest. Completion is scheduled for the late fall of 1980.

International Security and Commerce Program

It is becoming increasingly evident that international interdependence is no longer just a slogan, but a reality. A wide range of the U.S. national goals can only be achieved with the cooperation of other nations, while other goals may involve conflicts of interest with foreign countries. In the international arena, U.S. technology has long represented a particular area of strength, and we have grown accustomed to relying on superior technology to help us in achieving both economic and military strength. Technology should remain a distinctive U.S. asset in the future as well, but only if it is used wisely in the pursuit of national objectives. The International Security and Commerce Program assists Congress in a variety of areas where the appropriate national policy is in doubt because of questions regarding the impact of either U.S. or foreign advances in technology.

One such area is the international competitiveness of U.S. industry. Is the United States moving into a period in which key industries depend on exports for their survival, while some key products are imported because U.S. manufacturers can no longer compete? If so, what consequences can be hoped for, or feared? Is a more explicit national strategy appropriate, or feasible? A closely related question is that of technology transfer. How is technology transferred from the United States to other countries? What factors determine whether imported technology is efficiently used? Under what circumstances is technology transfer good or bad for the United States? Answers to questions such as these do not emerge reliably from theoretical analysis; instead, it is necessary to look closely at the details of a variety of specific cases. In 1979, the Program completed an assessment of technology and East-West trade. An ongoing assessment addresses the international competitiveness of the U.S. electronics industry. Future efforts will include other cases of competitiveness (probably

the aircraft industry, and a comparison across industries) and of technology transfer (such as technology transfer to the oil-rich nations of the Middle East, and the effects of relocation of U.S. industries to areas overseas where labor is cheaper).

Another such area is the technology of national security, including both the effects of weapons technology and the technological considerations involved in arms limitation. In 1979 an assessment of the effects of nuclear war was completed, and we expect to initiate further projects during 1980.

The Program is conducting a joint effort with the Energy Program to assess the implications of global trends in energy supply and demand. Based on work done in the Energy Program on petroleum supply, an assessment is planned for 1980 on the range of ways in which energy issues can affect East-West relations, and on the policy problems and options to be expected as a result.

The International Competitiveness of the U.S. Electronics Industry

While there are many factors other than technology which affect the competitiveness of the U.S. electronics industry, it is assumed that the relative sophistication and appropriateness of the technologies employed (both in end products and in manufacturing processes) will have a major impact, and that there are significant U.S. Government policy choices which in turn will affect the level of technology. This assessment, undertaken at the request of the Senate Committee on Commerce, Science, and Transportation; the House Committee on Ways and Means; and the Joint Economic Committee, addresses the technology issues affecting competitiveness in an industry that has been marked by a very high rate of innovation and by extremely sophisticated technologies. It is of interest not only for its own sake, but because of the strategic role that electronics are expected to play in the future of other industries. A companion study on the competitiveness of the U.S. steel industry is being carried out by the Materials Program.

The assessment addresses three sectors of the electronics industry: consumer electronics, in which the U.S. industry producing color television receivers has lost much of its market to Japanese manufacturers; semiconductor devices (notably integrated circuits), in which U.S. industry holds a strong competitive position, but is under a fierce challenge; and computers, in which U.S. industry is presently leading the world, but where future challenges are to be expected. The assessment will focus on those determinants of technological competitiveness that appear to be susceptible to modification by governmental action, and involves comparison of U.S. and Japanese practices and considerable attention to some sectors of Western European industry. The assessment is scheduled for completion in mid-1980.

Taggants in Explosives

This assessment responds to a request from the Senate Governmental Affairs Committee to assess a proposal to add substances to commercial explosives that would permit detection of the explosives by suitable sensing machines (so-called detection taggants) or identification of the batch of explosives involved in a bombing through so-called identification taggants retrieved from the debris. When hearings were held on this prospect, the assertions about the technologies involved from executive branch sources (who favor it) and industry sources (who oppose it) were so completely in disagreement that no reliable conclusions could be drawn. The request is being met by the Program because experts and laboratories who normally work for the military provide a source of unbiased expertise regarding explosives. The assessment addresses the safety of taggants, their probable costs, and their probable utility to law enforcement. The assessment is scheduled for completion early in 1980.

Materials Program

The industrial base of a modern technological society requires a vast array of raw materials of many different types. The importance of materials to our society is suggested by the fact that annual consumption of minerals in the United States is about 40,000 lbs per person. Society uses materials through what is called the materials cycle. The cycle starts with extraction of minerals or harvesting of renewable resources such as wood, proceeds through processing and end-product manufacture to use of the product by the consumer, followed by disposal of the product, and, in some cases, by reuse or remanufacturing of the product or recycling of the material.

At every stage of this cycle, the ways in which materials are handled are affected in complex and interlocking ways by institutional, economic, environmental, and technical factors. For example, the exploration, development, and production of a significant fraction of our minerals and timber are governed by the Federal land management laws and regulations; the degree to which materials are recycled after use depends partly on the relative costs of virgin and recycled materials and these costs partly depend, in turn, on institutional and technical factors; environmental concerns are leading to more stringent and costly controls on operations at all stages of the materials cycle from extraction through waste disposal; and new technology has simultaneously opened up hitherto untouched areas for exploration, development, and production, and helped to mitigate at least some of the associated impacts on the environment.

The Program has two ongoing projects related to extraction (oil shale and Federal coal leasing) and one ongoing project related to processing (impact of technology on the competitiveness of the U.S. steel industry). The new projects started in 1980 will probably be concerned with technologies for efficient and environmentally sound processing and manufacture.

Oil Shale Technology

At the request of the Senate Committee on Energy and Natural Resources, OTA is studying the history, status, and possible futures of efforts to develop the oil shale of the Western United States. The Committee's letter of request called for a complete assessment of shale oil recovery technology in general and of the current Federal prototype oil shale leasing program in particular.

U.S. dependence on foreign sources of liquid fuel has increased significantly since the 1973-74 oil embargo and price increases. In 1978, the United States imported nearly 45 percent of its petroleum at prices five to six times higher than they were in 1972, and prices have risen dramatically since the end of 1978. Short-term reliability of imported-oil supplies is uncertain, as exemplified by the problems in Iran. Long-term reliability is also questionable, as worldwide oil production may peak within the next few decades. In the United States, oil reserves have been declining for several years.

The richest oil shale deposits in the Western United States are those of the Green River formation in Colorado, Utah, and Wyoming. The Green River shales contain the largest single deposit of hydrocarbon materials in the world, but only a small portion of the total resource could be recovered by existing technologies. It has been estimated that about 190 billion barrels of shale oil could be recovered from the Green River deposits with existing technology, but the profitability of recovery is clouded by numerous technical, environmental, and economic uncertainties. These resources, if recovered, could supply a l-million-barrel-per-day oil shale industry for over 500 years.

In its assessment of oil shale technology, OTA will place emphasis on identifying the remaining technical, economic, and environmental uncertainties connected with commercial oil shale development and evaluating how these uncertainties could be resolved. OTA will formulate several scenarios for oil shale development, from "no additional Government involvement" to "Government-assisted accelerated massive development ." A range of financial and institutional incentives for each scenario will be analyzed for their effectiveness in achieving such aims as encouraging oil shale development, minimizing cost to the Treasury, and maximizing managerial efficiency. The likely environmental, socioeconomic, and water availability impacts for each scenario will be identified. Completion is scheduled for early 1980.

Impact of Technology on the Competitiveness of the U.S. Steel Industry

A growing number of people have become concerned that the U.S. steel industry has lost its ability to compete with foreign steel producers, both in domestic and world markets.

At the request of the House Committee on Ways and Means, OTA is analyzing the role played by technology in the fate of the U.S. steel industry and in steel manufacture around the world. This assessment will examine the kinds of technologies now available worldwide and attempt to anticipate those that may be available during the next few decades.

For the purposes of this study, the steel industry is not being treated as a single entity. Rather, three major elements of the industry are being treated separately: integrated carbon steelmaking, non-integrated carbon steelmaking (including "mini-mills"), and alloy/specialty companies. Each category presents unique opportunities and problems for study.

The study is examining ways in which research, development, and demonstration of new steelmaking techniques are now conducted in the United States and by our major competitors. It is also exploring the incentives and barriers to the introduction of new technologies. The impacts of a variety of Federal programs and regulations (including labor regulations, environmental controls, and health and safety regulations) are also being explored. A broad range of possible legislative solutions to problems identified will be presented and their impact assessed. Completion is scheduled for early 1980.

Federal Coal Development

The administration's National Energy Plan calls for expanded domestic coal production to offset the rising prices and uncertain availability of other fossil fuels. Over one-half of the Nation's coal reserves are found in the Western States. The Federal Government owns approximately two-thirds of these Western coal reserves. In 1974, an estimated 15 billion tons of Federal reserves were under lease, seemingly more than enough to meet future demand; yet less than 50 million tons of coal per year were produced from these leases. To meet the projected goal of 1.2 billion tons of coal in 1985, domestic coal production must increase nearly 80 percent over 1976 levels. Production goals for Federal leases call for a sixfold increase to approximately 300 million tons per year in 1985. Recent uncertainties about the role of nuclear power and increased interest in large synthetic fuel production may further increase the demand for coal.

The low-production figures for Federal coal leases raises uncertainties that some leases would not begin production in time to meet future coal demand. In 1973, in response to charges of speculation and mismanagement, the Department of the Interior imposed a moratorium on further leasing. The coal industry advocates increased Federal leasing to meet projected 1985 production goals.

The Federal Coal Leasing Amendments Act of 1975, Public Law 94-377, revised the leasing system and required that most existing leases begin production by 1986 under threat of cancellation.

Section 10 of Public Law 94-377 directed OTA to conduct an analysis of all outstanding Federal coal development rights, which include over 500 leases and 200 preference-right lease applications in effect in August 1976. This assessment will analyze all mining activities on Federal

leases, determine the present and potential value of the outstanding coal development rights, estimate revenues to the Federal Government, and examine the feasibility of using deep-mining technology in leased areas. Completion is scheduled for early 1981.

SCIENCE, INFORMATION, AND TRANSPORTATION DIVISION

Telecommunication and Information Systems Program

Telecommunication and information systems technologies are rapidly advancing and becoming more integrated. New facilities are being established, new services are being planned and offered, and new enterprises are emerging in the United States and abroad. Governments are taking increased interest in the social and institutional implications of the new technologies. Governmental and industrial reorganizations are occurring, new legislation is being proposed and adopted, and relevant international norms are being formulated in global and regional forums.

Because of the unprecedented growth in new telecommunication systems investment, and the expanding impacts on society of emerging national information systems, several committees of Congress consider it essential to assess the developing technologies and their broad societal impacts. The Telecommunication and Information Systems Program comprises two core projects, one on national information systems and the other on telecommunication systems. They are being conducted on a coordinated basis.

National Information Systems

The project on societal impacts of national information systems was initiated in fiscal year 1978 to explore the issues and impacts of three broadly representative information systems–the Federal Bureau of Investigation's National Crime Information Center and its Computerized Criminal History Program, the role of the U.S. Postal Service in electronic message systems, and the impacts of emerging electronic funds transfer systems. Using these case studies, issues and impacts generic to comparable national information systems will be assessed.

Previously available only at relatively high costs, computers are now available in drastically reduced sizes, at dramatically reduced prices, and with greatly enhanced speed and capability. In this "the information age," our greatly improved capacity for generation and dissemination of information should be for the benefit of all, but there is presently little understanding of how national information systems affect society. They could bring enhanced convenience and efficiency to many services and functions of society such as mail, criminal justice, research, education, and marketing, and to personal services such as banking and shopping. However, their use could result in the deprivation of individual rights and civil liberties and could have unanticipated impacts on areas such as: employment patterns; choices in the free market; national security; international data flow; and the infrastructures of providers, users, and regulators of information services.

The information systems study is designed to assess these impacts and to define policy options. Impacts and issues raised by the three in-depth case studies will be analyzed for any general conclusions that might help Congress in its efforts to shape a coherent national policy on information systems.

This assessment was requested by the House Committees on Post Office and Civil Service and on the Judiciary and the Senate Committee on the Judiciary. A report is expected in early 1980 on the implications of the National Crime Information Center and the Computerized Criminal Histories Program. Other aspects of the study are expected to be reported on in the spring of 1980.

Telecommunication Systems

The assessment of telecommunication systems, which was begun during early fiscal year

1979, will identify and analyze new technologies and emerging services, take into account the regulatory and institutional aspects of the Communications Act of 1934, project the rate and scope of system and service growth, and explore alternative national policy frameworks for the telecommunication sector.

Telecommunication technology has been in a period of revolutionary change since the mid-1960's, and the end of new system and service innovations is not in sight. Computers, satellites, optical fibers, cable TV, and many other developments have been added to the repertoire of available electrical and radio technologies for communication at a distance (i. e., telecommunication). As new systems and services become economic, as new competing forces emerge in the marketplace, it is both timely and necessary to assess the technological changes and their impacts, including the underlying national policies which need review and assessment.

This study explores alternative choices of future national policies affecting industry structure, Government structure, and the role and consequences of competition in telecommunication services. It will also assess the underlying economic and social relationships. The focus will be on technologies and the effect of industrial institutions and Government regulation and policy on their development, introduction, manufacture, availability, cost, and use.

Requested by the Senate Committees on Commerce, Science, and Transportation and on the Judiciary, this assessment is scheduled for completion in the spring of 1980.

Applications of Technology in Space

An assessment of applications of technology in space was initiated at the request of the Senate Committee on Commerce, Science, and Transportation.

In order for OTA to properly advise Congress regarding the merits of a given application of space technology, it is necessary to compare the costs, benefits, and risks of the space approach with competing nonspace approaches. In the absence of such a comparative approach, it will become increasingly difficult for Congress to provide oversight of executive branch programs or to provide leadership in areas of perceived shortcomings or opportunities. Accordingly, assessments of applications of space technology are being addressed in the context of the specific application (e.g., energy, telecommunication, oceans). These specific applications will be explored within a broader national space policy options review and a consolidated study will be prepared.

A contract study on the institutional options for the national space program has been initiated which develops a range of scenarios for future space activities and the institutional options appropriate for them.

All the evolving space studies explore the adequacy of the space technology base and evaluate the possible needs for large space structures and for improvements in space transportation in the context of alternate applications and policy.

Transportation Program

Of major concern to Congress is the ability of the transportation system in the United States to provide fast, efficient, and inexpensive mobility for people and goods. Transportation industries have had to contend with increasing economic, operational, environmental, and safety problems in recent years. In addition, there are a number of factors, growing in importance, which may force a change of transportation policies in order to modify the system and the manner in which it is operated. These include:

- the almost complete dependence of the transportation system on petroleum in an era where dependence on imports must be reduced, and where supplies are dependent on the political stability of the Middle East;
- the rising percentage of the overall system

cost represented by the cost of petroleum fuel;
- the physical deterioration of roadbeds and equipment at a more rapid rate than that of investment in their replacement; and
- the increasing cost of operating transportation systems–both public and private, freight and passenger—because productivity has not kept pace with demand for transportation services.

