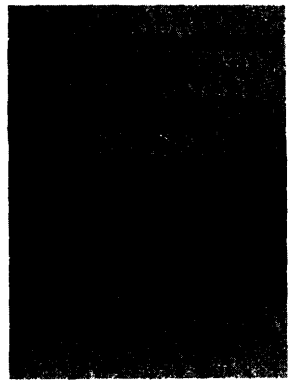
The assessments carried out by OTA cover a wide spectrum of major issues that Congress and the country are facing. They examine a broad range of policy options and their potential impacts. To provide examples of the breadth and depth of OTA's work, a brief summary of each report, published by the Office in 1982 are presented in this section. Also included are synopses of Background Papers and Technical Memoranda issued by OTA on specific subjects analyzed in recent OTA reports or on projects in progress at OTA. Background Papers and Technical Memoranda are neither reviewed nor approved by the Technology Assessment Board.

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

Technology and Handicapped People

Technology's great potential for aiding disabled people has not been fulfilled. There are numerous problems related to the development and distribution of assistive technologies, and many of them could be avoided or lessened. The most serious barriers to the effective use of technology are social ones—e.g., inconsistent and often inadequate financing for the acquisition or use of technologies, conflicting and ill-defined goals, and uncoordinated public programs.



Despite problems, technology is a pervasive and critical influence in the life of every disabled person. More disabled people have access to more technologies than ever before. Emerging and future technologies hold even greater promise.

OTA highlights the necessity of considering not only the individuals with disabilities but also the environments in which they function. A disability results in a handicap when the disabled person interacts with the physical and social environments. Use of a wheelchair due to a disability, for example, becomes a handicap when the environment (transportation, worksite, employer attitudes) is not compatible with a wheelchair.

OTA presents policy options for Congress that might lessen problems in the development, distribution, and use of technologies. The report

contains a range of options in five issue areas: consumer involvement, production and marketing of technologies, evaluation of current and emerging technologies, financial barriers to technology acquisition or use, and personnel availability.

Disability-related research and development (R&D) is highly innovative. Advances in solid-state electronics, other communications and information technologies, biomedical knowledge, and new alloys provide dramatic new possibilities. The U.S. Government spends approximately $66 million a year on R&D related to technologies for disabilities. These expenditures, however, are equal to only a small percentage of the social costs due to disability—e.g., payments to support the income of disabled people are 500 times greater than the Federal investment in R&D.

A focused and adequately funded program to evaluate technologies is needed, especially in view of the increased pace of technological innovation in this area. Evaluation is often performed in an oversimplified fashion with insufficient funding. Because evaluations frequently do not systematically use criteria such as reliability, cost, repairability, or reimbursement status, their utility is reduced.

For diffusion and marketing of technologies, the public-private sector relationship is particularly important. There are several examples of products developed under a Federal R&D program that have been subsequently marketed by private firms. Yet these successes appear to be exceptions; the market is ill-defined, disability-related technologies often do not appear financially viable, and financing or reimbursement systems sometimes provide disincentives to the marketing of certain types of technologies.

Over 100 Federal and other programs enhance or support the use of technologies by disabled people. Such programs include income maintenance, health care, social services, educational services, vocational rehabilitation, and independent living services. Issues related to the use of technologies include coordination of services, eligibility determination, device maintenance, consumer involvement, and shortage of providers.

Impacts of Technology on U.S. Cropland and Rangeland Productivity

Agricultural production need not be harmful to the quality of the land. On the contrary, production and conservation can be compatible, even on marginal land, if appropriate production technologies are developed and used.

Nonetheless, certain processes that harm the land's long-term productivity, especially erosion, are widespread and serious. Every year, U.S. cropland erodes at an average rate of 7 tons per acre. Yet soil is thought to form at a rate of only one-half ton or less per acre annually. Thus, it seems that America's agricultural land is eroding more than 10 times faster than it is forming.

Other processes related to agriculture also damage the productivity of the Nation's croplands and rangelands, including compaction, inadequate drainage, salinization, livestock mismanagement, ground water depletion, and land subsidence. However, data on the causes, consequences, and solutions for these problems are generally inadequate.

On the whole, U.S. land productivity is deteriorating gradually. But neither the problems nor the potential solutions can be broadly generalized. Both the degradation problems and the technological solutions are largely site-specific. If Federal policy is to be effective in preserving and enhancing land productivity, it must accommodate the Nation's great regionaI and local diversity.

For most agricultural land, technologies exist that can foster high production while maintaining land quality without sacrificing short-term profit potential, The most important new technologies to control erosion in the near future will be methods and equipment designed to minimize tillage on row and small grain cropland—i.e., technologies that also maintain or enhance farm profits.

There are some particularly fragile lands, however, where no such technologies are currently available. These lands are used for agriculture because it is profitable, with existing technologies, markets, and policies, to "mine" the land's inherent productivity as if it were a nonrenewable resource.

In recent years, losses in land productivity have been masked by gradual increases in capital inputs such as fertilizers, pesticides, and improved crop varieties, As the cost of these inputs rises and productivity losses become more severe, it will become increasingly difficult to sustain production on depleted agricultural land.

Federal agricultural programs have had mixed effects on resource conservation. While such programs intentionally or unintentionally af-

feet the natural resource base, they generally have not been designed to provide collateral conservation benefits. Little work, in fact, has ever been done to analyze the interrelationships between agricultural policies and conservation.

Agricultural policymakers today face problems quite different from those of the past. When agricultural programs supported prices primarily by keeping land out of crop production, no major effort was required to integrate production and conservation policies. Now, with economic goals shifting to full production, additional erosion-prone or otherwise fragile land is coming into use. This makes the need to integrate production and conservation much more significant.

Opportunities for congressional action to improve land productivity occur in five policy areas: 1) integrating conservation policy with economic policy, 2) improving the effectiveness of Federal conservation programs, 3) enhancing Federal capabilities to develop innovative technologies, 4) reducing pressure on fragile lands, and 5) encouraging State initiatives.

Energy Efficiency of Buildings in Cities

By ***2000,*** up to 7 Quads per year (equivalent to 3.5 million barrels of oil per day for 365 days) of energy savings is technically possible from investments in the energy efficiency of buildings found in cities. On the average these investments are likely to earn a high rate of return.

Existing technology for retrofits to the building shell, space heating and cooling, hot water, and lighting systems is already sufficient to achieve sizable savings, although opportunities remain for technological development. The effectiveness of retrofit measures depends on only a few building characteristics: size, use, wall and roof type, and type of mechanical system. For almost all building types, 70 to 80 percent of all potential savings will come from retrofits that pay back in 2 to 7 years.

About one-third of this savings potential will occur if current market conditions persist. Several categories of building owners have already installed or are planning to install retrofits that payback in 3 to 7 years. Owners investing in their buildings include institutional owners such as insurance companies and pension funds, corporations, and nationally syndicated partnerships. All have good access to equity capital, reliable professional advice on retrofits, and a long holding strategy for their buildings.

Two-thirds of the savings potential, on the other hand, is not now likely to be realized. The vast majority of building owners are individ-

uals and small local partnerships who, by and large, are limiting retrofits to those that pay back in 1 or 2 years.

One reason is poor access to long-term financing. For most types of commercial and multifamily building owners, loans for property improvement (including energy retrofit) are only available at high interest rates (2 points above prime) and short terms (less than 2 years). Debt service on such loans for energy retrofits far exceeds the value of the first year's energy savings for all options except retrofits with a 1- to 2-year payback.