Since transportation supplies society with mobility for people and the wide range of goods and services needed, a degradation in the transportation system could significantly effect the character and lifestyle of society in the future.

In 1980, congressional interest will probably continue to focus on the influence of the cost and availability of petroleum and its effect on the transportation system, the deterioration of roadbeds and equipment, and the inability of the existing system (based on yesterday's technology) to meet the economic, environmental, and social needs of the future.

The Program will center its efforts on the effects of technological development in the areas of:

- goods movement—rail and truck systems—to improve service and reduce costs;
- reduction of the dependence on petroleum through the development of electrical propulsion and energy distribution systems; and
- urban transportation—evaluation of alternatives to the automobile to reduce petroleum consumption, emissions, and congestion.

Automotive Fuel-Efficiency R&D and Alternative Energy Sources

The study will examine new or improved technologies for possible use in automobiles and trucks during the period 1985-2010 that would contribute to greater fuel economy. Included in this study will be an examination of the prospects for widespread introduction of electric and hybrid vehicles.

A second part, conducted in parallel by the Energy Program, will examine the potential for producing fuels from sources other than conventional petroleum obtained from primary and secondary recovery from domestic oilfields. The resource base for these alternate fuels and the technologies and time needed to produce them will be reviewed. In addition, the study will determine the economic and environmental costs of production and assess the fuels' potential contribution to the Nation's energy supply.

The results of these two lines of investigation will then be merged, to assess expected benefits and costs of each as near- and far-term solutions to the problems of dependency on imported petroleum. The cost and time needed to achieve increased automotive fuel economy will be compared with that of the development of alternative motor fuels.

One of the initial activities of this assessment was a 3-day workshop held in September 1979 to which automotive experts from industry and universities in the United States, West Germany, and Japan were invited to review the potential for fuel-efficiency improvements in engines and vehicle systems, materials, electronics, and electric and hybrid vehicles. A report on this workshop was published in the latter part of 1979.

Impact of Advanced Air Transport Technology

Acting on a request by the House Science and Technology Committee and the Senate Commerce, Science, and Transportation Committee, this study was initiated in late *1979.* The assessment examines the economic, energy, environmental, safety, and societal impacts of advances in the technology of transport aircraft of all types, both passenger and cargo. It also examines the potential impacts of the expected growth in air traffic for the next several decades and considers various options that may be appropriate for both managing and financing new aircraft which may satisfy the expected growth. An important portion of the assessment is the role of the Federal Government in R&D in aeronautics and civil aviation technology. The study is scheduled for completion in the spring of 1980.

Airport and Air Traffic Control System

One project under consideration for initiation in 1980 and completion in 1981 is an assessment to identify and analyze the airport and terminal area capacity problem for the Nation and the associated public investment decisions. This assessment will include an examination of the airport access problems and air traffic control and of alternative ways of alleviating these problems of future air travel.

Oceans Program

Recent years have brought an increased awareness of the impact of the oceans on the well-being of humankind—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 search for knowledge about his resources and environment. At the same time, we are beginning to understand that, although the oceans are vast, they are not inviolate to the interventions of man. Much more needs to be understood about the effects of such occurrences as oilspills, overfishing, the discharge of toxic substances, and the role of the oceans in atmospheric carbon dioxide concentrations.

The United States, with a heavy marine interest, predicates its policies on facts derived from comprehensive ocean research. This effort is becoming increasingly more expensive as demands become more extensive. As a result, the job of Congress in determining the most effective allocation of Federal resources, both financial and institutional, has become more difficult and more critical.

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

Radioactive Waste Management and Disposal

Although the United States is more than three decades into the nuclear age, nearly all of the high-level radioactive waste generated by weapons manufacture and by the operation of commercial nuclear powerplants is still in temporary storage. Continued delay in developing and implementing a radioactive waste disposal system might significantly limit the future use of nuclear power, whereas hasty action, if it were to lead to serious mistakes, might undermine public confidence in the Federal Government's ability to dispose safely of radioactive waste. While many technological solutions to the problem have been proposed, experience has shown that considerations focused solely on the technology are not enough.

A clear understanding of the problem of managing radioactive waste from its generation to final disposal requires comprehensive analysis of the interactive relationships among possible storage and disposal technologies, transportation systems, regulatory considerations, and Federal, State, and local jurisdictional prerogatives. The OTA study uses systems analysis techniques to evaluate a range of strategies for developing and deploying a commercial high-level radioactive waste disposal system. The study is intended to provide a framework not only for synthesizing existing information about proposed technological options for dealing with radioactive waste, but also for examining the interrelationships between technical and nontechnical considerations.

This study was requested by the House Committees on International Relations, on Merchant Marine and Fisheries, and on Science and Technology, and the Senate Committees on Commerce, Science, and Transportation and on Energy and Natural Resources, as well as the National Ocean Policy Study. The project is expected to be completed in the summer of 1980.

Ocean Research Assessment

This study examines future needs and capabilities of technologies used to conduct oceano-

graphic research supported by Federal funds. The request from the Senate Commerce Committee said it would like to know how the Federal Government is using the equipment it has and how it is preparing for future uses. The Committee also would like to know if our capabilities will meet the most urgent national needs; if there are opportunities for improvements in technology or management, or for savings in money; and if better, more efficient systems could be developed.

The study will evaluate the technologies used by the Federal Government in ocean research: ships, submersibles, aircraft, satellites, unmanned platforms such as buoys—and the equipment used to make scientific measurements. Eight Federal agencies have major activities in ocean research: the National Oceanic and Atmospheric Administration, the Navy, the National Science Foundation, the National Aeronautics and Space Administration, the Coast Guard, the Environmental Protection Agency, the Department of the Interior (U.S. Geological Survey and the Bureau of Land Management), and the Department of Energy. The total Federal ocean program costs over $1 billion a year and a large portion is spent on the technology to be addressed by this study.

A principal objective of this study will be to provide Congress with a comprehensive view and a coherent structure for evaluating the many new plans, proposed programs, and funding requests for ocean research. In addition, it is expected to present options for providing technical capabilities to conduct ocean research and more cost-effective methods for coordinating or consolidating Federal activities.

Several categories of ocean research efforts are directed towards addressing major national problems. These problems reflect the growing need not only for management of ocean activities and resources, but also for improved ocean research technology. Congress has recognized and responded to these problems through legislation establishing mandates for specific types of monitoring and research. Four research areas, which this study will examine to identify technological needs, are: weather and climate, marine pollution, ocean minerals and energy sources, and fisheries (and other living resources). The study is scheduled for completion in the summer of 1980.

Fresh water Resources Management, Planning, and Policy

The study, “Freshwater Resources Management, Planning, and Policy: An Assessment of Models and Predictive Methods, ” will summarize the numerous current and proposed models and predictive methods in the water resources field and determine their effectiveness as decision-making tools. As the Nation’s water problems become more complex, the often conflicting advice presented to Congress by the Federal agencies, advocacy groups, and expert witnesses is increasingly difficult to evaluate. Often this advice is based on the results of computer models and predictive methods of unknown quality or effectiveness. The critical need for an examination of the merits and disadvantages of the range of available techniques has been expressed in testimony before Congress by many distinguished panels of experts considering future water research priorities. OTA will advise Congress on the current and future capability of these tools to supply needed analyses to water resource managers, planners, and policy makers.

Specifically, the credibility and efficacy of major waste resource models will be examined in three broad subject areas: physical-ecological, socioeconomic, and integrative. Physical-ecological models are concerned with water supply prediction, the movement of materials through the environment, and effects on living systems. Topics in the socioeconomic category include future water use predictions, economic evaluation, and risk analysis of flood and drought. Integrative methods are a combination of the physical-ecological and socioeconomic approaches. For instance, integrative methods may be used to determine areawide development policies in watersport regions of the country. The assessment will also identify legal and institutional barriers to implementation, future research needs, and possible Federal Government roles.

This assessment was requested by the House Interior and Insular Affairs Committee, and was endorsed by the House Science and Technology Committee and the Senate Energy and Natural Resources Committee. The study is scheduled for completion in the late summer of 1980.

National R&D Priorities and Policies Program

The National R&D Priorities and Policies Program assists congressional deliberations addressing the use of science and technology to achieve national goals. More specifically, the Program provides analytical support to Congress in dealing with broad cross-cutting issues stemming from or common to several technologies as opposed to assessing an individual technology.

Technological Innovation and Health, Safety, and Environmental Regulation

This assessment was requested by the Senate Committee on Commerce, Science, and Transportation as part of the Committee's review of Federal policies affecting industrial innovation.

The issues addressed are:

1. whether regulation is effective or not in tapping the innovative resources of the private sector to reach health, safety, and environmental objectives, e.g., safer chemicals and nonpolluting industrial processes; and
2. whether, for a given level of protection, regulation creates unnecessary barriers for innovations to meet market demands.

The latter issue is important because innovation is a major source of economic growth, increased productivity, and exports.

This assessment will ascertain whether existing regulatory policies create problems, as defined here, and, if so, develop alternative policies for dealing with them.

To derive practical policy consequences from such a broad subject, the assessment has been organized around three sectoral studies:

1. effects of product regulation on innovation in pesticides and chemicals;
2. effects of emission, safety, and fuel economy regulations on innovation in the automotive industry; and
3. effects of regulation to control air and water pollution on innovation in industrial processes.

In addition, the effects of regulation on indicators of aggregate economic performance—gross national product, productivity, etc.—will be examined in order to formulate the issue of regulation's effect on future economic vitality through its effects on innovation. An analytic framework of alternative regulatory mechanisms will also be developed to delineate the role of innovation concerns in the broader range of concerns that determine the selection and implementation of regulatory programs. The study is scheduled for completion in the summer of 1980.

An Assessment of Technology for Local Development

The study was requested by the House Committee on Science and Technology and the House Select Committee on Population. It is concerned with those technologies that are designed to:

1. help meet tasks or needs as identified by the local community, and
2. utilize to the greatest degree possible renewable resources.

The study will assess the availability, feasibility, and impacts of several such technologies, the institutional supports necessary to develop and apply them. It will weigh the impacts, both positive and negative, of these technologies.

The project is based on case studies of specific technology areas and applications. It also includes a study of the history of Federal interest in appropriate technology to date; a study of relevant Federal, State, and local policies; and a study of the financing mechanisms which encourage or hinder the use of those technologies. The study is scheduled for completion in the spring of 1980.

The Impact of Inflation on the Federal R&D Investment

The United States will invest $31.2 billion in R&D activities in fiscal year 1980 to support the missions of various executive agencies, to ad-

vance our knowledge of basic science, and to stimulate innovation. In April 1979 the House Science and Technology Committee held hearings to review the Federal R&D budget. Their inquiry found little agreement on how inflation should be treated in the Federal R&D budget process and conflicting practices in accounting for inflation in budgeting for R&D among the executive agencies. The Committee's appraisal of the Federal R&D investment was hampered by a lack of understanding of how inflation affects the Nation's R&D efforts.

The OTA study will assist the House Science and Technology Committee in its appraisal of the Federal R&D investment by providing the Committee an understanding of:

- the response of the Federal R&D budget process to inflation, and
- the impact of inflation on the performers of federally funded R&D.

The project will be conducted in two parallel tasks. Task 1 will establish an understanding of the differences and similarities among the executive agencies in dealing with inflation in their R&D budget processes and Task 2 will address the question of the consequences of inflation for the performers of federally funded R&D. The study is scheduled for completion in early 1980.

HEALTH AND LIFE SCIENCES DIVISION

Food and Renewable Resources Program

As with energy and many other natural resources, until recently Americans took for granted that our supply of renewable resources—foods, soils, forests, water, and wildlife—was inexhaustible. But no resource is immune to the mounting pressures of our modern age; it is possible to stress even these self-renewing resources. With this in mind, and with growing congressional interest in renewable natural resources, OTA's Food Program broadened its scope and in April became the Food and Renewable Resources Program.

Food is a major concern. In today's world of 4 billion people, perhaps as many as 10 percent are suffering from malnutrition and, in some cases, starvation. And the global population will rise to 6 billion by the year 2000. Consequently, world food demands will continue to rise. How can technology contribute to the solution of food problems?

Economic and environmental pressures in the United States are affecting the nature of our agricultural base. We are losing some of our best soils to unacceptable rates of erosion. Competing uses tax our water resource, and affect its availability and quality. What are the new technologies that can help us sustain the land's natural productivity, and maintain water quality?

To provide Congress with information on these and other related problems, the Program identifies current and emerging technology issues that affect the U.S. and world food and renewable resources situation as well as issues affecting the renewable natural resource base.

The food studies are organized around three functional areas: 1) production including all resources required to produce agricultural products and get them to the farm gate; 2) marketing, consisting of processing, wholesaling, and retailing; and 3) consumption and nutrition, both in and out of the home.

Future renewable natural resource studies will fall into one or more of the following categories: land and soils; forests and other vegetation; ground and surface water; wildlife; and the interrelationships of these and how they might be maintained, restored, or improved through wise application of technology.

Impact of Technology on Productivity of the Land

This assessment is concerned with the sustainability of the primary productivity of our land.

Were it not for technological advances, world agriculture would never have been able to keep

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pace with world population growth thus far. Historically, U.S. technology, in particular, has had a pronounced positive impact on increasing the productivity of croplands and grasslands. Our dependence on a continuing supply of renewable natural resources and on maintaining stable ecological systems from which the resources are drawn is emerging as a key element in our country's future. Now, however, there is increasing evidence showing that parts of the natural biological and physical systems are being overburdened by human activities and that the land's productivity is in jeopardy.

The land productivity study will focus on the present use of technologies and their beneficial and adverse effects, and on emerging and new technologies that might be used to offset adverse effects derived from some present technologies. The assessment will include an evaluation of: 1) the adequacy of present data on our land's productivity and gaps in our knowledge base and 2) new or emerging technologies that may have potential for restoring, maintaining, and improving land productivity, especially croplands and rangelands. Selected case studies will be prepared that show how society is affected directly and indirectly as the land's ecological systems are altered through applications of technology.

This study **was** initiated in November 1979 and was requested by the Senate Committee on Environment and Public Works. Expressions of support were received from the House Committee on Agriculture, the Senate Committee on Appropriations, and the Subcommittee on Parks, Recreation, and Natural Resources of the Senate Committee on Energy and Natural Resources, and is scheduled for completion in late 1980.

U.S. Food *and Agricultural Research*

The success of U.S. food and agriculture industries has been based on an ever-increasing use of new technologies. However, the effectiveness of these technologies and/or their development seems to be decreasing at a time when areas requiring research are expanding and the intensity of some traditional problems, such as soil erosion, is increasing. The principal creators of new food and agriculture technologies in the United States are Agricultural Research, the U.S. Department of Agriculture (USDA); State agricultural experiment stations (SAES) of land-grant universities; and private food- and agriculture-oriented industries. Historically, USDA has been more concerned with problems of national and regional importance, and SAES with problems of a local and state nature. Yet often USDA and SAES work on problems that seem indistinguishable. In addition, the administration has attempted to reduce funding in certain areas in the hope that the private sector will provide the needed research.