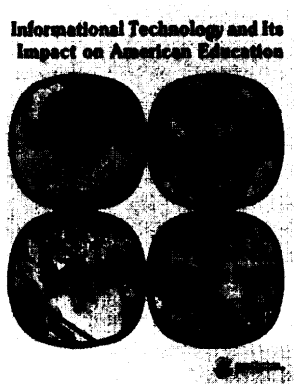
Another concern is the difficulty of predicting actual energy savings from a retrofit. The range can be 50 to 70 percent above or below predictions. Variability of energy savings from building to building is due partly to the uniqueness of each structure (including previous retrofits) and the influence of building maintenance and occupants behavior. Difficulty of prediction is exacerbated by the lack of reliable data on actual retrofit results.

In some cities, private companies are effectively marketing retrofits to small numbers of building owners. Only a handful of companies, however, have offered either retrofit financing or savings guarantees. Financial and regulatory considerations are limiting utility involvement in large-scale retrofit. OTA's analysis, including case studies of public and private energy efforts in five cities, also showed that large-scale retrofit would receive high priority in only a few cities.

Three possible options for the Federal Government are: 1) no intervention, letting the private sector develop and market the retrofit options; 2) small Federal market assistance role to improve technology and the predictability of energy savings from retrofit; and 3) large active Federal role to improve retrofit predictability and also provide financing subsidies to lower interest rates slightly and lengthen loan terms substantially.

Informational Technology and its Impact on American Education

The "information revolution" is profoundly affecting American education and training—creating new demands for instructional services and, at the same time, providing new opportunities for the improvement and delivery of such services. Whether or not new information technologies will fulfill their potential will depend, in part, on the kinds of actions that the Federal Government takes.



Explosive developments in new computer and communication technologies and their integration into complex national, and even worldwide, information systems have transformed the information industry into a major component of the U.S. economy. Many firms involved with producing and selling information and information technology are large, and rapidly growing. Moreover, business, in general, is beginning to treat information as an important economic resource and, like land, labor, and capital, as a factor of production.

This revolution is creating new demands on individuals, constantly changing what they must know and the skills that they must have to participate fully in society as both citizens and workers. Further automation and the continuing shift to an information economy will create a greater demand for, and place a greater premium on, basic literacy and an understanding of technology, Individuals will have to be continually educated and retrained. Lifelong education will become the norm,

Many of the institutions that have traditionally been responsible for educational services—public schools, libraries, and museums—may be unable or unwilling to adapt to meet these changing educational needs, Faced with a decline in the level of economic, social, and political resources at their disposal, many of them are having to curtail some of the services they provide. On the other hand, new profitmaking institutions are emerging to take advantage of the developing market for special kinds of educational services. As educational services are increasingly provided in the marketplace, some national educational goals may not be met and some educational benefits may become less accessible to all.

The new information technologies can help all educational institutions to meet the new demands. They include direct broadcast satellites, two-way interactive cable, low-power broadcasting, personal and handheld computers, television, video disks, and video tape cassettes, Many are already being effectively used in education and training. Experience with them proves that they can be cost effective, versatile, and are capable of being used in a variety of institutional settings. They can be used

to extend education to those who have previously been denied it due to age or geographical location, socioeconomic background or physical condition, They can be interactive and engaging.

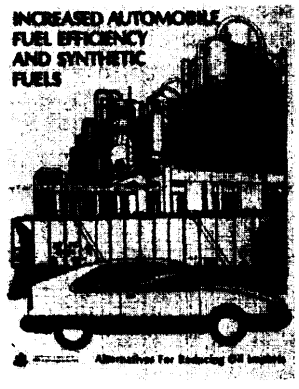
Notwithstanding the potential benefits of educational technologies, OTA has identified a number of institutional barriers to their use—among the their high initial cost, the lack of high quality programing, and the dearth of local personnel with adequate training. Experience shows that some of these barriers can be overcome if the technologies are carefully integrated into their social and institutional environments. Since public institutions may find it more difficult than profitmaking institutions to overcome these barriers, Federal action may be required to assure that the benefits of educational technologies are accessible to them.

Information technologies will be increasingly used for educational purposes. Since relatively little is known about the long-term effects on learning of substituting information technologies for more traditional teaching methods, additional research needs to be focused on this question.

Congress could take a number of specific actions to affect the development, educational application, and distribution of information technologies. For example, it might provide tax incentives for donations of computers to schools, fund teacher training programs, or support and encourage the production of high quality and economical curriculum software. But such an approach would address only a single aspect of the problem and may generate undesirable and unexpected side effects. If this is to be avoided, a broader approach, which takes into account the changing needs for education and training, considerations of equity, and changing institutional roles, will be required.

Increased Automibile Fuel Efficiency and Synthetic Fuels: Alternative for Reducing Oil Imports

Even with moderate increases in auto fuel efficiency, moderate success at developing a synthetic fuels industry, and projected reductions in the stationary (nontransportation) uses of fuel oil, U.S. net petroleum imports could still exceed 4 million barrels per day (MMB/D] by 2000 (1981 imports averaged 5.4 MMB/D). Only with vigorous promotion and fortuitous technical success in all three options could the United States expect to eliminate imports before 2010.



OTA's detailed assessment of two of these alternatives-increased automobile efficiency and synfuels production—showed that projections of their contribution to import reduction vary over a wide range. For both alternatives, the higher projection is technically feasible but improbable. In particular, the synfuel upper limit would require a "war mobilization" effort, and production of even 1 MMB/D by 2000 is unlikely without the kinds of incentives offered by the Synthetic Fuels Corporation.

Projections: Average new car fuel efficiency by 2000 is likely to be at least 45 mpg but could range as high as 80 mpg, depending on the success of technical developments, demand for fuel efficiency, and the size mix of cars sold. Depending on the actual fuel efficiencies achieved, automobile fuel consumption in 2000 could be 1.3 to 2.1 MMB/D, compared with 4.3 MMB/D in 1980. Production of synthetic transportation fuels could range from negligible levels of 5 MMB/D by 2000, depending on the technical success of the first commercial plants, the level of Federal support and the comparative costs of synthetic and conventional fuels. By 1990, the U.S. Department of Energy projects stationary uses of fuel oil at 2.6 MMB/D. By 2000, 60 to 100 percent (1.5 to 2.6 MMB/D) of the remaining stationary fuel oil use could be displaced, depending on the ability and willingness of individuals and businesses to invest in conservation and fuel switching, and on successfully overcoming technical obstacles.

Costs: During the 1980's, efforts to reduce stationary oil use and to increase new-car fuel efficiency to at least 35 to 45 mpg by 1990 are likely to require less capital investment per barrel per day (B/D) of oil displaced than will synfuel production. However, in the 1990's, further increases in automobile fuel efficiency, synthetic fuels production, and further reductions in stationary uses of fuel oil all appear to require comparable investments—about $50,000 to $150,000 per equivalent B/D. Because the uncertainties in these cost estimates probably cannot be reduced to significantly lower levels before substantial investments are made, national decisions favoring one option over another

for the 1990's cannot now be made simply on the basis of differentials in investment cost but require examination of other factors.

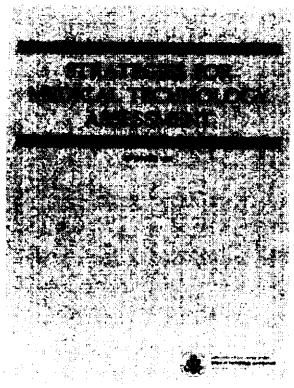
Safety and Environment: Vehicle size reductions associated with increased auto efficiency can cause increases in crash-related injuries and deaths. Improved safety design and greater seatbelt usage could offset this impact. For synfuels, important environmental damage can result from extensive coal and oil shale mining and, potentially, from release of toxic substances formed in the production process. Although such releases should be preventable, remaining regulatory gaps and scientific uncertainties prevent complacency.

Socioeconomic: Rapid increase in auto fuel efficiency will require accelerated rates of capital investment in the auto industry and may be accompanied by an accelerated demand shift towards smaller cars—a market where U.S. manufacturers historically have been weak competitors. These investments also are likely to speed the deployment of labor-saving technologies in the replacement of existing manufacturing facilities. Production by domestic and auto firms is likely to shift away from the North-Central region to other regions of the United States and to foreign countries unless countered by Government policies or production cost changes.