Congress and others have shown concern over how research priorities are developed and how time and funds are allocated among various research activities, as well as over what appears to be a lack of overall research planning especially at the top levels of administration. These concerns have prompted numerous studies, but none has addressed specifically what needs are best addressed by what research branch. Which research problems should be dealt with at the national, regional, or local level has never been determined on a scientific basis. Moreover, the roles of the various actors—Federal agencies, State experiment stations, and private industry– are not well-defined.

This assessment will: 1) examine the scientific base for establishing national, regional, and local research problems; 2) identify the role of Federal, State, and private research institutions in developing technologies for solving national, regional, State, or local problems; 3) evaluate methods by which the expertise and interests of the Federal, State, and private research organizations can be used in a cooperative manner to identify priority research areas and the role of each actor in solving these priority problems; 4) update evaluations of the adequacy of present research efforts as related to research priorities for basic, applied, and developmental research; and 5) evaluate public policy options for Congress that will maximize our research potential.

The Senate Committees on Appropriations and on Agriculture, Nutrition, and Forestry have requested this assessment. In addition, the House Agriculture Subcommittee on Department Investigations, Oversight, and Research has endorsed this request. The assessment is scheduled for completion in the spring of 1981.

Genetics and Population Program

The Genetics and Population Program was created to accommodate the increasing interest in these subjects in recent years. Interest in genetics arises from greatly expanded understanding of, and emerging capability for, altering or affecting, the inherited characteristics of man, animals, and plants. The term "genetics" is used broadly and includes related biological technologies such as in *vitro* fertilization and artificial insemination. The importance of these emerging technologies is illustrated by the concern of the scientific community and the public over research with recombinant DNA which led to development of the National Institutes of Health guidelines, the increasing use of procedures to detect genetic defects, and the recent successful human in vitro fertilization.

Rapidly growing population is a major factor influencing the quality of life everywhere. World population did not reach 2 billion until 1930, but only 45 more years were required to double it. Such rapid growth has placed great stress on the Earth and its resources as well as on economic and political stability, especially in those developing countries where population growth rates are highest. Increasing recognition of the importance of the rights of individuals both to have children and to choose their number and spacing is illustrated by rising support for family-planning programs over the last 25 years. Prior to 1965 only a few third-world countries officially supported family planning whereas by 1979 all but a few third-world countries had developed such policies.

Two assessments are underway: one on the impacts of applied genetics; the other on technology and world population. Both subjects are of unusual interest because of the central importance of many of the issues they raise to individual and societal values, attitudes, and beliefs.

Impacts of Applied Genetics

This assessment is concerned with nonhuman applications of genetic technologies. It is expected that a subsequent study will be proposed to the Board for assessment of applications of genetic technologies to humans.

To date the Federal Government has been primarily concerned with one technology, recombinant DNA, and one issue, containment of new and possibly harmful organisms. Little attention has been given to other technologies, such as cell fusion, or to other issues, such as costs and benefits and social and ethical questions.

This assessment is concerned with a range of technologies and their application to animals, plants, and micro-organisms (single-cell preparations). Single-cell applications are an especially rapidly growing area and the study will look at the use of such preparations to produce chemicals, pharmaceuticals, and food products. Some examples of issues to be considered include:

- the potential of genetic technologies to produce plants resistant to environmental stress;
- the relationship between Government regulation of research, freedom of scientific inquiry, and public risk;
- ownership of new life forms with commercial value, incentives for R&D, and distribution of benefits; and
- the potential contribution of genetically engineered organisms to easing energy and resource shortages and, more generally, to developing a sustainable society.

For each application, the state of the art will be described and alternatives to genetic approaches will be identified and characterized. Factors likely to promote or impede further development of genetic technologies will be described. The environmental, political, and social impacts of the technologies will be analyzed and appropriate policy options discussed.

The assessment is of interest to Senate and House committees with responsibility for agriculture, commerce, health, science and technology, and judicial issues. Expressions of support for the study were received from the House Committee on Interstate and Foreign Commerce and the Senate Committee on Human Resources. Congressional interest in this subject as an OTA assessment area dates back to September 1976 when 36 House Members requested an assess-

ment of recombinant DNA technologies. The assessment is scheduled for completion in the autumn of 1980.

Technology and World Population

This study, initiated in June 1979, will examine the causes and consequences of world population growth, with special attention to planned-birth technologies, national governmental actions, and U.S. international assistance.

The status of scientific understanding of the physiology of human reproduction and the characteristics of technologies to alleviate infertility and to control the number and spacing of births will be described. Of particular concern are the cultural factors affecting acceptability and use of these technologies throughout the world during the period 1960-80. New technologies which could reach the market during the period 1980-2000 will be identified and characterized, and a comparison of the consequences of world population growth during 1980-2000 and beyond under different assumptions about population planning and growth will be prepared. Policy issues that national governments may face in dealing with population growth during this same time period will be identified, and a research agenda will be prepared.

This study is primarily concerned with the less developed countries where infertility is often frequent and where, at the same time, population problems associated with fertility are particularly acute. For this reason, and because of the wide interest in world population, special attention has been given to development of advisory mechanisms for this assessment. In addition to a 17-member advisory panel to provide general oversight and review of the project, two other groups have been organized. A world roster of approximately 100 experts, half from less developed countries, will review and critique project products before the same products are reviewed by the advisory panel. A liaison group with representatives from executive branch agencies and national and international organizations in the population field has also been formed. This group will help the OTA staff and the advisory panel keep abreast of the many activities underway in the population field.

Congressional interest in domestic and international population issues is shown by the large number of population-related bills and resolutions introduced each session and the number of committees having jurisdiction in population-related areas. Fifteen standing committees in the House and Senate have population policy responsibilities during the 96th Congress. Issues to be taken up in this assessment are of particular interest to two of the committees: House Foreign Affairs and Senate Foreign Relations, which have written letters of support for this study. Completion is scheduled for late 1980.

Health Program

The value placed on health by the American people is reflected in the large number of Federal policies designed to assure health. Many of these policies directly address issues of health-related technology; a great many others indirectly affect the development and use of such technology. As a result, the Federal Government has become deeply involved in every aspect of medical technology—from R&D to regulating its spread into widespread use, from assessing its effects to encouraging abandonment of unsafe or obsolescent technologies. In turn, medical technology and its effects exert considerable influence on the Federal Government in areas such as fiscal policy.

The Health Program assists Congress by: 1) examining the Federal role in anticipating and managing domestic and international impacts of health-related technology; 2) identifying and highlighting the social, political, economic, and ethical concerns surrounding the development and use of medical technology; 3) examining evidence of the benefits and risks of particular medical technologies; and 4) assessing the consequences of Federal policies involving the provision of and payment for particular medical technologies.

The work of the Health Program up to now has focused on two areas: 1) methods of eval-

uating clinical medical technologies and 2) evaluation of computers in health care. However, although health may be viewed as being determined by four factors (genetics, personal behavior, environment, and health care), those two issues related almost exclusively to only one of the four—health care. The area of genetics is the responsibility of another OTA program, but little work has been done by OTA in the other two areas. Because of this fact, in 1978 it was decided to initiate studies concerning health and the physical environment. The first study is examining cancer and the environment. In addition, the Health Program is working with other programs on aspects of their assessments where health effects may be an important factor. For example, the Program has taken responsibility for developing information on the health effects of synfuel programs as part of an assessment being carried out by the Materials Program.

Cost= Effectiveness of Medical Technologies

Increased use of medical technologies are a prime factor in rapidly rising health care costs and these costs consume an increasingly greater share of the country's resources. Answers need to be found to questions on the relative contribution or benefit of the various medical technologies, whether they are drugs, devices, surgical procedures, or systems technologies? Are the resources spent on health care being allocated in the most rational manner? Does the patient have any voice in the spending decision?

Cost-effectiveness analysis is often suggested as a way to help allocate health resources more rationally. Such analysis compares the costs of alternate ways of attaining specified goals or results. There is growing pressure to make cost-effectiveness a prime consideration in deciding whether to adopt particular medical technologies.

This assessment, requested by the Senate Committees on Labor and Human Resources and on Finance, is examining the social costs and benefits of potentially widespread use of cost-effectiveness analysis and cost-benefit analysis in health care decisionmaking. In addition to a report addressing the above issues and setting out policy options, the assessment will produce a methodology and literature review; a report of an international comparison of use of cost-effectiveness analysis and other mechanisms for managing medical technology; and about 20 case studies of specific medical technologies. The assessment is expected to be completed in late spring of 1980.

Technologies **for Forecasting Physician** *Supply and Requirements*

Reauthorization of the Health Professions Educational Assistance Act is scheduled for 1980. Essentially, the Act reflects Congress' policies toward medical and other health professions education support and toward identifying and addressing the problem of rural and urban areas that lack adequate medical care. Forecasts of future requirements for physicians in the United States are needed by Congress to help determine its policies in the next decade.

Estimates of the distribution of physicians by specialty and geographic location, as well as aggregate numbers, are necessary for this task. Several models have been developed and used to predict both the supply of and requirements for physicians. However, these forecasting methods can yield very different estimates, and considerable debate surrounds the interpretation of these results, leaving Congress in doubt about their implications.

Consequently, the Senate Committee on Labor and Human Resources and its Subcommittee on Health and Scientific Research have requested assistance in interpreting different forecasts of physicians' supply and requirements. The House Committee on Interstate and Foreign Commerce and its Subcommittee on Health and the Environment have also expressed support for the request.

The assessment will consist of three tasks:

1. Specification of forecasting *models.* Explicit assumptions used in the models, as well as the results, will be compared in a quick reference format.
2. *Technical review of models.* The results of each model will be compared to ascertain the relative importance and weighting of

model components and underlying assumptions.

3. *Implications of predictive models.* The implications for policy of relying on different models will be considered. The effects of changing the assumptions underlying the estimates for the aggregate number, the number of primary care physicians, and the geographic distribution of physicians will be analyzed.

The assessment is expected to be completed in the spring of 1980.

Technologies for Determining Cancer Risks From the Environment

Prevention of cancer has become a prominent aspect of public health thinking during the past 20 years. Reducing exposure to agents that cause cancer requires the identification of causative agents, assessment of their potency, and location of sites of exposure. In addition, regulations to reduce exposure must be politically and socially acceptable.

The assessment will include the following parts:

- *Assessment of the estimates of cancer risk* from different exposures. Estimates of the percentage of cancers caused by environmental factors vary widely: the most commonly quoted range between 60 and 90 percent. Different data sources and different methods for making projections have produced divergent estimates for the risk from each component of human environment—the air and water, the workplace, radiation, personal habits, and diet. The data sources, the methods, and the use of the estimates in public policy discussions and decisionmaking will be examined and compared.
- *Assessment of cancer-testing technologies.* Technologies used by the Federal Government and the private sector for the identification of carcinogenic chemicals will be analyzed. Recent initiatives and alterations in the carcinogen-testing policies of the Federal Government, and heightened interest in short-term tests for carcinogenicity make this study particularly timely.
- Assessment of extrapolation techniques. Carcinogenic chemicals are tested in animals and lower life forms. The assessment will analyze existing and potential methods that may be used to translate test results into estimates of potential human hazard. Issues and controversies regarding these methods will be examined.
- *What is "unreasonable risk?"* If science were perfect, and society knew that a chemical caused a number of cancers, society might still have a problem. If the chemical is essential and, at the same time, a risk, what should society do? The Federal Insecticide, Rodenticide, and Fungicide Act as well as the Toxic Substances Control Act require that the Administrator of EPA decide a chemical is an unreasonable risk before moving against it. Unreasonable risk can be defined from a number of perspectives including public health, legal, economic, and ethical. Comparing, contrasting, and merging these views will provide a useful foundation for policy decisions about risk.

The House Subcommittee on Health and the Environment and the Senate Subcommittee on Health and Scientific Research sent letters of endorsement for the assessment. The Senate Committees on Commerce, Science, and Transportation and on Agriculture, Nutrition, and Forestry have also expressed support. The assessment is expected to be completed in late 1980.

Section IV
OTHER SERVICES FOR CONGRESS

In addition to major assessments, OTA provides a wide variety of special responses to congressional needs, including testimony, briefings, technical memoranda on current issues, workshops, and responses by phone or mail to requests for specific information.

This sect ion describes some of these short-term responses.

Section IV
OTHER SERVICES FOR CONGRESS

Through its comprehensive, long-term assessments of some of the most enduring and complicated issues facing the country, OTA has—during its 5 years as an operating agency—built up a broad base of expertise and information which it taps for a range of special responses to current congressional needs. For example, because of the knowledge it had acquired through specific assessments, OTA was called on to testify more than 20 times before congressional committees in 1979. Reflecting the fact that energy was among the most dominant congressional concerns, OTA testified 15 times on energy issues alone.

OTA's special responses to congressional needs fall into three basic categories:

1. Spinoff studies in which OTA draws on knowledge and insight derived from earlier or ongoing major assessments. These may take such forms as congressional testimony, brief technical memoranda (relatively short analyses on specific subjects covered in larger assessments), or staff briefings.
2. In-process reports, which draw on specific elements of an ongoing study. Often a long-term study can be organized into a series of tasks, each of which can constitute an interim output useful to Congress. Generally these responses take the form of a technical memorandum.
3. OTA also provides limited services in which the Office serves as an arbitrator or expert witness concerning technical matters on which conflicting testimony has been presented to Congress.

The technical memorandum is a new form of communication with Congress, initiated in 1979, in an effort to make the results of OTA's longer and larger studies available in a more timely fashion. OTA issued two technical memoranda in 1979: *Gasohol* and the Benefits of Increased *Use of* Continuous Casting by *the U.S. Steel Industry.*

Gasohol

In October 1979, OTA delivered a 71-page technical memorandum on Gasohol to requesters, Senators Wendell Ford and Frank Church, both members of committees and chairmen of subcommittees with gasohol responsibilities. This memorandum was an interim product of the OTA *Energy From Biological* Processes report scheduled for delivery to Congress in early 1980. (Gasohol is a mixture of one part ethanol, commonly known as "grain alcohol" or beverage alcohol, and nine parts unleaded gasoline.)

The gasohol memorandum looks at the potential for gasohol and the major technical, economic, environmental, and social factors involved.

Some of its key points are:

- *In the* 1980's, OTA *estimates that 1 billion to 2 billion gallons of ethanol per year* (10 billion to 20 billion gallons of gasohol, *enough ethanol to displace 1 to 2 percent of the current gasoline consumption of 110* billion *gallons per year) can be produced without a significant impact on food prices.* Perhaps more can be produced, but it is not known how much new cropland can actually be brought into production without inflating farm commodity prices.

  In the 1990's, the land available for the production of crops for uses other than food, feed, and fiber is likely to drop. Maintaining a large fuel ethanol industry (several billion gallons per year) will probably require shifting to grasses, crop residues, wood, and municipal solid waste as feedstocks.
- The effectiveness of gasohol as a substitute for premium fuel (oil and natural gas) depends on: 1) the fuel used at the distillery and 2) whether the ethanol is used as an octane booster. If *distilleries are fueled with coal or solar energy (including biomass) and the octane of the* gasoline *blended* to gasohol is lowered *to exactly* compensate *for*

ethanol's octane-boosting effect, then nearly 1 gallon of gasoline and natural gas energy *equivalent* is *displaced by each gallon of ethanol used (i. e., for every 10* gallons of gasohol), On the other hand, if the ethanol is produced in an energy-inefficient distillery fueled with oil or natural gas, and the ethanol is used to produce a fuel of higher octane than would otherwise have been produced, then the use of gasohol could result in an increased consumption of oil and the energy equivalent to natural gas.

- Depending on the method of financing, distilleries should be able to sell ethanol (from $2.50/bu. corn) at between $0.91 and $1.11 per gallon plus delivery (currently $0.10 to $0.30 per gallon for service stations outside the distillery's immediate locale). With the current Federal subsidy at $0.04 per gallon of gasohol–$16.80 per barrel of ethanol—gasohol is competitive with gasoline at today's ethanol production costs and gasoline prices.
- The environmental effects of producing gasohol feedstocks are those associated with conventional farming: increased soil erosion and pollution of ground water with nutrients, pesticides, and herbicides. However, these impacts may be magnified since the average quality of marginal cropland is less than that of current cropland. The environmental impacts of a 50-million-gallon-per-year coal-fired distillery would be similar to those of a 50 MW coal-fired electric-generating plant. The effects on automotive emissions of using gasohol are mixed and cannot be unambiguously classified as good or bad.
- If the demand for fuel ethanol increases beyond the supply of feedstocks, competition between energy and food uses of land could result in more rapidly rising food prices and, eventually, more rapidly rising land prices. Low- and middle-income groups would bear the greatest share of these costs because food and fuel costs are a greater portion of their expenses. Furthermore, historic experience indicates that rising land prices would absorb much of the farmer's profit.

If market imbalances are avoided, the overall social and economic impacts of fuel ethanol production could be positive. On-farm and distillery employment could help to stabilize those rural communities that are currently experiencing unemployment problems.

Benefits of Increased Use of Continuous Steel Casting by the U.S. Steel Industry

In October 1979, OTA delivered a technical memorandum on the Benefits of Increased Use of Continuous Steel Casting by the U.S. Steel Industry to requesters, Senator John Heinz; Representative Joseph M. Gaydas, Chairman of the Congressional Steel Caucus; and Representative Charles A. Vanik, Chairman of the Subcommittee on Trade of the House Committee on Ways and Means. This memorandum was an interim product of the U.S. industrial competitiveness project. (Continuous casting is the use of an open-ended mold to cast an indefinite length of solid steel; it is a one-step technology which replaces a much more complex process.)

The memorandum first describes continuous casting, contrasting it with the older ingot casting process. It then explains the advantages of the continuous casting process, contrasts the rate of adoption of this technology in the U.S. steel industry with that in foreign steel industries, and examines the level of continuous casting that the United States might reach in 1990. The factors that have constrained the greater adoption of continuous casting in the United States are briefly discussed and the economic costs and benefits of converting existing capacity to this new process are analyzed.

The memorandum does not discuss the more advanced technologies for steelmaking that would be applicable only in the longer term. Nor does it analyze congressional policy options that could help the U.S. steel industry to improve its technical and economic performance, These analyses will appear in the complete steel assessment.

Some of the key points of the memorandum are:

- For integrated steelmaker, the most important technological change in prospect over the next 10 years is the greater adoption of continuous casting. Continuous casting is the preferred choice in new steelmaking plants, although there are still some types of steels that have not been converted from the older ingot casting method to continuous casting.
- The U.S. steel industry has fallen behind almost all other steel industries in the adoption of continuous casting although the process saves energy, produces less scrap, boosts labor productivity, and increases domestic steelmaking capacities. For example, in 1978 the Japanese made about 50 percent of their steel by the continuous casting method, the European community 29 percent, and the United States only 14 percent.
- OTA's analysis indicates that the overall economic benefits of continuous casting justify its greater adoption. A key question is how much continuous casting could and should be adopted by the U.S. steel industry, and in what time frame? OTA's conclusion is that to achieve a minimum of cost and technological competitiveness with foreign producers, 50-percent continuous casting for the whole industry is needed by 1990. This goal of 50-percent continuous casting appears feasible. However, even though returns on investments could be approximately 20 percent or greater, there is probably insufficient capital now and in the foreseeable future, given present price levels, import levels, and Government policies, to finance the achievement of this goal.

Workshop on R&D and Auto Fuel Efficiency

In September 1979, OTA conducted a 3-day workshop on the needs and opportunities for R&D in auto fuel efficiency. Jointly sponsored with the Senate Commerce and House Science and Technology Committees, this workshop brought together some of the most knowledgeable technical people from this country and abroad to look at the prospects for technological improvement in six basic areas of auto engineering and to assess the comparative advantages and disadvantages of those prospects.

The Health Program: An Example of Interactions Between OTA and Congress

A complete description of all the short-term interactions between OTA and Congress would be both long and repetitive. The following profile of the interactions between the Health Program people and Congress during 1979 is presented as a typical example of the interactions all OTA programs have with Congress.

Briefings, Testimony

The Health Program maintains close relationships with four committees of Congress: Senate Committee on Labor and Human Resources, Senate Committee on Finance, House Interstate and Foreign Commerce Committee, and House Ways and Means Committee. These four committees have jurisdiction over the major health care and public health programs, including all of those in the Department of Health, Education, and Welfare (HEW). Program staff members meet with staff of these committees periodically to discuss present and emerging issues and future legislative concerns. During 1979, the Health Program staff held 11 formal meetings with committee staff.

At the completion of each health project, the staff of the four committees is offered a formal briefing.

In the planning of the assessment of technologies for determining cancer risk from the environment, in addition to the four committees listed above, the following committees were visited: House Science and Technology; Senate Agriculture, Nutrition, and Forestry; Senate Commerce, Science, and Transportation; and Senate Environment and Public Works. All of these committees are kept informed about progress in the study .

On March 12, staff from the Health Program briefed Congressman Andrew McGuire and his staff, at their request, on issues concerning health promotion and disease prevention.

On March 16, staff discussed toxic chemicals and problems of their disposal with Congressman Blanchard and his staff, at the Congressman's request.

On April 4, staff of the technologies for determining cancer risk from the environment assessment testified in hearings before the Subcommittee on Investigations of the House Committee on Post Office and Civil Service.

Staff of several committees expressed interest in an update of the 1978 CT scanner report, covering the areas of distribution of CT scanners and Federal policies toward scanners.

Finally, the Program has continual informal contact with congressional staff. These focus primarily on issues concerning medical technology and cancer causation. For example, when the Nobel prize was awarded to the developers of the CT scanner, several congressional staff called to learn more about the scanner. In addition, whenever a Congressman makes a speech or floor statement indicating interest in an area under study by OTA, the Health Program staff provides it.

The Program also attempts to maintain close liaison with its "sister" congressional agencies. Program staff contact the Congressional Budget Office (CBO), the Congressional Research Service (CRS), and the General Accounting Office (GAO) at the onset of any assessment to share information and to ensure cooperation. Program staff meet periodically (about once every month or two) with GAO staff to discuss projects underway and future plans.

Workshops

As part of the development of a case study of the cost-effectiveness of psychotherapy, two workshops were held to identify central issues in the current debate **about** mental health services and to ensure balanced treatment of the current state of research. In addition to outside experts, a number of congressional staff participated in various aspects of the workshops (from the Senate Committee on Finance, the House Interstate and Foreign Commerce Committee, the House Select Committee on Aging, GAO, and CBO). Workshop panelists reached consensus on a number of issues, including the importance of establishing the cost-effectiveness of psychotherapies and whether it is possible to do so, given particular mental health problems and therapies.

Other Activities

The Health Program manager has had ongoing contacts with the Director of the Health Policy Forum, a privately funded educational seminar for Washington, D. C., health policy makers, including congressional staff.

A senior program member has participated for the past year in a program on pharmaceutical R&D. Administered by the Institute for Alternative Futures. The program involves a series of seminars for congressional staff.

In addition, the Health Program maintains close contact with other agencies and programs that may present information to Congress in areas of our expertise. In particular, the Program has assisted the Institute of Medicine in developing its own activities in medical technology and consulted with a number of HEW agencies and commissions on issues concerned with medical technology.

Other Special Responses

Following is a small sample of special OTA congressional interactions, other than testimony, during 1979:

Briefings

- For members of the Congressional Steel Caucus, Representative Adam Benjamin, Jr., Senator John Heinz, and several other interested committees and members on the OTA assessment, "The Impact of Technology on the Competitiveness of the U.S. Steel Industry. "
- For staff of the Senate Banking Committee on the OTA study, "Technology and East-West Trade."

- For staff in the Speaker's Office on the status and prospects of oil shale.
- For several House committee staff members on the OTA study, "Environmental Contaminants in Food ."
- For several Senate and House committee chairmen and their staffs on the OTA assessment, "Technology and World Population ."
- For Senate and House health staff on the vaccine report.
- For several Senate and House committee chairmen and their staff on the OTA assessment, "Impacts of Applied Genetics. "
- For counsel of the House Subcommittee on Oversight and Investigations which is conducting hearings on polychorinated biphenyl contamination, on the "Environmental Contaminants in Food" assessment.
- For the Chairman of the Subcommittee on Science, Research, and Technology, House Committee on Science and Technology on the telecommunications study.
- For Senate Committee on Government Operations staff concerning administration-proposed Institute for Scientific and Technological Cooperation (ISTC).
- For Congressional Clearing House on the Future, Management of *Technology in* a *Democratic Society.*
- For the Chairman of the Subcommittee on Science, Research, and Technology, House Committee on Science and Technology, on use of telecommunication technologies for development.

Other Interactions

- Provided substantial parts of a CRS study on "Satellite Communications: Technological System and Services for Developing Countries" prepared for the Chairman of the Subcommittee on Science, Research, and Technology, House Committee on Science and Technology.
- Prepared a summary of issues on synthetic fuels for the Senate Budget Committee which was subsequently requested by other congressional committees and members.
- Began work on a paper on oil shale for use during the current congressional deliberations on synthetic fuels.
- Convened a task force of specialists in and outside of OTA to review and comment on specific problems highlighted by the Senate Judiciary Committee in connection with the Federal Bureau of Investigation's procurement of a front-end processor for the computerized files of the National Crime Information Center. Results of the task force evaluation were sent by letter to the Chairman, Senate Judiciary Committee.
- Provided an analysis of the proposed ISTC to the staffs of the Senate Foreign Relations and Commerce Committees. The paper derived from work OTA had underway concerning North-South technology transfer.
- Convened a workshop on solar power satellite systems to aid the House Science and Technology Committee in developing questions for hearings on relevent legislation as well as to help to plan OTA's assessment on this topic.
- Prepared a note on the potential for energy savings by small business at the request of the Senate Select Committee on Small Business.
- Participated in a symposium on gasohol sponsored by staff of the House Agriculture Committee.

Section V

ORGANIZATION AND OPERATIONS

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ORGANIZATION AND OPERATIONS

Created by the Technology Assessment Act of 1972 (86 Stat. 797), OTA is a part of and is responsible to the legislative branch of the Federal Government. OTA received funding in November 1973 and began operations as the second session of the 93rd Congress convened in January 1974.

The Act provides for a bipartisan Congressional Board, a Director, Deputy Director, and such other employees and consultants as may be necessary to conduct the Office's work.

The Congressional Board is made up of six Senators, appointed by the President pro tempore of the Senate, and six Representatives, appointed by the Speaker of the House, evenly divided by party. In 1979, Congressman Morris Udall, D-Arizona, and Senator Ted Stevens. R-Alaska, served as the Chairman and Vice Chairman, respectively, of the Board. The two posts alternate between the Senate and House with each Congress. The Board members from each House select their respective officer.

The Congressional Board sets the policies of the Office and is the sole and exclusive body governing OTA. The Board appoints the Director, who is OTA's chief executive officer, and he serves as a nonvoting member of the board.

The Act also calls for a Technology Assessment Advisory Council comprising of 10 public members eminent in scientific, technological, and educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. The Advisory Council advises the Board and the Director on such matters as the balance, comprehensiveness, and quality of OTA's work, and the extent to which OTA utilizes resources outside Government.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships of the applications of technology; identify alternative technological methods of implementing specific actions; identify alternative programs for achieving requisite goals; estimate and compare 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

OTA's primary function is to provide congressional committees with assessments or studies that 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:

- the Chairman of any standing, special, select, or joint committee of Congress, acting alone, at the request of the ranking minority member, or a majority of the committee members;
- the OTA Board; or
- 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 early established priority areas of study, and approves individual assessment projects within those areas. To facilitate 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 in-

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volved, 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 this assessment?
- Would this assessment complement or detract from other OTA projects?

Assessment reports emerge from the combined effort of a staff with appropriate expertise, citizen advisory panels of experts, consultants, contractors, and other congressional information agencies. A particular assessment project may involve exploratory meetings, workshops of advisory panels, staff analyses, and consultant studies.

Different approaches are used. The method employed, personnel involved, and the skills tapped depend on the technology under study, the requesting client, the nature of the issues at stake, and the time available for and the setting of the project. Required to consider the needs of Congress, the vast range of technological issues, and the resources available for a study, OTA remains flexible in its assessment methods.

All OTA assessments strive to be objective, fair, nonpartisan, and authoritative. They must also be timely so as to meet congressional schedules.

Organizational Structure

The Office is organized into three operating divisions, each headed by an assistant director. The three divisions are Energy, Materials, and International Security; Health and Life Sciences; and Science, Information, and Transportation. They encompass assessments grouped in the areas of energy, food and renewable resources, genetics and population, health, materials, international security and commerce, oceans, R&D priorities and policies, telecommunication and information systems, and transportation. A chart detailing OTA's organizational structure accompanies this section.

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

Public Participation

OTA makes a serious and systematic effort to ensure that the views of the public are fairly reflected in each of its assessments.

The involvement of a broad spectrum of the public informs and improves OTA's work by helping eliminate bias, introducing new or little understood points of view, and identifying any important contrasts between the perspectives of technically trained experts and lay citizens.