Rapid local population changes during synfuel plant construction and startup can lead to disruption or failure of social services in sparsely populated coal and oil shale regions. Accelerated development of a synfuels industry could also encourage the adoption of near-term technologies that may be more expensive in the long run than other synfuels options. Although from a national perspective water requirements for a large synfuels industry are small, hydrologic, institutional, and legal uncertainties prevent an unqualified conclusion about the availability of sufficient water, particularly in the West.

Strategies for Medical Technology Assessment

The Nation's current policies and processes for assessing medical technologies are inadequate to ensure that these technologies are appropriately used. A more integrated system of assessing medical technologies and spreading information about their safety, effectiveness, costs, and social effects is needed.



The Food and Drug Administration (FDA) has for many years regulated the safety and efficacy of new prescription drugs through its premarketing approval process, and since 1976 has regulated certain classes of medical devices. However, neither FDA nor any other agency systematically collects information on the incidence of long-term or rare adverse reactions to drugs approved for marketing.

New medical and surgical procedures generally originate within medical practice and are not subject to premarketing approval.

The excessive or inappropriate use of medical technologies contributes significantly to the rising costs of medical care. One problem is the lack of criteria for appropriate use on which to base reimbursement decisions. In the absence of such information, third-party payers such as Blue Cross/Blue Shield, Medicare, and Medicaid may reimburse for technologies that are not appropriately used. Furthermore, some medical and surgical procedures may become widespread before their safety and efficacy are determined.

The current system of medical technology assessment has major deficiencies in four areas: 1) identifying technologies needing assessment; 2) testing technologies to develop reliable information about their health and economic effects; 3) coordinating and synthesizing information; and 4) distributing information to Federal agencies, health care providers, third-party payers, and patients.

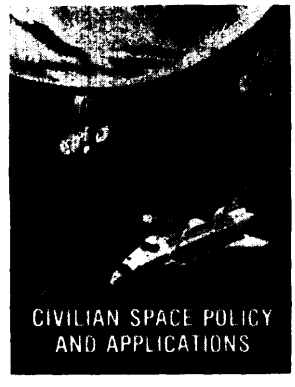
These deficiencies could be addressed through legislation or congressional oversight. Through oversight, for example, Congress could examine how Federal research agencies (e.g., the National Institutes of Health or the Office of Research and Demonstrations of the Health Care Financing Administration (HCFA)) might better identify technologies in need of assessment. In the area of testing, Congress could change statutes to allow HCFA, under the Medicare and Medicaid programs, to reimburse for the use of experimental technologies in return for the resulting clinical data. With regard to synthesizing information, Congress could explore why research evidence is not better evaluated by HCFA, its carriers and fiscal intermediaries when making reimbursement decisions, and by Professional Standards Review Organizations (PSROs) when setting standards for care. In the area of distributing in-

formation, Congress could encourage the National Library of Medicine to expand its literature base to include more government research reports and other nonserial literature.

Most importantly, a more integrated system of developing and distributing information about medical technologies is needed. One of the challenges is to devise a system that will meet the information needs of public and private parties, but will not hinder the innovation process. Legislative options include granting a charter to a public/private organization such as the Institute of Medicine to undertake technology assessment activities, or restoring funding for the National Center for Health Care Technology (NCHCT). As an alternative to legislative initiatives, Congress could hold oversight hearings to signal its intent that the Secretary of Health and Human Services should use existing authorities to develop a more integrated system of medical technology assessment, to endorse and encourage executive branch refunding of the NCHCT for that purpose, or to encourage the private sector (e.g., insurance companies) to take the lead in assessments.

Civilian Space Policy and Applications

Foreign competition is beginning to threaten U.S. leadership in commercially profitable space technologies. As developing European and Japanese systems become operational, the United States stands to lose significant revenues as well as prestige and influence. The situation is aggravated by the absence of overall agreement within the Federal Government about the future direction or scope of the U.S. civilian space program. The need to increase the program's effectiveness is an essential part of the broader problem of maintaining or regaining U.S. leadership in all aerospace and high-technology industries. The U.S. civilian space program is technologically capable, but it must develop more flexible policies and institutions to meet changing conditions.



For the past 25 years, the United States has been the acknowledged world leader in developing and using space technology for civilian applications in the private sector and Government. However, increasing institutional and fiscal constraints, as well as the growth of foreign competition, present Congress with four key issues: What are the appropriate roles of the Federal Government and of private industry in funding or otherwise encouraging civilian space applications research, development, and demonstration? What entities should operate space systems once they are developed and demonstrated? What is the most productive relationship between the civilian and the rapidly expanding military space programs? What major new space projects, if any, should the United States embark on after the space shuttle?

In order to increase the value of space to the United States, it is important for the Government to enlist a greater share of private resources in space technology by developing innovative institutional mechanisms and incentives. In particular, it is critical to continue and encourage the transfer of federally developed technology to the private sector once significant commercial potential has been established. However, the Government continues to play a crucial role in at least four areas that are essential to the Nation's future in space: contribution to basic research and development (R&D); support of space science; provision of public goods and services; and regulation/coordination of national efforts, particularly with respect to international agreements.

OTA examined four space applications technologies that illustrate both the realities of foreign competition and the challenge of Government/industry interaction:

- ***Satellite communications.*** The National Aeronautics and Space Administration has conducted important research in two advanced communications technologies, 30/20 GHz systems and large communications platforms, but neither has been funded for demonstration. Although foreign 30/20 GHz systems are already being developed, the U.S. private sector has maintained that it cannot take the lead in such risky projects.
- ***Land remote*** sensing (sensing of the Earth's surface from space). There is presently no Federal commitment to provide data to U.S. and foreign users beyond the mid-1980's. Nor is the private sector willing to provide data continuity, leaving the field open to France's well-advanced SPOT remote-sensing system.
- Space ***transportation.*** The costs and timetable for the shuttle system remain uncertain. In addition, the small number of projected shuttle flights, and the high costs for U.S. expendable, have already caused U.S. business to purchase launch services from France's Arianespace.
- ***Materials processing.*** Determining the economic feasibility of manufacturing high-value, low-volume products in space will require considerable R&D by the Government and the private sector. Both Europe and Japan are pursuing extensive long-term research.

More effective use of our substantial institutional, technical, and managerial assets would require several changes. Among them are:

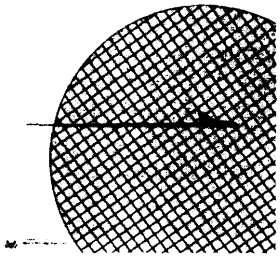
- closer civilian-military planning, including emphasis on technology transfer, and possible joint management and funding of common interest projects, where appropriate;
- establishment of a high-level multirepresentative body to coordinate Federal space policy;
- selected new international cooperative ventures, particularly in remote sensing; and
- reassertion of congressional leadership prerogatives and oversight direction.

A lay consideration for the future development of outer space is that it will continue to both push and be pulled by private sector involvement.

Airport and Air Traffic Control System

Present congestion and delay result mostly from the concentration of air traffic at a few major hubs. Changes in air traffic control equipment or procedures would allow some increases in the utilization of available capacity, but technology is only one form of response to the problems of congestion. The others are economic and regulatory. In the short term, congested airports find it more helpful to use demand management measures such as peak-hour landing fees, slot allocation quotas, or access restrictions in order to shift traffic to times or places where it can be handled more effectively.

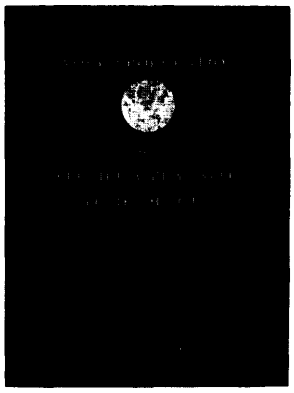
AIRPORT AND AIR TRAFFIC CONTROL SYSTEM



The traffic and slot restrictions that the Federal Aviation Administration placed on busy hubs and en route centers following the Professional Air Traffic Controllers Organization strike in 1981 already impose this kind of demand management or flow control on the entire system. The report points out that these restrictions, which will remain in effect until 1984 and possibly later, raise a more fundamental policy issue: can the Nation continue its past practice of making investments to accommodate aviation growth wherever and whenever it occurs; or is growth to be managed and directed so as to make economical use of existing resources and capacity.

World Population and Fertility Planning Technologies

More than 20 new or improved contraceptive methods will be available in the next decade. The new methods will meet an important need in the United States and other developed countries, and will play a critical role in the developing world, where rapid population growth is now widely acknowledged to be a significant problem.



But the "ideal" contraceptive is likely to remain elusive; it would have to be completely effective in preventing pregnancy; have no harmful effects; be fully reversible; simple and inexpensive to produce and use, be acceptable to all governments, cultures, and religious groups; and fit the needs of all potential users at all stages of their reproductive lives. No such method exists or is expected to be developed. A more realistic goal is for each country to have enough technologies appropriate for local conditions and standards so that each couple has access to at least one that meets that couple's current needs.

Rapid population growth in the developing world is expected to account for nearly 92 percent of the projected increase in world population by 2000. It is seriously hampering efforts to raise living standards in these nations, which face high rates of disease and infant mortality, serious problems of food distribution, and severe shortages of jobs, housing, and educational opportunities.

Three-quarters of all developing country population growth in the next 18 years is projected to take place in just 18 countries, led by India, China, Brazil, Nigeria, Indonesia, Bangladesh, Pakistan, Mexico, and the Philippines.

Birth rates are falling in most of these nations, particularly in those with strong family planning programs. But the huge momentum for future growth generated by the rapidly falling death rates and continuing high birth rates of the recent past is expected to boost the yearly increase in world numbers from 80 million this year to 95 million annually by the end of the century.

All current fertility planning methods have a greater benefit than risk for the vast majority of women in developing countries because of the high incidence of mortality and complications associated with pregnancy and childbearing in these countries. Governments have thus increasingly turned to family planning programs for their maternal and family health benefits as well as for demographic reasons, and the proportion of the world's people living in countries that provide some support for family planning has risen from 10 percent in 1960 to about 90 percent today.

Although current methods are far superior to those of 20 years ago, they remain inadequate to meet the needs of users in industrialized countries and both inadequate for and beyond the reach of most couples in the developing world. When the lifetime requirements of couples who want an effective, safe, reversible, easy-to-use contraceptive for 20 to 25 years of their lives are taken into account, the disparity between present technology and desires of users is greater still.

New or better steroid hormonal contraceptives likely to be available by 1990 include safer oral contraceptives, improved long-acting injections, vaginal rings, and capsules implanted in the forearm. Chemical analogs of one of the hormones that controls ovulation—luteinizing releasing factor, or LRF—show great promise as contraceptives. LRF analogs in the form of nasal sprays, injections, suppositories, or oral capsules, which could offer the advantage of monthly rather than daily use, are likely to provide major new alternatives to the "pill."

Improved IUDS that release copper or progestins and that would need replacement only every *5* to *10* years will include a postpartum IUD that can safely be inserted following delivery. Simplified methods that a woman can use herself to accurately detect the occurrence of ovulation will benefit both users of periodic abstinence or "natural family planning" and women hoping to achieve pregnancy.

Prostaglandin analogs that induce menstruation by contracting uterine muscles when administered as vaginal suppositories, and that can also induce abortion in 90 percent of cases, are expected to be available by 1990. New and more effective barrier devices such as one-size-fits-all, spermicide-impregnated, and disposable diaphragms; vaginal films, rings, and sponges; and cervical caps that can be left in place for weeks or months are also expected by the end of the decade.

Beyond 1990, technologies for fertility planning may include a monthly pill or injection, vaccines for both women and men, simplified and fully reversible sterilization procedures, LRF analogs for self-administered induction of menstruation, and lactation-linked oral contraceptives for women.

The OTA report examines the U.S. role in contraceptive research, development, and marketing, and the U.S. component of international population assistance, which amounts to just under 4 percent of total U.S. development assistance. Worldwide, population assistance totaled about $1 billion in 1980, exclusive of China. The rise in numbers of couples reaching childbearing age will increase the yearly cost of meeting the need for family planning supplies and services to a minimum of $10.7 billion in 1980 dollars by 2000, the report estimates.

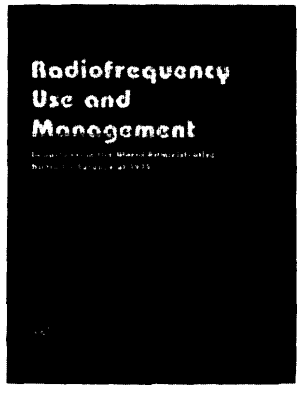
Although demographers do not agree on the relative contribution of family planning programs to reducing birth rates, there is a consensus that stepped-up governmental efforts to provide family planning services would make a significant difference in the world population total

in 2000. If governments take actions to meet the need for such services, the world total will be closer to the low projection (5.9 billion) than to the high projection (6.5 billion). The difference between the two projections—650 million people—is equivalent to adding three times the current U.S. population to global numbers in less than 20 years.

The study also covers the implications of current population growth, the determinants of fertility change, the factors that influence the acceptance, distribution, and use of fertility planning technologies in developing countries, and identifies related issues and options for congressional consideration.

Radiofrequency Use and Managememt: Impacts From the World Administratlve Radio Conference of 1979

A coordinated and consistent national policy is essential to enable the United States to effectively address critical international and domestic telecommunication issues. However, there is no clear responsibility and accountability for telecommunication policy in the U.S. Government. Lack of appreciation and concern for telecommunication issues at the top decisionmaking levels of Government and industry has resulted in a failure to assign sufficient importance to telecommunication matters, including radio spectrum management and negotiation at international conferences.



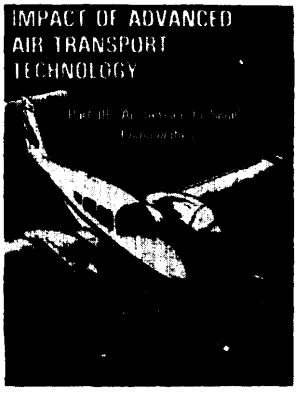
Telecommunication systems are vital to U.S. economic strength and national security. With its technological proficiency, the United States has, in the past, been able to develop domestic telecommunication systems apart from the activities of other countries. However, U.S. requirements for access to the international radio spectrum and geostationary satellite orbit locations are expanding. At the same time, the international mechanism which has successfully managed the allocation of radio spectrum and allowed interference-free operation is coming under stress. This stems from the sharply increased demand for communication services and the resulting congestion in economically attractive parts of the radio spectrum.

The second general World Administrative Radio Conference (WARC-79) was convened in 1979 under the auspices of the International Telecommunication Union (ITU), a United Nations agency responsible for achieving agreement among nations in the use of telecommunications. The Final Acts of WARC-79 are to be submitted to the U.S. Senate for advice and consent to ratification. The majority of decisions relating to technical and operational issues and the international allocation of radio spectrum were acceptable to the United States. It is far from certain, however, that equally satisfactory outcomes can be achieved in future negotiations.

The Final Acts of WARC-79 reflect the rapidly growing differences among nations over the use of the radio spectrum and related satellite orbit capacity. The struggle for influence will continue at future conferences, such as the 10 major ITU international conferences scheduled over the next 7 years. If the United States is to contribute to a satisfactory resolution of international differences, U.S. Government and industry need to examine alternative means for coordinating and managing global use of the radio spectrum. Regardless of what means are implemented, the United States must begin to develop policies now that will assure that international telecommunication decisions do not jeopardize its political, economic, and national security interests.