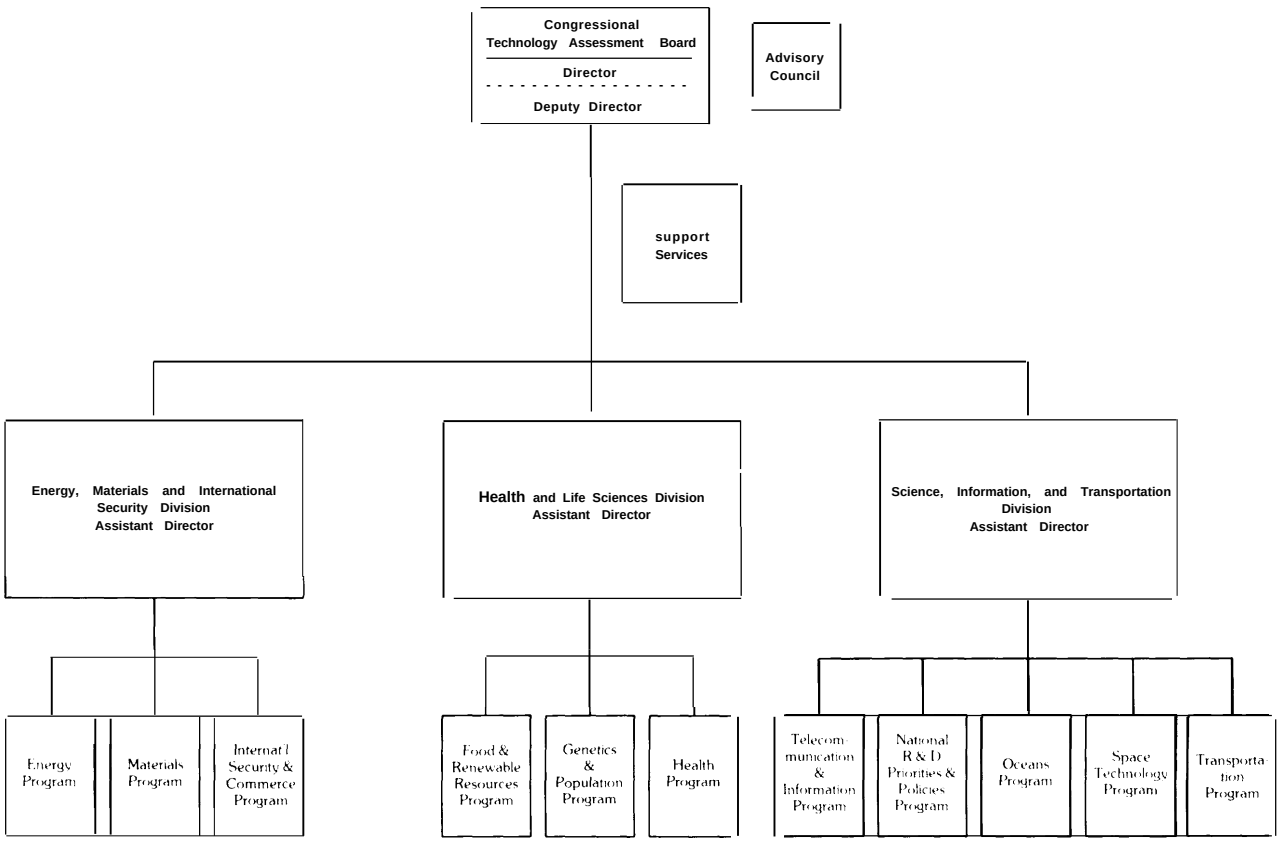
OTA uses a number of methods for involving the public. Members of advisory panels and workshops represent diverse viewpoints and political positions. Interviews and surveys are sometimes conducted. Formal and informal public meetings are held. A major effort is made to obtain public comments and review of draft documents as work continues. All or any of these methods may be used in any study; the topic itself defines the appropriate choices. The crucial element is that the method be truly participatory, so that a real exchange of views can occur.

Information Services

An information services staff, which maintains an in-house library of books, reports, journals, and other materials on science, technology, and related areas, supports OTA activities. The library serves as a liaison to the Library of Congress as well as to other libraries and organizations in order to meet the information needs of the OTA staff.

Office of Technology Assessment

Organizational Structure



Current awareness tools and computerized literature search services, the latter providing access to more than 150 data bases, provide staff members with an extensive array of information services. The library also maintains a collection of background materials on the OTA history and legislation, speeches and testimony given by OTA staff, and other information pertinent to the work of the Office.

The library is available to members of the general public who have a specific interest in technology assessment or in the work of the Office.

Organizational Roster of OTA Staff as of December 1979

OFFICE OF THE DIRECTOR

John H. Gibbons, Director
Sue Bachtel, Executive Assistant
Daniel De Simone, Deputy Director
Marion Fitzhugh, Deputy's Assistant
John Burns, Senior Editor
Debra Datcher, Secretary
Patricia Halley, Receptionist/Corres. Controller

Liaison Office

Liaison Officer, TAB/TAAC (vacant)
Eugenia Ufholz, Assistant to Liaison Officer

Personnel Office

Evelyn Davis, Personnel Officer
Dale Donahue, Personnel Specialist
Katherene Mason, Personnel Specialist

Medical Services

Rose McNair, Resident Nurse*

Public Communications Office

John Burns, Acting Public Communications Officer
Vicki L. Sibley, Press Officer

ADMINISTRATION

Thomas P. McGurn, Administrative Officer
Alban Landry, Asst. Administrative Officer
Susan Carhart, Contract Specialist
Lola Craw, Asst. to Administrative Officer
Tom Jennings, Senior Analyst
Lynne P. Pietz, Director, Contracts& Legal Services
Richard Tyler, Contract Specialist
Geneva Watkins, Administrative Specialist
Ann Woodbridge, Assistant Controller

Information Services

Martha Dexter, Librarian
Suzanne Boisclair, Library Technician
Marian Ulincy, Assistant Librarian

*Detailed from the Attending Physician's Off Ice, U S Capitol

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Lionel S. Johns, Assistant Director
Linda Riddiough, Division Assistant
Marvin Ott, Associate

Energy Program

Richard Rowberg, Program Manager
Thomas Bull, Project Director
Clark Bullard, Senior Analyst
David Claridge, Senior Analyst
Alan Crane, Project Director
J. Bradford Hollomon, Project Director
Lisa Jacobson, Administrative Assistant
Nancy Naismith, Project Director
Stephen Plotkin, Senior Analyst
Lillian Quigg, Secretary
Jenifer Robison, Analyst
Joanne Seder, Research Assistant
Richard Thoreson, Analyst
Frank Tugwell, Senior Analyst
Yvonne White, Secretary
Ray Williamson, **OTA** Fellow

Publishing Office

John C. Holmes, Publishing Officer
Kathie S. Boss, *Assistant Printing Specialist*
Joanne Heming, Printing Specialist

International Security & Commerce Program

Peter Sharfman, Program Manager
John Alic, Senior Analyst
Ronnie Lee Goldberg, Project Director
Helena Hassell, Secretary
Dorothy Richroath, Editorial Assistant
Jacqueline Robinson, Administrative Assistant

Materials Program

Audrey Buyrn, Program Manager
Patricia Canavan, Secretary
William E. Davis, Project Director
Carol Drohan, Administrative Assistant
Joel Hirschhorn, Project Director
Karen Larsen, *Analyst*
Patricia Poulton, Analyst
Phillip Robinson, Senior Analyst
Frank Wobber, Project Director

HEALTH AND LIFE SCIENCES DIVISION

Joyce Lashof, Assistant Director
Ogechee Koffler, Division Assistant

Food and Renewable Resources Program

Walter E. Parham, Program Manager
Phyllis Balan, Administrative Assistant
Christine Elfring, OTA Fellow
Elizabeth Galloway, Secretary
Michael Phillips, Project Director
Bruce A. Ross-Sheriff, Project Director
Robert L. Smith, Jr., Research Assistant
Catherine Woteki, Project Director

Genetics and Population Program

Gretchen Kolsrud, Program Manager
Marya Breznay, Administrative Assistant
Lawrence Burton, Analyst
Susan Clymer, Secretary
Leslie Corsa, Project Director
Zsolt Harsanyi, Project Director
Emiline Ott, Senior Analyst

Health Program

H. David Banta, Program Manager
Clyde Behney, Project Director
Virginia Cwalina, Administrative Assistant
Pamela Doty, OTA Fellow
Shirley Gayheart, Secretary
Michael Gough, Project Director
Nancy Kenney, Secretary
Bryan Luce, Senior Analyst
Lawrence Miike, Project Director
Michael A. Riddiough, Senior Analyst
Leonard Saxe, OTA Fellow

SCIENCE, INFORMATION, AND TRANSPORTATION DIVISION

Eric H. Willis, Assistant Director
Doris Smith, Division Assistant
Samuel Hale, Executive Assistant

Telecommunication and Information Systems Program

Stephen Doyle, Program Manager
Raymond Crowell, Project Director
Elizabeth Emanuel, Administrative Assistant
Marcia MacNaughton, Senior Analyst
Teri Miles, Secretary
Wladimir Naleszkiewicz, Associate
Zalman Shave]], Senior Analyst
Frederick Wood, Project Director

Oceans Program

Robert Niblock, Program Manager
Prudence Adler, Analyst
Kathleen Beil, Administrative Assistant
Junior Bridge, Senior Analyst
Thomas Cotton, Project Director
Robert Friedman, Project Director
Linda Garcia, Analyst
Carolyn Gilmore, Secretary
Nancy Ikeda, Research Assistant
Peter Johnson, Project Director
Bennett L. Silverstein, Project Director
Lucia Turnbull, Analyst

National R&D Priorities & Policies Program

Robert F. Daly, Program Manager
Scott Finer, Analyst
William Mills, Senior Associate
Leslie Sederlund, Research Assistant
Michaela Walsh, Project Director
John Young, Project Director

Transportation Program

Robert Maxwell, Program Manager
Yupo Chan, OTA Fellow
Lee Dickinson, Project Director
Larry L. Jenney, Project Director
Jacqueline Mulder, Secretary
Paula Walden, Administrative Assistant
Jerry Ward, Senior Associate
Richard Willow, Associate

APPENDIXES

Appendix A—Summary Report of Advisory Council Activities

Appendix B—Work in Progress

Appendix C— List of Published OTA Reports

Appendix D— List of Advisors and Panel Members

Appendix E—Technology Assessment Act of 1972

Summary Report of Advisory Council Activities

Frederick C. Robbins, *Chairman*

During this year, the Council spent considerable time discussing the quality of the product of OTA. In general, we were pleased with the quality of OTA's studies given the level of maturity and budget. Since the value of the Office to Congress depends on the objectivity and scientific accuracy of its work, we recommend that quality control receive the highest priority within the Office.

At the last meeting of the year, the Council proposed several recommendations for improving the service OTA offers the congressional community.

- We feel that "sole source" contracts should, in certain circumstances, be utilized since it appears that this process is the most expeditious and effective way to obtain a high quality of performance.
- We suggest that OTA might hold occasional colloquia with business, academic, and other institutional representatives in order to acquaint them with the vitality and originality of OTA's work.
- In recent years, the Council has lost some of its sense of involvement. It is felt that a more active relationship and frequent contact with the Technology Assessment Board might improve its effectiveness. We are looking forward to scheduling several joint Board/ Council meetings in the year ahead.

The Council wishes to express its confidence that the actions the new Director, John H. Gibbons, has taken and the procedures he has implemented to improve the management of the Office clearly reflect sound management practices.

Dr. Gibbons has also been effectively coordinating the work of the Office with the General Accounting Office (GAO), the Congressional Research Service (CRS), and the Congressional Budget Office (CBO). We believe that overlap is minimal, and that what overlap does occur is probably defensible. These efforts by the Director should not be allowed to lapse. This coordination does appear to be enhanced by the presence of Gilbert Gude, Director of CRS and Elmer Staats, Director of GAO on the Council, and we believe it would be further benefited by the presence of Alice Rivlin, Director of CBO.

OTA has been a bold experiment, attempting to provide Congress with future-oriented analyses employing the best scientific and technical expertise in the country. The Council finds that the Office, in its ability to assess the long-term impacts of technologies and their real and potential threats to the social fabric, offers an indispensable and unique resource for the U.S. Congress. The mission of OTA is important and it deserves our vigorous support.

Work in Progress

1. Alternative Energy Futures
2. Energy From Biological Processes
3. Decentralized Electric Energy Generation Systems
4. Global Energy Trends
5. Liquefied Natural Gas
6. Solar Power Satellites
7. Synthetic Fuels for Transportation
8. The International Competitiveness of the U.S. Electronics Industry
9. Taggants in Explosives
10. Oil Shale Technology
11. Impact of Technology on the Competitiveness of the U.S. Steel Industry
12. Federal Coal Development
13. National Information Systems
14. Telecommunication Systems
15. Automotive Fuel-Efficiency R&D and Alternative Energy Sources
16. Impact of Advanced Air Transport Technology
17. Airport and Air Traffic Control System
18. Applications of Technology in Space
19. Radioactive Waste Management and Disposal
20. Ocean Research Assessment
21. Freshwater Resources Management, Planning and Policy
22. Technological Innovation and Health, Safety, and Environmental Regulation
23. An Assessment of Technology for Local Development
24. The Impact of Inflation on the Federal R&D Investment
25. Impact of Technology on Productivity of the Land
26. U.S. Food and Agricultural Research
27. Impacts of Applied Genetics
28. Technology and World Population
29. Cost-Effectiveness of Medical Technologies
30. Technologies for Forecasting Physician Supply and Requirements
31. Technologies for Determining Cancer Risks From the Environment

Appendix C

List of Published OTA Reports

		Available through: U S Government Printing Office		National Technical Information Service	
		Stock Number	Price	Stock Number	Price
1. OTA-A-1	**Annual** Report to the Congress, March 15, 1974.			PB 246191	$6.00
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	$3.50
3. OTA-H-3	Drug Bioequivalence, July 1974.			PB 244862	$8.00
4. OTA-M-4	Requirements for Fulfilling a National Materials Policy, August 1974.			PB 250631	$13.00
5. OTA-T-5	Automobile Collision Data: An Assessment of Needs and Methods of Acquisition.			PB 244861	$15.00
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. '			PB 252202	$6.00
7. (2)	An Analysis Identifying Issues in the Fiscal Year 1976 ERDA Budget, March 1975.[2]			PB 244863	$9.00
8. OTA-A-6	Annual Report to the Congress, March 15, 1975.	052-070 -03050-3	$1.15	PB 244833	$7.00
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	$3.50
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	$20.00
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	$17.00
12. (3)	Analyses of Effects of Limited Nuclear Warfare, September 1975.[3]				
13. OTA-T-10	The Financial Viability of Conrail, September 1975.			PB 250630	$8.00
14. OTA-T-11	A Review of Alternative Approaches to Federal Funding of Rail Rehabilitation, September 1975.			PB 250632	$8.00
15. OTA-E-12	An Analysis of the ERDA Plan and Program, October 1975.	052-010 -00457-3	$3.85	PB 250636	$18.00
16. OTA-E-13	An Analysis of the Impacts of the Projected Natural Gas Curtailments for the Winter 1975-76, November 1975.			PB 250623	$6.00
17. OTA-T-14	A Review of National Railroad Issues, December 1975.	052-003 -00124-1	$1.70	PB 250622	$9.00
18. OTA-T-15	Energy, the Economy, and Mass Transit, December 1975.	052-003 -00132-2	$2.00	PB 250624	$11.00
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	$8.00

		Available through U S Government Printing Office		National Technical Information Service	
		Stock Number	Price	Stock Number	Price
20. OTA-T-17	Volume 2: Atlanta Case Study.	052-003 -00138-1	$1.15	PB 253680	$6,00
21. OTA-T-18	Volume 3: Boston Case Study.	052-003 -00140-4	$1.15	PB 253681	$6.00
22. OTA-T-19	Volume 4: Chicago Case Study.	052-003 -00141-1	$ .95	PB 253682	$7.00
23. OTA-T-20	Volume 5: Denver Case Study.	052-003 -00143-8	$1.05	PB 253683	$6.00
24. OTA-T-21	Volume 6: Los Angeles Case Study.	052-003 -00145-4	$1.45	PB 253684	$7.00
25. OTA-T-22	Volume 7: Minneapolis-St. Paul Case Study.	052-003 -00146-2	$ .85	PB 253685	$6.00
26. OTA-T-23	Volume 8: San Francisco Case Study.	052-003 -00148-9	$1.35	PB 253686	$7.00
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James Boyd, ex officio
Private Consultant

Frank Fernbach
Retired Assistant to the President
United Steelworkers of America

Bruce Hannon
Director, Energy Research Group
University of Illinois

Talbot Page
California Institute of Technology
Environmental Quality Laboratory

Simon Strauss
Vice Chairman
ASARCO, Inc.