Air Service to Small Communities

Air service to small communities is presently undergoing a rapid and sometimes disruptive transition from regulation to deregulation. Ultimately, future service will depend on the ability of commuter airlines to provide competitive service in short-haul markets. This in turn depends partly on the introduction of a new generation of cost-cutting commuter aircraft.



Scheduled passenger air service provides small communities with access to the Nation's primary air transportation network and plays an important part in local economic development. Between 1960 and 1978, however, 187 communities were dropped from regulated airline routes. To address this problem, the Airline Deregulation Act of 1978 guaranteed continued air service for 10 years to eligible communities, with direct Federal subsidy if necessary .-The Civil Aeronautics Board established the Essential Air Service (EAS) program to implement this guarantee.

Changes in air service patterns since 1978 suggest that many small- and medium-size cities, and some States and regions, have not benefited equally from recent improvements in domestic air service, Communities in at least 34 States have appealed their EAS determinations, which they feel do not provide for adequate levels of service to maintain or develop markets in small communities. Supporters of EAS respond that it has protected eligible communities, that it was not intended to be a market-development program, and that the cost of such a program would be prohibitive.

Even before 1978 regulated carriers had been replaced in many markets by unregulated, unsubsidized commuter airlines whose smaller aircraft and lower operating costs were better suited to low-density, short-haul air service. Since deregulation, commuters have replaced larger carriers in over 132 EAS-eligible communities and have also reentered previously abandoned markets.

Commuter airlines have added 1,000 aircraft to their fleets since 1965, and current projections indicate a worldwide market for as many as 8,000 new commuter aircraft by 2000 ($1 billion per year). However, few of the commuter aircraft under development are American, and most of these are derivatives of current-technology aircraft. This has raised questions about a loss of traditional U.S. technology lead and about the competitiveness of U.S. manufacturers, not only in the growing foreign market but also in holding their share of a domestic market worth $5 billion to $10 billion in 1980 dollars.

One possible response to the needs of small communities, commuter airlines, and aircraft manufacturers alike is the Small Transport Aircraft Technology (STAT) program initiated by the National Aeronautics and Space Administration (NASA) in 1978. STAT has identified potential advanced-technology applications in four areas—aerodynamics, propulsion, systems, and structures. Studies by three U.S. manufacturers suggest that commuter aircraft incorporating these potential improvements could significantly reduce fuel consumption and direct operating and production costs.

According to NASA, a dedicated R&D program to bring these technologies to readiness for commercial development would require between 3 and 6 years and cost between $18 million and $135 million. Some airline and aerospace observers feel that such a program would encourage U.S. firms to develop advanced-technology commuter aircraft, but others question whether the results of a NASA program would in fact be used by U.S. firms.

Global Models, World Futures, and Public Policy: A Critique

Global models–computerized mathematical simulations of the world's physical and socioeconomic systems—have been the basis for a number of long-range forecasts of global trends in population growth, resource availability, economic development, and environmental conditions.

These forecasts range from guardedly optimistic to highly pessimistic, but they generally identify the same potential problems and arrive at roughly similar qualitative conclusions about the present state of the world and its plausible futures:

> Population and consumption cannot grow indefinitely without eventually causing widespread hunger and resource scarcities, but there is no-physical reason why the basic material needs of all the world's people cannot be met for the foreseeable future. These needs are not now being met

because of unequal distribution of resources and consumption, not because of overall physical scarcities.

- While progress is notable in some areas, continuation of many other recent trends would result in growing environmental, economic, and political difficulties; as a result, "business as usual" is not a likely future course. Regional problems of global concern, such as food shortages in South Asia and perhaps Central Africa, are far more likely than a global collapse.
- The next 20 to 30 years will see a transition to a state of the world that is qualitatively different from the present. Technological progress is expected and indeed vital, but the models suggest that social, economic, and political changes will also be necessary.
- Actions taken soon are likely to be more effective and less costly than the same actions taken later, and cooperative long-term approaches are more beneficial for all parties than competitive short-term strategies.
- Many existing plans and agreements–particularly complex, long-term international development programs—are based on assumptions about the world that are mutually inconsistent or inconsistent with physical reality.

In its study, OTA surveyed four major global models and the Global 2000 study conducted by the U.S. Government. The study also examines the Government's use of such models and their potential usefulness in dealing with long-range issues.

Although the accuracy and usefulness of global models are limited by theoretical constraints and by a lack of adequate and reliable data in some areas, global models offer several advantages over traditional techniques of long-range analysis and policy development. As tools for understanding complex interrelationships, they could be useful in four areas: 1) assessing the future impacts of current policies, 2) detecting early signs of potential problems or opportunities, 3) testing a wide range of policy alternatives, and 4) ensuring consistency between agencies and between short- and long-term goals.

OTA found extensive and growing use of models by Federal agencies ranging from the Department of Agriculture to the Joint Chiefs of Staff. Steps toward improving the models could include efforts to expand and standardize data bases and to strengthen communication between model developers and model users in different agencies. Technical advances in methodology and validation are also desirable, but another vital step would be to make modeling a continuing activity that responds to the information needs of decisionmakers.

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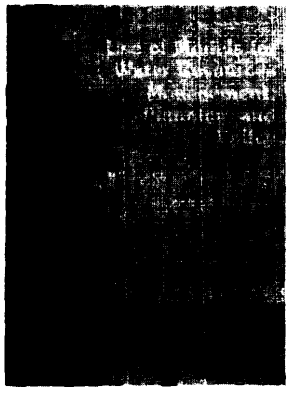
Use of Models *for* Water Rosources Management, Planning, and Policy

Mathematical models have significantly expanded the Nation's ability to manage and wisely plan the use of its water resources, and promise even greater benefits in the future. However, the rapidly advancing field of water resource modeling has outstripped the capacities of Federal, State, and local agencies to support and effectively use these tools.



As the United States approaches full use of its water resource, the ability to analyze the consequences of water resource development becomes increasingly important and difficult. Mathematical models—most often computerized—are extensively relied on to meet this purpose. They are among the most sophisticated analytic technologies available, despite varying technical capabilities among the many water resource issues. They are significantly improving the accuracy of information on water supplies, floods and droughts, water quality, and the economic and social consequences of water-related development and controls.

Models can substantially reduce the cost of managing water resources. For example, models are used to predict the water quality that would result from proposed wastewater discharge, before costly treatment systems are built. They assist in decisionmaking by providing information for people to interpret in light of existing laws, political and institutional structures, and informed professional and scientific judgment.

Much of the analysis presently performed to assess water resources would not be feasible without current modeling capabilities. Models are also relied on to perform analyses required by many of the major Federal laws, including the Clean Water Act, the Water Resources Planning Act, and Federal flood control legislation.

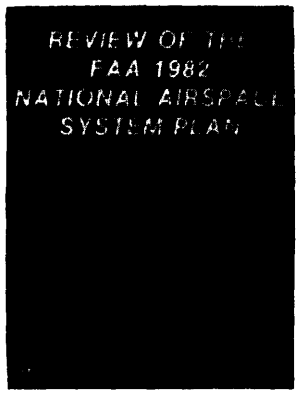
The Federal Government spends approximately $50 million per year on water-related mathematical models to help plan billions of dollars of annual water resource investments, and help manage hundreds of billions of dollars of existing facilities. Nonetheless, no overall strategy for developing and using models exists within most Federal agencies. Little effort has been made to coordinate the development, use, and dissemination of models throughout the Federal Government, or to assist State and local governments in using these tools. As a result, many legislative requirements and decisionmaker needs for information are not being met. Moreover, many water resource agencies, particularly at State and local levels, are unaware of currently available models that could be applied to their information needs.