Management of Fuel and Nonfuel Minerals in Federal Land Advisory Panel

Elburt Osborn, Chairman
Distinguished Professor
Carnegie Institution of Washington

Walter Ackerman
Administrator, Land Quality Division
Department of Environmental Quality
State of Wyoming

Earl Beistline
Dean, School of Mineral Industry
University of Alaska

James Boyd, ex officio
Private Consultant

Analysis of Laws Governing Access Across Federal Lands Advisory Panel

Earl Beistline, Chairman
Dean, School of Mineral Industry
University of Alaska

Roger Allington
Land and Engineering Officer
Sealaska Corporation

James Boyd, ex officio
Private Consultant

Charles Clusen
Conservation Director
Sierra Club

John Katz
Chief Counsel, Federal-State Land Use Planning Commission for Alaska

Elburt Osborn
Distinguished Professor
Carnegie Institution of Washington

Technical Options for Conservation of Materials Advisory Panel

Nathan E. Promise], Chairman
Executive Director Emeritus
National Materials Advisory Board
National Academy of Sciences

Seymour Blum
Vice President-Program Development
Northern Energy Corporation

James Boyd, ex officio
Private Consultant

Edwin Gee
President, International Paper

Farno L. Green
Executive Engineer
Manufacturing Development
General Motors Company

Julius Harwood
Director
Materials Sciences Lab.
Ford Motor Company

Paul Lerman
Associate Professor
Fairleigh Dickinson University

Richard Priest
Assistant National Manager
Merchandise Development & Testing Laboratories
Sears, Roebuck & Company

Oil Shale Advisory Panel

James H. Gary, Chairman
Chemical and Petroleum Refining Dept.
Colorado School of Mines

William Brennan
Rancher

James Boyd, ex officio
Private Consultant

Roland Fischer
Secretary/Engineer
Colorado River Water Conservation District

John D. Haun
Department of Geology
Colorado School of Mines

Carolyn A. Johnson
Public Lands Institute

Sidney Kate]]
College of Mineral& Energy Resources
West Virginia University

Estella Leopold
Director, Quaternary Research Center
University of Washington

Charles H. Prien •
Senior Research Fellow
University of Denver Research Institute

John F. Redmond
Private Consultant

Richard D. Ridley
Vice President for Marketing
Occidental Oil Shale, Inc.

Raymond L. Smith
President
Michigan Technological University

Thomas W. Ten Eyck
Vice President for Community, Government, and Public Affairs
Rio Blanco Oil Shale Project

Wallace Tyner
Department of Agricultural Economics
Purdue University

Glen D. Weaver
Department of Economics
Colorado State University

Federal Coal Leasing Advisory Panel

Lynton Caldwell, Chairman
Department of Political Science
Indiana University

James Boyd, ex officio
Private Consultant

Thomas France
Private Consultant

James R. Jones
Director of Environmental Quality
Peabody Coal Company

Robert Lang
Plant Science Division
University of Wyoming

Jonathan Lash
Senior Project Attorney
Natural Resources Defense Council, Inc.

Alfred Petrick, Jr.
Petrick Associates

Jack Simon
Director
Illinois State Geological Survey

Gary Tabak
Assistant Manager
Western Fuels Association, Inc.

Joseph Yancik
Vice President
Research & Technical Services
National Coal Association

Impact of Technology on the Competitiveness of the U.S. Steel Industry Assessment Advisory Panel

Gordon Geiger, Chairman
Professor and Head
Department of Metallurgical Engineering
University of Arizona

Edmund Ayoub
Research Director
United Steelworkers of America

Howard O. Beaver
President
Carpenter Technology Corporation

James Cannon
Research Director
Citizens for a Better Environment

Robert W. Crandall
Senior Fellow
The Brookings Institution

Milton Deaner
Vice President, Engineering
National Steel Corporation

Stewart G. Fletcher
Senior Vice President
American Iron and Steel Institute

William B. Hudson
Executive Vice President, Planning and Development
The McKee Corporation

Robert R. Irving
Senior Technical Editor
Iron Age Magazine

F. Kenneth Iverson
President, NUCOR Corporation

Betty Jardine
League of Women Voters

Ruth Macklin
The Hastings Center

Peter F. Marcus
First Vice President and Director
Paine, Webber, Mitchell, Hutchins, Inc.

Mary Ann Ritter
Manager, Purchasing, Forward Planning, and Research
General Motors Corporation

Roger E. Shields
Vice President, International Economics Department
Chemical Bank

Edward A. Stanton
Director, Human Development-social Action
Diocese of Youngstown Catholic Charities

Caroline Ware
National Consumers League

"Deceased, April 1979

FOOD AND RENEWABLE RESOURCES ADVISORY COMMITTEE

Martin E. Abel, Chairman
Senior Vice President, Schnittker Associates (Resigned)

Johanna Dwyer, Vice Chairman
Director, Frances Stern Nutrition Center
New England Medical Center

David Call
College of Agriculture and Life Sciences
Cornell University
(Resigned)

Cy Carpenter
President
Minnesota Farmers Union

Eliot Coleman
Director, Coolidge Center for
the Study of Agriculture

Almeta Edwards Fleming
Teacher Coordinator
Florence, S. C., School District

Lorne Greene
Chairman, American Freedom From
Hunger Foundation

Richard L. Hall
Vice President, Science and Technology
McCormick & Company, Inc.

Laura Heuser
Agricultural Council of America

Arnold Mayer
Legislative Representative
Amalgamated Meat Cutters and
Butcher Workmen of North America

Max Milner
Executive Officer
American Institute of Nutrition

Robert O. Nesheim
Vice President, Science and Technology
The Quaker Oats Company

Kathleen O'Reilly
Director
Consumer Federation of America

R. Dennis Rouse
Dean, School of Agriculture
Auburn University

Lauren Seth
Agricultural Consultant
(Resigned)

Thomas Sporleder
Professor of Agricultural Economics
Texas A&M University

Sylvan Wittwer
Director and Assistant Dean
College of Agriculture and
Natural Resources
Michigan State University

Global Food Futures Advisory Panel

Martin E. Abel
Senior Vice President
Schnittker Associates

Howard Baumann
Vice President
Science and Technology
The Pillsbury Company

Paul Bente
Executive Director
Bioenergy Council

C. O. Chichester
The Nutrition Foundation, Inc.

Milo Cox
School of Renewable Natural Resources
University of Arizona

Johanna Dwyer
Director
Frances Stern Nutrition Center
New England Medical Center

Norge Jerome
Associate Professor of Community
Health
University of Kansas Medical Center

Omer Kelley
Agriculture Consultant

Mihajlo D. Mesarovic
Department of Systems Engineering
Case Western Reserve University

Peter Oran
Deputy Director, International Food
Policy Research Institute

Dan Padberg
Head, Department of Agricultural
Economics
University of Illinois

Nevin Scrimshaw
Head, Department of Nutrition and
Food Sciences
Massachusetts Institute of Technology

Walter W. Wilcox
Agriculture Consultant

Beverly Winikoff
Population Council

Sylvan Wittwer
Director and Assistant Dean
College of Agriculture and Natural
Resources
Michigan State University

Pest Management Strategies Advisory Group

R. Dennis Rouse, Chairman
Dean, School of Agriculture
Director, Agricultural Experiment Station
Auburn University

Perry Adkisson
Department of Entomology
Texas A&M University

Phillip Alampi
Secretary of Agriculture
State of New Jersey

J. Lawrence Apple
Assistant Director
Agricultural Experiment Station
North Carolina State University

O. C. Burnside
Agricultural Experiment Station
University of Nebraska

Brian Croft
Entomology Department
Michigan State University

John C. Davies
Department of Epidemiology and Public Health
University of Miami School of Medicine

Boysie E. Day
Agricultural Experiment Station
University of California

W. E. Fry
Department of Plant Pathology
Cornell University

Maureen Hinkle
Environmental Defense Fund

Paul Hoch
Director, Richmond Research Center
Stauffer Chemical Company

Donald M. Huber
Department of Botany and Plant Pathology
Purdue University

Marion Moses
Environmental Sciences Laboratory
Mount Sinai School of Medicine

John Reese
Farmer
Alexandria, Ohio

Ray F. Smith
Department of Entomological Sciences
University of California

Peter Sullivan
Research Specialist
National Wildlife Federation

John Thomas
Department of Entomology
Texas A&M University

H. David Thurston
Department of Plant Pathology
Cornell University

Samuel Turnipseed
Department of Entomology and Economic Zoology
Edisto Experiment Station
Clemson University

Pest Management Strategies
National Constraints
Work Group

Edward H. Glass, Chairman
Head, Department of Entomology
New York State Agricultural Experiment Station
Cornell University

Don Anderson
President
Texas Pest Management Association

Edwin A. Crosby
Senior Vice President
National Food Producers Association

Lynn Davis
Cooperative Extension Service
University of Georgia

Robert E. Hamman
Manager, Government Relations
CIBA-GEIGY Corporation

Blanche Haning
Department of Plant Pathology
Interdepartmental Pest Management Program
North Carolina State University

Bruce Hawley
Assistant Director, National Affairs
American Farm Bureau Federation

Maureen Hinkle
Environmental Defense Fund

Ellery Knake
Department of Agronomy
University of Illinois

L. D. Newson
Department of Entomology
Louisiana State University

Earle S. Raun
President
Pest Management Consultants

John Siddall
Vice President, Scientific Affairs
Zoecon Corporation

Jerry Weekman
Specialist in Charge
Entomology Extension
North Carolina State University

Pest Management Strategies
Great Plains Wheat Belt
Regional Work Group

O. C. Burnside, Chairman
Professor, Agricultural Experiment Station
Department of Agronomy
University of Nebraska

William Baxter, Ben Schole
Game and Parks Commission
Lincoln, Nebr.

Charles R. Fenster
Crop Production Specialist
University of Nebraska

Jimmy Hatchett
Entomologist, USDA
Department of Entomology
Kansas State University

Glenn Helmers
Department of Agricultural Economics
University of Nebraska

Elmer G. Heyne
Department of Agronomy
Kansas State University

John B. Rowell
Research Leader
Cereal Rust Laboratory
University of Minnesota

Pest Management Strategies
Central Corn Belt Regional
Work Group

Donald D. Huber, Chairman
Associate Professor, Department of Botany and Plant Pathology
Purdue University

Samuel R. Aldrich
Assistant Director
Illinois Agricultural Experiment Station
University of Illinois, Urbana

Michael Boosalis
Chairman, Department of Plant Pathology
University of Nebraska

Eileen Choffnes
Citizens for Better Environment

Vivan Jennings
Extension Weed Control Specialist
Department of Botany and Plant Pathology
Iowa State University

William H. Luckmann
Head, Section of Economic Entomology, Natural History Survey
Head, Section of Agricultural Entomology
University of Illinois, Urbana

Charles R. Taylor
Assistant Professor
Department of Agricultural Economics
Texas A&M University

Frank T. Turpin
Associate Professor of Entomology
Purdue University

Herman Warren
Department of Botany and Plant Pathology
Purdue University

Marcus Zuber
Department of Agronomy
University of Missouri

Pest Management Strategies
Northern Deciduous Tree-Fruits
Regional Work Group

Brian Croft, Chairman
Professor, Entomology Department
Michigan State University

J. L. Anderson
Department of Plant Science
Utah State University

Donald Elfving
Pomology Department
Cornell University

John Gilpatrick
Department of Plant Pathology
New York State Agricultural Experiment Station

Stanley C. Hoyt
Tree Fruit Research Center
Wenatchee, Wash.

Richard Norton
Farm and Home Center
Spencerport, N.Y.

Sherman Thompson
Department of Plant Pathology
University of California, Berkeley

Pest Management Strategies
Northeastern Potatoes
Regional Work Group

W. E. Fry, Chairman
Associate Professor, Department of Plant Pathology
Cornell University

H. D. Thurston, Co-Chairman
Professor, Department of Plant Pathology
Cornell University

Karen Cathey
Northern Maine Regional Planning Commission

Fred Holbrook
New England Plant, Soil, and Water Laboratory
University of Maine

Tom Lyons
Environmental Management Bureau
New York State Office of Parks and Recreation

Joe B. Sieczka
Vegetable Crops Department
Cornell University

Dwayne Smith
Extension Economist
Cooperative Extension Service
Presque Isle, Maine

Robert Sweer
Vegetable Crops Department
Cornell University

Pest Management Strategies
California Vegetables
Regional Work Group

Boysie E. Day, Chairman
Professor, Agricultural Experiment Station
Department of Plant Pathology
University of California, Berkeley

Raymond C. Grogan
Department of Plant Pathology
University of California, Davis

Lyn Hawkins
Economic Entomologist
1PM Unit
California Department of Food and Agriculture

W. Harry Lange
Department of Entomology
University of California, Davis

Oscar A. Lorenz
Chairman, Department of Vegetable Crops
University of California, Davis

Gordon Rowe
Giannini Foundation of Agricultural Economics
University of California, Berkeley

Lari Sheehan
Interjurisdictional Liaison Officer
Integrated Planning Office
County of San Diego. California

Pest Management Strategies
Soybeans in the Southeast
Regional Work Group

Samuel Turnipseed, Chairman
Department of Entomology and Economic Zoology
Edisto Experiment Station
Clemson University

Paul Backman
Department of Botany and Microbiology
Auburn University

Gerald Carlson
Department of Economics and Business
North Carolina State University

Jacqueline E. Jacobs
Executive Director
South Carolina Wildlife Federation

Jim Jones
Department of Agricultural Engineering
University of Florida

Stephen Lewis
Department of Plant Pathology
Clemson University

L. D. Newsom
Department of Entomology
Louisiana State University

Harold Walker
Department of Agronomy and Soils
Auburn University

Pest Management Strategies
Cotton and Sorghum Pests in Texas
Regional Work Group

John G. Thomas, Chairman
Department of Entomology
Texas A&M University

Luther S. Bird
Department of Plant Sciences
Texas A&M University

James R. Cate
Department of Entomology
Texas A&M University

Guy L. Curry
Department of Industrial Engineering
Texas A&M University

Richard A. Fredrickson
Department of Plant Sciences
Texas A&M University

Raymond E. Frisbie
Department of Entomology
Texas A&M University

Albert W. Hartstack
Cotton Pest Control and Methods Research Group
SEA-Research, USDA
Texas A&M University

Martin Heilman
Soil Scientist
USDA Soil and Water Conservation Research

John A. Jackman
Department of Entomology
Texas A&M University

Ronald D. Lacewell
Resource Economics
Texas A&M University

Stuart D. Lyda
Department of Plant Sciences
Texas A&M University

Robert B. Metzer
Department of Soil and Crop Sciences
Texas A&M University

G. Alvie Niles
Department of Soil and Crop Sciences
Texas A&M University

Rupert D. Palmer
Department of Soil and Crop Sciences
Texas A&M University

Dan Pustejovsky
Blackland Farm Service Company
Hillsboro, Tex.