Opportunities for congressional action to improve the Nation's water resource analysis capabilities include:

- modifying the mechanisms governing Federal water research to direct adequate resources toward developing research results into usable analytic tools;
- directing individual Federal agencies to provide comprehensive support programs for modeling and other analysis needs, both for their own use and for use at State and local government levels; and
- directing agency resources toward training in the use and interpretation of models, and disseminating information about existing water resources models.

Review of the FAA 1982 National Airspace System Plan

The 1982 National Airspace System (NAS) Plan for modernizing air traffic control (ATC) facilities and equipment is a significant and bold step compared to past Federal Aviation Administration (FAA) efforts to chart a future course for aviation. However, it lacks a clear sense of priorities and provides no contingencies in the event of delays or problems. It proposes improvements in the en route traffic control system, but fails to relate them to the system as a whole and to deal with the principal constraint on the future growth of aviation—airport and terminal area capacity.



Other findings and issues identified in OTA's NAS Plan review are:

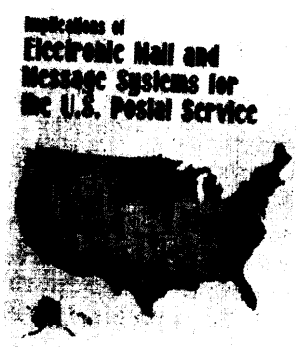
- FAA may be overestimating future air traffic growth. These projections underlie the proposed approach to and funding for enroute computer replacement, a decision that sets the pace and direction for overall system modernization.
- FAA's first step in computer replacement—''rehosting" existing ATC software in processors which "emulate" the IBM 9020 computers—runs the risk of freezing future system development. Alternative approaches, such as upgrading the existing computers and beginning immediately to design a complete system of hardware, software, and displays, could take better advantage of advances in computer technology and provide a replacement system within the same time frame. The cost savings could be as high as $186 million.
- The NAS Plan asserts that substantial cost savings will accrue from the planned use of advanced automation but does not provide supporting analysis.
- The proposed long-term ATC system improvements are generally directed to the needs of high-altitude traffic operating under In-

strument Flight Rules. If carried out, they would also benefit FAA itself in the form of manpower savings and reduced operating costs. They do not seem as well suited to the needs of general aviation and of military services.

- Implementing the improvements proposed in the 1982 NAS Plan would more than double FAA's budget for facilities and equipment through 1987, compared to average annual expenditures over the last 10 years, FAA proposes to cover 85 percent of capital investments and about half of operating costs through user fees and a drawdown on the uncommitted Trust Fund balance. The proposed user fee schedule would perpetuate the existing cross-subsidy from airline passengers and shippers of air cargo to general aviation, particularly business aviation, In addition, high user fees may dampen the growth of aviation, thereby reducing projected revenues,

Implications of Electronic Mail and Message Systems for the U.S. Postal Service

Commercially offered electronic mail and message systems (EMS) and electronic funds transfer (EFT) systems will increasingly compete with portions of the traditional market of the U.S. Post Service (USPS), While there is disagreement on how fast EMS and EFT markets may develop, it seems clear that two-thirds or more of the current mainstream could be handled electronically and that the volume of USPS. delivered mail is likely to peak and then fall below today's level sometime in the 1990's, Any significant decline in the volume of mail would affect future postal rates, service levels, and labor requirements,



A key policy issue requiring congressional attention *is* how USPS will participate in providing EMs services, both in the near term and in the longer term. A USPS role in the provision of EMS services, especially those which require delivery of hardcopy (Generation II), has the potential to cushion some of the effects of reduction in conventional mail volume and revenue, Since private firms are neither willing nor able to duplicate the nationwide physical delivery structure of USPS, any large-scale Generation II EMS service depends on USPS participation for hardcopy delivery, But beyond this, there is little consensus on exactly what the USPS role should be.

USPS believes its participation in EMS is authorized by the Postal Act mandate to use new facilities and equipment to improve the convenience, efficiency, and cost effectiveness of mail service, However, various telecommunication and computer firms view USPS involvement in EMS as the entry of a Federal agency into competition with

private industry, raising difficult questions of ratesetting and possible cross-subsidy. Without congressional action to provide a clear direction for USPS and to clarify or redefine regulatory boundaries, the current controversy over USPS participation in EMS is likely to continue, and opportunities for USPS, as well as for private telecommunication carriers and mailers, may be lost.

USPS is already involved in Generation II EMS to a limited extent. In January 1982, USPS introduced an electronic computer-originated mail service, known as E-COM, in which USPS accepts letters in electronic form, converts them to hardcopy (including printing and enveloping), and delivers them. A review of E-COM costs and markets is needed in order to determine the USPS role that would be most conducive to growth of Generation II traffic (and hence USPS mail volume) and have the most favorable impact on USPS finances.

Congress may also wish to clarify the applicability of the Private Express Statutes to delivery of Generation H EMS hardcopy; delineate the division of regulatory jurisdiction between the Postal Rate Commission and the Federal Communications Commission; decide on the desirability of a separate USPS entity for any EMS offering; mandate an independent security review to ensure that adequate technical measures are in place to protect the privacy of EMS messages; and consider amending the Postal and/or Communications Acts to provide additional statutory privacy protection for EMS.

For the longer term, Congress will need to maintain oversight and initiate planning on the future viability of USPS, including ways to increase cooperation with the private sector (e.g., joint technical and market tests), possible USPS use of telecommunication or all-electronic Generation 111 EMS delivery (e.g., in rural and less populated areas) through lease or contract with private firms, use of EMS in combination with the USPS structure to provide other Federal Government services, and the need for adjustments in anticipation of USPS labor force reductions.

Regardless of the USPS role in EMS, improved postal worker productivity combined with eventual declines in conventional mail volume is expected to lead to reductions from the present number of employees. The USPS labor force requirement in 2000 is most likely to be down by at least 20 to 25 percent, with some employee groups (such as mail handlers) declining by 30 to 35 percent. The ability of USPS to handle necessary reductions through attrition and the possible effects on minority employment, upward mobility, employee morale, and union contract negotiations are areas that warrant attention and study.

Alternatives for a National Computerized Criminal History System

Computer and communication technology has the potential to substantially improve the nationwide exchange of criminal history information, thereby assisting criminal justice decisions (e.g., police investigation and booking, pretrial release and bail, sentencing). However, the debate over a national computerized criminal history (CCH) system has raised difficult questions about the use and quality of information in the system, and management and control of the system itself. Depending on the mechanisms established to control a national CCH system, the quality of the records exchanged, and the standards set for operation and use, the system could have important implications for employment and licensure, Federal-State relationships, and civil and constitutional rights, as well as for public safety and the administration of justice.

Criminal history records are used at all levels of government, by all sectors of the criminal justice community, and increasingly by the noncriminal justice community. There are many ways that a national CCH system could be designed to facilitate exchange of criminal history records. The emerging consensus among Federal and State criminal record repository and law enforcement officials favors the Interstate Identification Index (III) concept. Here, only Federal offender records and an index to State offender records would be maintained at the national level, along with a national fingerprint file on criminal offenders. Most of the building blocks for 111 are already in place. But without Federal direction in resolving several key issues as well as some modest Federal funding, full implementation of III would probably take many years.

One key issue is how to devise a policy control mechanism that will represent the interests of the law enforcement, prosecutorial, judicial, correctional, public and private defender, and noncriminal justice sectors, as well as Federal, State, and local criminal history record managers and the general public. There are many possibilities, such as a consortium of States, a Federal agency responsible for system management (e.g, the Department of Justice or Federal Bureau of Investigation (FBI)), an advisory policy board to that agency, and/or an independent board.