Don R. Rummel
Agricultural Experiment Station
Texas A&M University

Winfield L. Sterling
Department of Entomology
Texas A&M University

C. Robert Taylor
Department of Agricultural Economics
Texas A&M University

George L. Teetes
Department of Entomology
Texas A&M University

J. Knox Walker
Department of Entomology
Texas A&M University

Allen F. Wiese
Weed Control
Texas A&M University

Lambert H. Wilkes
Department of Agricultural Engineering
Texas A&M University

Drugs in Livestock Feed Advisory Panel

Lauren Seth, Chairman
Agriculture Consultant

H. R. Bird
Professor of Poultry Science
University of Wisconsin

David Clayson
Deputy Director, Eppley Institute
for Research on Cancer and
Allied Diseases

W. W. Cochrane
Professor of Agricultural Economics
University of Minnesota

Ruth Desmond
President
American Federation of Homemakers

Charles M. Dobbins
Associate Dean
College of Veterinary Medicine
University of Georgia

S. T. Donta
Director of Infectious Disease Services
University of Iowa Medical School

C. M. Hardin
Director of Research
Ralston-Purina Feed Company

Kenneth Monfort
Chairman of the Board
Monfort of Colorado

Sheldon Murphy
Professor and Director
Division of Toxicology
University of Texas

Pauline Paul
Acting Head
Food and Nutrition
University of Illinois

Virgil Rosendale
President
Pork Producers Council

James S. Turner
Codirector
Consumer Action for Improved Drugs

Environmental Monitoring Advisory Panel

Raymond Allred
Director
Environmental Conservation Research
Continental Oil Company

Richard Anderson
Chairman, Statistics Department
University of Kentucky

John Bourke
Director, Analytical Division
Food Science Department
Cornell University

Vaughan Bowen
Senior Scientist
Woods Hole Oceanographic Institute

Shirley Briggs
Executive Director
Rachel Carson Trust for the
Living Environment, Inc.

Leon Chesnin
Professor, Department of Agronomy
University of Nebraska

William Cooper
Professor, Department of Zoology
College of Natural Science
Michigan State University

John Davies
Chairman, Department of Entomology
and Public Health
School of Medicine
University of Miami

Blake Early
Legislative Director
Environmental Action, Inc.

Edward Elkins
Director, Chemistry Division
Washington Research Laboratory
National Food Processors Association

Ronald J. Hingle
Administrator, Food and Drug
Control Unit
Bureau of Environmental Services
Office of Health Services and
Environmental Quality
State of Louisiana

S. Roy Koirtyohann
Environmental Trace Substances Center
University of Missouri

Charles Krister
Retired Manager
Biochemical Department
E. 1. du Pent de Nemours & Co.

John Laseter
Director
Center for Bio-Organic Studies
University of New Orleans

John Martin
Director
Moss Landing Marine Laboratories

Rebecca Sharitz
Associate Research Professor
Savannah River Ecology Laboratory
University of Georgia

Gerald Ward
Professor
Department of Animal Science
Colorado State University

Environmental Tolerance Advisory Panel

James Anderson
Manager for Material Safety
Allied Chemical Corporation

Louise Burke
Executive Director
Consumer Council of Virginia Foundation
Consumer Council of Virginia, Inc.

Kenneth Crump
Department of Mathematics and Statistics
Louisiana Tech University

Donald Epp
Associate Professor
Department of Agricultural Economics and Rural Sociology
Pennsylvania State University

Frederick Halbert
Dairy Farmer
Delton, Mich.

Joseph Highland
Chairman, Toxic Chemicals Program
Environmental Defense Fund

Robert Jackson
Assistant State Health Commissioner
Director, Office of Health Protection and Environmental Management
Health Department
Commonwealth of Virginia

Kazuo K. Kimura
School of Medicine
Wright State University

Marvin Legator
Director, Division of Environmental Toxicology
Department of Preventive Medicine and Community Health
University of Texas Medical Branch

David Lindsay
Technical Secretary
Steering Group on Food Surveillance
Ministry of Agriculture, Fisheries, and Food
London, England

Roy Martin
Director
Science & Technology
National Fisheries Institute, Inc.

Richard Merrill
Professor
School of Law
University of Virginia

Joseph Rosen
Department of Food Science
Rutgers University

John Rust
Professor Emeritus
Pharmacology/Radiology
University of Chicago

Gary Van Gelder
College of Veterinary Medicine
University of Missouri

John Van Ryzin
The RAND Corporation

George Whitehead
Deputy Director for Consumer Affairs
Department of Agriculture
State of Michigan

Open Shelf-Life Dating of Food Advisory Panel

Jane Anderson
Director of Consumer Affairs
American Meat Institute

Jules Bauerman
Director of Food Technology
H. W. Longacre, Inc.

Lowrie M. Beacham
Special Advisor to the President
National Food Processors Association

John Bennett
Chief, Weights & Measures Division
Department of Consumer Protection
State of Connecticut

Judy Braiman-Lipson
President
Empire State Consumers Association

Chambers Bryson
Chief, Food and Drug Section
Department of Health
State of California

Mahlon Burnette
Director of Scientific Affairs
Grocery Manufacturers of America

Carl D'Alessandro, ex officio
Assistant to the Administrator
Food Safety and Quality Service
U.S. Department of Agriculture

John DeMoss
Executive Director
Virginia Food Dealers Association

John Farquhar
Vice President, Education and Technology
Food Marketing Institute

G. William Fouse
Chief, Division of Milk Sanitation
Bureau of Foods and Chemistry
Department of Agriculture
Commonwealth of Pennsylvania

Edward Heffron
Chief, Food Inspection Division
Department of Agriculture
State of Michigan

Herman Kammerman
Director, Office of Consumer Affairs
Cleveland, Ohio

James Kirk, Chairman
Department of Food Science and Human Nutrition
University of Florida

Gary Kushner
Attorney at Law
Leighton, Conklin, and Lemov

Theodore Labuza
Professor, Department of Food Science and Nutrition
University of Minnesota

Amihud Kramer
Professor, Department of Horticulture
University of Maryland

Darryl Lund
Professor, Department of Food Science
University of Wisconsin

Roy Martin
Director of Science and Technology
National Fisheries Institute

Stan McHugh
Vice President
American Bakeries Company

George Michael
Director, Division of Food and Drugs
Department of Public Health
Commonwealth of Massachusetts

Sharon Morganstern
Assistant to the President
National American Wholesale Grocers Association

Jeffrey Odum, ex officio
Staff Assistant, Committee on Laws and Regulations
National Conference on Weights& Measures
National Bureau of Standards

Daniel Padberg
Chairman, Department of Agricultural Economics
University of Illinois

Taylor Quinn, ex officio
Associate Director of Compliance
Bureau of Foods
Food and Drug Administration

Austin Rhoades
Administrative Assistant
Milk Industry Foundation and International Association of Ice Cream Manufacturers

Morton Shaevel
Vice President for Research and Development
Freezer Queen Foods, Inc.

Gary Smith
Professor, Department of Animal Science
Texas A&M University

Jeri Smith-Fornara
Arizona Consumers Council

Thomas Sporleder
Professor, Department of Agricultural Economics
Texas A&M University

Joe Suiter
Assistant Supervisor
Dairy and Food Division
State of Washington

Dale Watson
Vice President for Produce Merchandising
Great A&P Tea Company

Ruth Yannatta
California Citizens Action Group

GENETICS AND POPULATION

Impacts of Applied Genetics Non-Human Applications Advisory Panel

J. E. Legates, Chairman
Dean, School of Agriculture and Life Sciences
North Carolina State University

Ronald E. Cape
Cetus Corporation

Peter S. Carlson
Michigan State University

Nina V. Fedoroff
Department of Embryology
Carnegie Institution of Washington

G. June Goodfield
The Rockefeller University

Harold P. Green
The National Law Center
The George Washington University

Halsted R. Holman
Stanford University Medical School

M. Sylvia Krekel
Health and Safety Office
Oil, Chemical, and Atomic Workers International Union

Oliver E. Nelson, Jr.
Laboratory of Genetics
University of Wisconsin

David Pimental
Department of Entomology
Cornell University

Robert Weaver
Department of Agricultural Economics
Pennsylvania State University

James A. Wright
Pioneer Hi-Bred International
Plant Breeding Division

Norton D. Zinder
The Rockefeller University

Population Advisory Panel

Leona Baumgartner
Martha's Vineyard, Mass.

Wilbur J. Cohen
School of Education
University of Michigan

Cyril Crocker
Howard University School of Medicine

Arthur Dyck
Harvard Divinity School

Julia Henderson
Warwick, N.Y.

William N. Hubbard, Jr.
President
The Upjohn Company

Snehendu B. Kar
School of Public Health
University of California

Nathan Keyfitz
Harvard University Center for Population Studies

Philip R. Lee
Director, Health Policy Program
School of Medicine
University of California

Marjory Mecklenburg
President
American Citizens Concerned for Life

Deborah Oakley
School of Nursing
University of Michigan

Kenneth J. Ryan
Boston Hospital for Women

Nafis Sadik
United Nations Fund for Population Activities

Susan Scrimshaw
School of Public Health
University of California

Carol Tauer
Department of Philosophy
College of St. Catherine

Faye Wattleton
President
Planned Parenthood Federation of America

HEALTH ADVISORY COMMITTEE

Frederick Robbins, Chairman
Dean, School of Medicine, Case Western Reserve University

Stuart H. Altman
Dean, Florence Heller School
Brandeis University

Robert M. Ball
Senior Scholar
Institute of Medicine
National Academy of Sciences

Bernard Barber
Professor
Department of Sociology
Columbia University
{Term ended 7/79)

Lewis Butler
Health Policy Program
University of California

Kurt Deuschle
Professor
Mount Sinai School of Medicine

Zita Fearon
Consumer Commission on the Accreditation of Health Services, Inc.

Rashi Fein
Professor
Center for Community Health and Medical Care
Harvard Medical School

Melvin Glasser
Director
Social Security Department
United Auto Workers of America

Patricia King
Professor
Georgetown Law Center

Sidney Lee
Associate Dean
Community Medicine
McGill University

Mark Lepper
Vice President for inter-lnstiutional Affairs
Rush-Presbyterian Medical School
St. Luke's Medical Center

C. Frederick Mosteller
Professor and Chairman
Department of Statistics
Harvard University

Beverlee Myers
Director
Department of Health Services
State of California

Helen E. Nelson
President
Consumers Research Foundation
(Term ended 7/79)

Mitchell Rabkin
General Director
Beth Israel Hospital

Charles A. Sanders
General Director
The Massachusetts General Hospital
(Term ended 7/79)

Kerr L. White
Deputy Director, Health Sciences
Rockefeller Foundation

Cost-Effectiveness of Medical Technologies Advisory Panel

John R. Hogness, Chairman
President
Association for Academic Health Centers

Stuart H. Altman
Dean, Florence Heller School
Brandeis University

James L. Bennington
Chairman, Department of Anatomic Pathology and Clinical Laboratories
Children's Hospital in San Francisco
Clinical Associate
Professor of Pathology
University of California. San Francisco

John Chase
Associate Dean for Clinical Affairs
University of Washington School of Medicine

Joseph Fletcher
Visiting Scholar
Medical Ethics
School of Medicine
University of Virginia

Clark C. Havighurst
Professor of Law
School of Law
Duke University

Sheldon Leonard
Manager, Regulatory Affairs
General Electric Company

Barbara J. McNeil
Department of Radiology
Peter Bent Brightam Hospital

Robert H. Moser
Executive Vice President
American College of Physicians

C. Frederick Mosteller
Professor and Chairman
Department of Statistics
Harvard University

Robert M. Sigmond
Advisor in Hospital Affairs
Blue Cross of Greater Philadelphia

Jane Sisk Willems
VA Scholar
Veterans Administration

Psychotherapy Review Advisory Panel

Jerome Frank
Professor Emeritus of Psychiatry
Phipps Clinic
Johns Hopkins Hospital

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Donal Klein
New York State Psychiatric Institute

Beverly Long
National Mental Health Association

Thomas McGuire
Assistant Professor of Economics
Department of Economics
Boston University

Morris Parloff
Chief, Psychotherapy and Behavioral Intervention Section
National Institute of Mental Health

Hans Strupp
Department of Psychology
Vanderbilt University

Gary VandenBos
Administrative Officer
Mental Health Policy
American Psychological Association

Carcinogenesis Advisory Panel

Norton Nelson, Chairman
Professor, Department of Environmental Medicine
New York University Medical School

David Axelrod
Commissioner of Health
New York State Department of Health

Peter A. A. Berle
Butzel and Kass
New York, N.Y.

Theodore L. Cairns
E. 1. du Pent de Nemours & Co.
(Retired)

Paul F. Deisler, Jr.
Vice President, Health, Safety, and Environment
Shell Oil Company

George S. Dominguez
Director, Government Relations
Health and Environment
CIBA-GEIGY Corporation

A. Myrick Freeman
Department of Economics
Bowdoin College

Robert H. Harris
Environmental Defense Fund
(Resigned)

Priscilla W. Laws
Dickinson College

Michael Wright
Safety and Health Department
United Steel Workers of America

Mark Lepper
Vice President for Evaluation
Rush-Presbyterian Medical School
St. Luke's Medical Center

Brian MacMahon
Harvard School of Public Health

Elizabeth C. Miller
McCardle Laboratory for Cancer Research
University of Wisconsin
(Resigned)

Robert A. Neal
Director of Center in Environmental Toxicology
Vanderbilt University School of Medicine

Vaun A. Newill
Research & Environmental Health Division
EXXON Corporation

William J. Nicholson
Environmental Sciences Laboratory
Mount Sinai School of Medicine

R. Talbot Page
California Institute of Technology

Margaret Seminario
Industrial Hygenist–AFL/CIO
Department of Occupational Safety and Health

Alice S. Whittemore
Division of Epidemiology
Stanford University School of Medicine

Technologies for Estimating Physician Supply and Requirements Advisory Panel

E. Harvey Estes, Chairman
Department of Community and Family Medicine
Duke University School of Medicine

E. B. Campbell
Executive Vice President
Lane College

Kurt Deuschle
Professor
Mount Sinai School of Medicine

Margaret Gordon
Carnegie Council on Higher Education

Jack Hadley
Urban Institute

John Hatch
School of Biomedical Education
City College of New York

Lauren LeRoy
Senior Analyst
Health Policy Program
University of California

Charles Lewis
Department of Medicine
UCLA School of Medicine

Beverlee Myers
Director
Department of Health Services
State of California

Ted Phillips
Associate Dean for Academic Affairs
School of Medicine
University of Washington

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Health Services Research Center

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Princeton University

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University of Chicago

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Dartmouth College

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Private Consultant

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Department of Orthopedics
University of Washington

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Graduate School of Public Administration
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Director, Institute for Interdisciplinary Engineering Studies
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Covington and Burling

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World Wildlife Fund, Inc.

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International Brotherhood of Electrical Workers

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Environmental Defense Fund

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Manager of Regulatory Affairs
Zoecon Corporation

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Executive Vice President
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Acting Head, Problem Analysis Group
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Consumer Action Now

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Sean Wellesley-Miller
Assistant Professor of Environmental Control
Massachusetts Institute of Technology

Appropriate Technology Task Force

Lola Redford, Chairperson
President
Consumer Action Now

Tom Bender
Freelance Writer, Energy & Technology

Robert S. Browne
Director, President of the Board
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Wilson Clark
Energy Advisor
The Governor's Office
State of California

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Coordinator
Alternative Energy Resources Organization

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Cecil E. Cook, Jr.
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Inter-Culture Associates

Nicholas Georgescu-Roegen
Distinguished Professor Emeritus
Vanderbilt University

Jerome Goldstein
Editor and Publisher
The J. G. Press, inc.

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Member, Technology Assessment Advisory Council of OTA

Karl Hess
Author, Community Technology (Harper & Row)

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Professor of Law
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Massachusetts Institute of Technology

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Department of Humanities
College of Engineering
University of Michigan

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Goodmeasure, Inc.

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Federal Coordinator
Cities in Schools Program

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Co-Director
The New Alchemy Institute

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Department of Physics
University of Illinois

Seymour Abraham son
Department of Zoology
University of Wisconsin

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American Association for the Advancement of Science

Frank Collins
Oil, Chemical, and Atomic Workers International Union

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Electric Power Research Institute

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School of Law
University of Georgia

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Scripps Institute of Oceanography
University of California

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Kansas Geological Survey
The University of Kansas

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Westinghouse Electric Corporation

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State of South Carolina

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Staff Scientist
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Institute for Environmental Studies
University of Washington

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Pinellas County Commissioner
State of Florida

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Center for Environmental Studies
Princeton University

Glen Paulson
Vice President for Science
National Audubon Society

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Professor, John F. Kennedy School of Government
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Harvard University

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American Bar Foundation

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Vice President, Corporate Planning
Pacific Gas & Electric Company

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Director, Rockwell international Waste Program
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The City College of the City University of New York

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Executive Vice President
Armed Forces Communications and Electronics Association

Roger C. Aude
Executive Officer
International Communications Association

Ruth Baker
Attorney at Law
Cohn & Marks Law Firm

K. Woodward Benekert
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International Telephone & Telegraph Corporation

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Computers & Communications Industry Association

James B. Booe
Assistant to the President
Communications Workers of America

Kurt Borchardt
Harvard Program on Information Resources Policy
Harvard University

Warren Braren
Associate Director
Consumers Union

Willard T. Carleton
Department of Finance
University of North Carolina

Joseph V. Charyk
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Satellite Business Systems

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Federal Communications Bar Association

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Whittemore School of Business and Economics
University of New Hampshire

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Vice President
IDCMA
General Data Communications Industries, Inc.

Jack Kinn
Staff Director
Institute of Electrical and Electronics Engineers

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President
American Federation of Labor& Congress of Industrial Organizations

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Research Associate
Common Cause

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International Brotherhood of Electrical Workers

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United Church of Christ

Billy B. Oliver
Vice President, Engineering Planning
AT&T Long Lines Department

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Senior Vice President for Distribution
National Public Radio

Edward W. Page, ex officio
Department of-Computer Science
Clemson University

George E. Pickett
Executive Vice President
USITA

Russell Pipe
Translational Data Report

Ithiel De Sola Pool
Department of Political Science
Massachusetts Institute of Technology

Paul Reardon
Deputy Director
Economic Policy Center
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Association President
Commodity News Service

Bert Roberts
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Telenet Communications Corporation

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Executive Director
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Larry Singer
Attorney at Law
Fager & Singer

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Vice President
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President
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Private Consultant

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Chief Systems Planner
New York Public Service Commission

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Director
Institute of Public Utilities
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Vice President for Business Development
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President
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Lee Wing
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North Carolina Agency for Public Telecommunication
Department of Administration

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Telecommunication Technologies Special Panel

Edward W. Page, ***Chairman***
Department of Computer Science
Clemson University

Paul Baran
Cabledata Associates

John Clark
Director, Space Applications and Technology
RCA Corporation

Douglas Crombie
Director
Institute for Telecommunication Sciences/NTIA
U.S. Department of Commerce

Burton I. Edelson
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Bell Telephone Laboratories

Richard G. Gould
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Richard Marsten
Professor of Engineering
The City College of the City University of New York

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Computer Systems
ITT, Telecommunications Technology Center

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Wilbur Pritchard
President
Satellite Systems Engineering, Inc.

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NASA Headquarters

David L. Solomon
Deputy Assistant, Technical Policy & Operations
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President
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Graduate School of Management
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Engineering-Economic Systems Department
Stanford University

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AFL-CIO

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Jeremiah Gutman
Attorney at Law
Levy, Gutman, Goldberg& Kaplan

J. Robert Harcharik
President
TYMNET, Inc.

Rob Kling
Department of Information and Computer Science
University of California, Irvine

John C. LeGates
Director, Program on Information Resources Policy
Harvard University

Henry Lucas
Computer Applications and information Systems Department
Graduate School of Business Administration
New York University

Daniel McCracken
President
Association for Computing Machinery

Arthur S. Miller
Professor Emeritus of Law
The National Law Center
George Washington University

Sharon Nelson
Attorney at Law
Consumers Union

Phil Nyborg
Computer and Communications Industry Association

Russell Pipe
Translational Data Report

Ithiel De Sola Pool
Department of Political Science
Massachusetts Institute of Technology

James Rule
Department of Sociology
State University of New York

Richard M. Schmidt
American Society of Newspaper Editors

Robert P. Smith
Research & Development Department
U.S. Postal Service

Sherry Turkle
School of Humanities and Social Sciences
Massachusetts Institute of Technology

Ron Uhlig
Manager, Business & Services Planning
Bell Northern Research Lab

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President
INFOMEDIA

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IBM

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System Planning Corporation

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Columbia University

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Graduate School of Management
Institute of Government Service
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Center for Futures Research
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Senior Vice President, Finance
The Gap Stores, Inc.

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Attorney at Law
Levy, Gutman, Goldberg& Kaplan

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Consumer Federation of America

Michael Levine
Citi-Bank

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Electronic Banking Incorporated

John McDonnell, Jr.
Eastern Regional Manager
TYMNET, Inc.

Susan Nycum
Attorney at Law
Chickening & Gregory

William Riley
Grand Island, Nebr.

James Rule
Department of Sociology
State University of New York

Jerry Svigals
IBM

Willis Ware
The RAND Corporation

Bob Zimmer
Counsel
Electronic Money Council

National Information Systems Technology Advisory Panel

Paul Baran, Chairman
President
Cabledata Associates

Craig Fields
Senior Program Manger
ARPA

Dean Gillette
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Systems Research Division
Bell Telephone Laboratories

Vico Henriques
CBEMA

Lance Hoffman
Department of Electrical, Engineering, and Computer Science
School of Engineering and Applied Science
The George Washington University

Kas Kalba
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Association for Computing Machinery

Theodore Myer
Senior Scientist
Bolt, Beranek and Newman

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Computer and Communications industry Association

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Senior Management Systems Consultant
SRI International

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Manager, Business & Services Planning
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The George Washington University

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Armstrong Associates

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Legislative Counsel
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Washington Office

Robert Gallati
College of Criminal Justice
Northeastern University

Lance Hoffman
Department of Electrical, Engineering, and Computer Science
School of Engineering and Applied Science
The George Washington University

John Kennedy
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Massachusetts Institute of Technology

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Harvard University

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Counsel
National Association for the Advancement of Colored People

James Rule
Department of Sociology
State University of New York

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National Association for State information Systems

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The George Washington University

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University of North Carolina
(Resigned)

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Brandeis University
(Resigned)

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University of Tennesee

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Center for Auto Safety
(Resigned)

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President
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(Resigned)

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University of Virginia

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Howard Young
United Auto Workers

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School of Public Administration
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Parsons, Brinckerhoff, Quade, and Douglas

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The Johns Hopkins University

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Secor D. Browne Associates. Inc.

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Lockheed Corporation

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Massachusetts Institute of Technology

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Airline Passengers Association, Inc.

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President
SMS Associates

John Wild
Executive Director
National Transportation Policy Study Commission

Holden W. Withington
Vice President, Engineering
Boeing Commercial Airplane Company

Michael Yarymovych
Vice President, Engineering
Rockwell international

Observers:

Charles R. Foster
Associate Administrator for Aviation Administration
Federal Aviation Administration

James J. Kramer
Associate Administrator for Aeronautics and Space Technology
National Aeronautics and Space Administration

Advanced High-Speed Aircraft Working Group

Richard Alpagh
Chief, Nonhighway Transportation Branch
Department of Energy

Jane H. Bartlett
President
Arlington League of Women Voters

Frederick Bradley
Vice President
Citibank, N.A.

Richard D. Fitzsimmons
Director, Advanced Program Planning
Douglas Aircraft Company

Jack 1. Hope
General Manager, International Engine Group
General Electric Company

William Sens
Pratt and Whitney Engine Company

Armand Sigalla
Chief, Technology Preliminary Design
Boeing Commercial Airplane Company

John Wesler
Acting Director for Environment and Energy
Federal Aviation Administration

Bruce R. Wright
Lockheed California Company

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Jane Bartlett
President
Arlington League of Women Voters

Charles L. Blake
Chief, Airport Group
Federal Aviation Administration

Fredrick Bradley
Vice President
Citibank N.A.

Secor D. Browne
Secor D. Browne Associates, Inc.

Richard D. Fitzsimmons
Director, Advanced Program Planning
Douglas Aircraft Company

Jack I. Hope
General Manager, International Engine Group
General Electric Company

William Sens
Pratt and Whitney Engine Company

Armand Sigalla
Chief, Technology Preliminary Design
Boeing Commercial Airplane Company

Robert W. Simpson
Director, Flight Transportation Laboratory
Massachusetts Institute of Technology

David S. Stempler
Airline Passengers Association, Inc.

Barney Vierling
Retired, Formerly with the U.S. SST Program Manager

John Wesler
Acting Director for Environment and Energy
Federal Aviation Administration

Low-Density Working Group

Raymond A. Ausrotas
Flight Transportation Laboratory
Massachusetts Institute of Technology

Jane H. Bartlett
President
Arlington League of Women Voters

David Brewster
Babcock and Schmid Associates, Inc.

Tulinda Deegan
Director, Government Relations
Commuter Airlines Association of America

Marcy Fannon
Retired, Formerly Vice President
Eastern Airlines

Joseph M. Fugere
President
Pilgrim Airlines

Stanley Green
General Aviation Manufacturers Association

Harry W. Johnson
General Aviation Office
NASA Headquarters

Adib Kanafani
Institute of Transportation Studies
University of California

David S. Stempler
Airline Passengers Association, Inc.

Janet St. Mark
President
SMS Associates, Inc.

Shirley Ybarra
Smat, Heiliesen, and Eichner

Air Cargo Working Group

Keith G. Brady
Manager, Innovative Concepts Development
Boeing Commercial Airplane Company

Douglas A. Fisher
Assistant General Manager
Emery Air Freight

Joel H. Fisher
Director and Washington Counsel
Seaboard World Airlines

E. R. Hichens
Manager, Traffic Systems
Sears Roebuck and Company

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Douglas Aircraft Company

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Manager, Development and Operation Engineering
Federal Express Corporation

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Manager, Operation Research Department
Lockheed Georgia Company

George A. Pasquet
Scott Air Force Base

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Director, Technology Development
Flying Tiger Line

Ray Siewert
Technical Specialist for Aeronautical Technology
Pentagon

Nawal K. Taneja
Massachusetts Institute of Technology

Matthew M. Winston
NASA Langley Research Center

Shirley Ybarra
Simat, Helliesen, and Eichner

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 relatio
(3) identify alternative technological methods of imp
specific programs;
(4) identify alternative programs for achieving
goals;
(5) make estimates and comparisons of the impacts o
tive methods and programs;
(6) present findings of completed analyses to the ap
legislative authorities;
(7) identify areas where additional research or data
is required to provide adequate support for the assessr
estimates described in paragraph (1) through (5) of
section; and
(8) undertake such additional associated activiti
appropriate authorities specified under subsection (d) n
(d) Assessment activities undertaken by the Office may b
upon the request of:
(1) the chairman of any standing, special, or select
of either House of the Congress, or of any joint con
the Congress, acting for himself or at the request of th
minority member or a majority of the committee me
(2) the Board; or
(3) the Director, in consultation with the Board.

Information, ation, availability. bility.

(e) Assessments made by the Office, including informs
veys, studies, reports, and findings related thereto, shall
available to the initiating committee or other appropriat
tees of the Congress. In addition, any such information
studies, reports, and findings produced by the Office may
available to the public except where—
(1) to do so would violate security statutes; or
(2) the Board considers it necessary or advisable tc
such information in accordance with one or more of the

81 Stat. 5-4. t. 54.

paragraphs in section 552(b) of title 5, United States (

TECHNOLOGY ASSESSMENT BOARD

Membership. ship.

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

Vacancies. ies.

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

Chairman and vice chairman. man and chairman.

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

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

Meetings.

(d) The Board is authorized to sit and act at such places
during the sessions, recesses, and adjourned periods of Con

Subpena.

upon a vote of a majority of its members, to require by s
otherwise the attendance of such witnesses and the producti
books, papers, and documents, to administer such oaths an
tions, to take such testimony, to procure such printing anc
and to make such expenditures, as it deems advisable. The E
make such rules respecting its organization and procedures a
necessary, except that no recommendation shall be reported
Board unless a majority of the Board assent. Subpenas may
over the signature of the chairman of the Board or of any vo
ber designated by him or by the Board, and may be serve
person or persons as may be designated by such chairman o
The chairman of the Board or any voting member the
administer oaths or affirmations to witnesses.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

SEC. 5. (a) The Director of the Office of Technology A
shall be appointed by the Board and shall serve for a te
years unless sooner removed by the Board. He shall receive

Compensation.

at the rate provided for level III of the Executive Sched
section 5314 of title 5, United States Code.

83 Stat. 863.

(b) In addition to the powers and duties vested in him b
the Director shall exercise such powers and duties as may be
to him by the Board.
(c) The Director may appoint with the approval of the
Deputy Director who shall perform such functions as the
may prescribe and who shall be Acting Director during t
or incapacity of the Director or in the event of a vacancy ir
of Director. The Deputy Director shall receive basic pay a
provided for level IV of the Executive Schedule under secti
title 5, United States Code.

Employment restriction.

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

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within th
available appropriations, to do all things necessary to carr
provisions of this Act, including, but without being limit
authority to—
(1) make full use of competent personnel and org
outside the Office, public or private, and form speci
task forces or make other arrangements when approp

Contracts.

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

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.

Agenoy 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.

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

(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.

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. 92 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.

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.