Since 1970, Congress has expressed concern about the completeness and accuracy of criminal history records. OTA found that record quality has improved, but significant problems remain, especially with respect to court disposition reporting. On the average, about one-third of court dispositions are not being reported to State criminal record repositories,

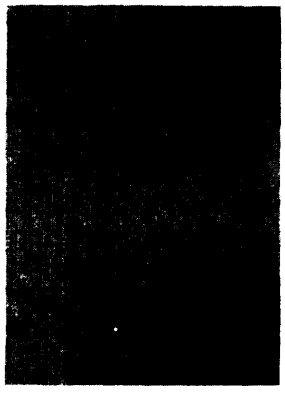
although individual States vary widely. Congress may wish to strengthen current reporting requirements and/or fund efforts to improve record quality.

Congress also has expressed concern about noncriminal use of criminal history records (for employment and licensing and security checks). Such use is permitted under many State and Federal statutes. But the definitions of authorized users and policies on record dissemination vary widely among jurisdictions. This reflects in part considerable disagreement over the value of criminal history records for noncriminal justice purposes—especially arrest records without court disposition or conviction information. Congress could entirely prohibit noncriminal justice access to a national CCH system, permit such access only to records with disposition or conviction information, or resolve existing conflicts between and among State and Federal laws but otherwise maintain the status quo.

Congress may wish to review the size and content of any national index or file, establish new oversight and audit procedures to help ensure compliance with system standards, and provide modest Federal funding to improve court disposition reporting and facilitate III implementation. Congress also could determine whether a Department of Justice or FBI role in the electronic interstate exchange of criminal history records and inquiries (i.e., message switching) should be authorized, request the preparation of alternative plans for the consolidation of Federal criminal history functions, and consider the need for legislation on a national CCH system.

Medical Technology Under Proposals TO Increase Competition in Health Care

Greater competition in health care is intended to increase the cost consciousness of physicians, hospitals, and patients, which, in turn, could lower hospitalization rates and promote the use of less expensive medical technologies. However, an analysis of two major strategies to increase competition raises concerns about the resulting quality of care. Both strategies would also intensify the need for information on benefits and costs of decisions consumers would have to make about when to seek care, what kind of care to seek, and which health plan to choose.



The term “medical technology” includes drugs, devices, medical and surgical procedures, and the organizational systems involved in providing health care. Economists and policy makers have attributed the dramatic upward spiral in health care costs over the last 15 years to the lack of competition, or lack of

sensitivity to price, on the part of those who buy and use medical technology.

Two strategies to promote price competition are: 1) to require that patients pay a larger share of their medical bills ("cost sharing"), and 2) to create greater competition among organizations providing health insurance and delivering comprehensive medical care. A change in tax policy—making it more neutral toward medical insurance coverage—is a key element of both approaches. Both would also cover comprehensive care and catastrophic medical expenses, and subsidize premiums or costs according to income levels.

Some of OTA's findings in regard to greater patient cost sharing are as follows:

- Higher direct costs would discourage people from seeking medical care and would lead those who did to use fewer and less expensive services. As a result, physicians might choose less costly technologies and settings, such as outpatient care instead of hospitalization.
- There would probably be little effect on the use of preventive technologies, because present insurance often excludes them from coverage. Important exceptions are children in low-income families, who have historically made less use of preventive technologies when paying a greater share of medical costs.
- The effect on technology use and cost of coverage for catastrophic medical expenses is unclear; fewer cases would reach the catastrophic limit, but those that did might be treated more intensively.
- Physicians and hospitals would continue to have an incentive to overuse technology because they would continue to receive more revenue from its greater use. Overuse of technologies such as hospitalization could cause the quality of medical care to suffer, as often happens under present systems.

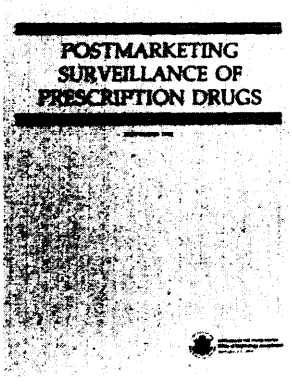
The other proposal—to increase competition among comprehensive care organizations—relies on the organizations that deliver care to control technology use and cost as they compete for enrollees. Major findings for this approach are:

- With lower cost sharing for outpatient care that is common in prepaid groups, cost would not discourage people from seeking care as much as the option to increase cost sharing would. Hospitalization rates, especially for surgery, would fall for all age groups and income levels. Changes would be expected in the innovation and use of managerial technologies in staffing patterns, the delivery of outpatient care, and alternative delivery systems.
- Organizations would control technology use for catastrophic care as prepaid groups do now. They would not necessarily provide more immunizations or counseling.
- There would be a concern about less than adequate quality of care, because physicians and hospitals would have financial incentives to limit costs, even at the expense of quality.

Strategies to increase competition would not eliminate regulation. Although greater dependence would be placed on individuals to decide about the value and use of technologies, regulation would be needed to establish an environment in which the buyers and users of medical technology would be sensitive to price. Specific areas of policy interest are Government's role in consumers' selection of plans, quality assessment and assurance, consumer information, and regional distribution of technologies.

Postamarketing Surveillance of Prescription Drugs

This OTA report describes the drug approval process, the history and objectives of postmarketing surveillance activities, the methods used in premarket and postmarket testing, and current activities in postmarketing monitoring. It then provides legislative options, including ways to strengthen authority of the U.S. Food and Drug Administration (FDA) in postmarket evaluations of prescription drugs.



The premarketing approval process is now the primary method for assessing the safety and efficacy of prescription drugs. However, the premarketing tests are not capable of detecting some adverse effects that may occur only after months or even years of use of a drug. Therefore, over the last decade, postmarketing surveillance activities have been proposed to monitor drug usage mainly to determine more completely a drug's beneficial and harmful potentials.

Current interest in prescription drug evaluation and monitoring is focused on the premarketing approval process and the length of time it takes for a drug to be approved by FDA. This interest is reflected in: 1) bills before Congress to extend the patent life of drugs and other federally regulated products by the amount of time it takes for such products to clear the premarket approval process; 2) establishment of a recent Congressional Commission on the Federal Drug Approval Process; and 3) proposals to improve and speed-up the drug approval process. However, postmarketing surveillance of drugs is also a critical policy issue.

The issue of postmarketing surveillance of the effects of drugs has been spotlighted only periodically. In August 1982, Eli Lilly& Co. withdrew its new arthritis drug, Oraflex after it was banned in Great Britain pending further investigation of evidence linking the drug to adverse effects, including deaths. The drug had been available in Great Britain for 2 years but available in the United States for only 3 months. A similar withdrawal occurred in January 1980, when Smith Kline & French withdrew its high blood pressure drug, Selacryn following reports of

liver damage and deaths. While FDA has the authority to ban a drug immediately as an "imminent hazard to the public health," this power has been used only once—in 1977, when FDA banned Phenformin a diabetes drug.

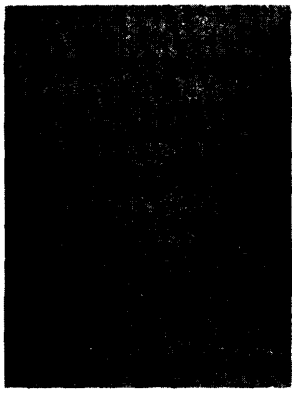
Legislative options that could strengthen FDA's powers in the postmarketing period include: 1) giving FDA the power to require postmarketing studies; 2) giving FDA the power to restrict the distributing, dispensing, and administering of a drug; and 3) changing the standard for a drug's immediate removal from the market from "imminent hazard to the public health" to "unreasonable risk of illness to any segment of the population" or some other less stringent standard. These options could be pursued independently of any revisions in the premarketing approval process.

The OTA report also provides guidelines for determining whether various possible changes in the drug approval process would affect its current capability to detect adverse drug reactions prior to a drug's release for marketing.

TECHNICAL MEMORANDUMS AND BACKGROUND PAPERS

Technology Transfer at the National Institutes of Health (Technical Memorandum)

This Technical Memorandum examines the current technology transfer and assessment activities of the National Institutes of Health (NIH).



The timely transfer of medical technologies from the research setting to medical practice has important implications for the quality and cost of health care. The Institutes of NIH are responsible for much of the basic science knowledge that exists and for a large share of the evaluation of medical technologies that takes place.

The report presents general information on how biomedical research leads to the development of medical technologies and how those technologies are evaluated for their benefits and risks and then transferred into the health care svstem, The current state of NIH activities related to developing, evaluating, and transferring technologies is described. The report also contains detailed examinations of two NIH Institutes—the National Cancer Institute and the National Heart, Lung, and Blood Institute—because of their size, importance, and the extent of their involvement in the transfer of medical technologies.

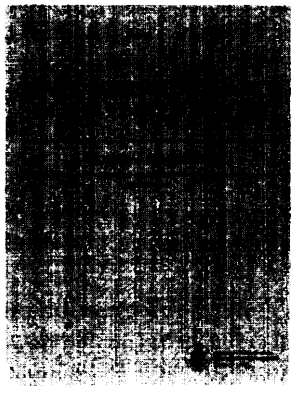
OTA's findings apply to medical technology transfer in general, and are not confined to NIH. NIH was examined because it is one of the most crucial participants in such evaluation and transfer.

The main findings are that, despite some difficulties in the timely transfer of technologies, the most critical problems are: 1) inadequate attention as to whether technologies being considered for transfer rest upon a sufficient knowledge base; and 2) insufficient evaluation of the potential benefits and risks of medical technologies prior to their transfer.

The report concludes that NIH's current methods for transferring technology are appropriate. The agency disseminates information on new technologies and funds demonstrations of their potential uses. However, when information on the benefits and risks of technologies to be transferred is inadequate, these processes cannot operate properly. Thus, if NIH's activities that provide such information—clinical trials and consensus activities are the major examples—are to be fully effective, additional funding may be required.

Space Science Research in the United States
(Technical Memorandum)

In the view of many scientists, space science is in a state of crisis. The future of several subdiscipline (e.g., solar and heliospheric physics,



and-X-ray an-d gamma ray astronomy) as well as the disciplinary area of planetary science is uncertain because of recent and proposed budget cuts. Several major missions have been indefinitely postponed, and funding for important interim activities such as data analysis from previous missions is inadequate.

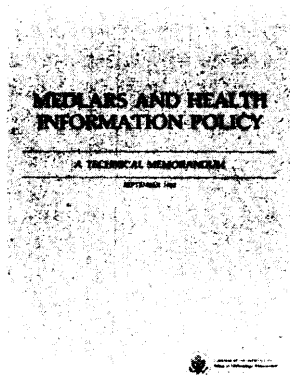
Unlike the manned space program, space science has never been directed toward a particular national goal of unequivocal priority. As a result, space science policy has been conducted in a mode where the programs undertaken are determined primarily by available budget and only secondarily by scientific goals. Furthermore, no base budget has ever been set to ensure that certain scientifically critical activities are sustained.

The current practice of budgeting most flight missions as independent new starts emphasizes spectacular accomplishments, and is not necessarily optimal for scientific progress. With a view to implementing a more programmatic approach, it might be advisable to develop an alternative budgeting strategy, in which budgets are separately established for important continuing activities (including instrument design, data analysis, theory, and perhaps small- to moderate-sized missions) and for major missions (including hardware, launch, and operations). In this way, activity that is scientific per se might be better protected from cost overruns, whether in the high-priority manned program or in large science missions.

International cooperation in space science activities has been fruitful in the past and, for possible major missions in the future, may be highly desirable in order to share costs. There has been, however, a continuing problem of the United States' changing its commitments to international missions. Potential foreign partners are therefore reluctant to enter future agreements with the United States.

MEDLARS and Health Information Policy
(Technical Memorandum)

This Technical Memorandum examines the relationship between the National Library of Medicine (NLM) and the private sector in creating and distributing health-related information by means of computerized bibliographic retrieval systems. The study also examines the effectiveness of NLM's computerized system MEDLARS (Medical Literature Analysis and Retrieval System) in distributing health information.



The National Library of Medicine is the Nation's principal resource for the collection, organization, and retrieval of scientific literature in the health and biomedical fields. MEDLARS is a complex system that maintains data files, provides on-line retrieval services, and produces computer-photocomposed publications. MEDLINE (MEDLARS on-line) is the largest "and most extensively used of NLM's data bases.

In its analysis of the effectiveness of MEDLARS in distributing bibliographic information, OTA examined three issues: 1) the subject content of the literature cited in the MEDLARS data bases, especially MEDLINE; 2) the coverage of nonjournal literature in the MEDLARS data bases, particularly MEDLINE; and 3) an evaluation of the methodological design of articles in literature cited in the MEDLARS data bases. OTA's conclusion is that MEDLARS, in general, is effective in distributing health information. Yet, there are technical limits to the system that prevent MEDLARS from satisfying the needs of all its users.

OTA's examination of the relationship between NLM and the private information sector focuses primarily on the issues related to leasing NLM's data base tapes and the charges for on-line access to its data bases. Some argue that MEDLARS' subsidized prices give NLM a competitive advantage, and that NLM should recover the "full costs" of its products and services. At the same time, others claim that its low cost aids in the dissemination of health information to all who seek it. The debate is further complicated by the fact that "full cost recovery" has many different interpretations.

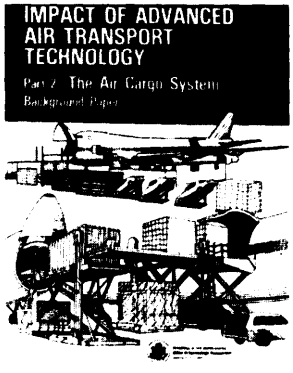
The study concludes that the creation of MEDLINE by the Library seems warranted by NLM's extensive collection of biomedical materials, by its legislative mandate, and on economic grounds. It is uncertain taht if NLM were to stop creating MEDLINE that a new or established private firm would produce a similare product. OTA also concludes that there is no compelling reason for NLM either to continue or to discontinue providing on-line access to MEDLINE, as opposed to access through private information services that lease the MEDLINE data tape.

In drawing the proper balance between the public and private sectors, OTA finds that there are insufficient data to decide, on purely technical grounds, the most efficient and effective combination of public and private computerized health-related bibliographic activities. Arguments presented by proponents or opponents seem to reflect philosophical perspectives rather than objective analysis.

OTA also finds that rapid advances in the computer and communications fields may, in the near future, profoundly alter the issues and change the effects of current decisions on information policies and practices.

Air Cargo
(Background Paper)

This study is one of four parts of an OTA assessment of the economic, environmental, and societal impacts of advances in the technology of transport aircraft. It focuses on the principal factors that could influence the future evolution of air cargo transport.



Revenues from the air cargo industry exceeded $3 billion in 1980. However, air cargo is still dwarfed by the passenger side of the airline business and the surface transport side of goods movement. It totals only 11 percent of all U.S. airline revenues and 1.4 percent of all domestic freight revenues. Growth has been steady and well above the gross national product growth, according to the OTA paper.

Today, almost all civil cargo aircraft are derivatives of passenger aircraft. Current estimates of future market prospects (7 to 12 percent annual growth) do not indicate that this situation will change appreciably in this century. While a dedicated cargo carrier using 1990's technology might cut fuel consumption by as much as 50 percent compared to today's most efficient carriers, very nearly the same gains in efficiency could be achieved through conversion of 1990's passenger aircraft for cargo use.

The Department of Defense is studying several options for meeting its future airlift needs, including the design of a joint civil/military cargo aircraft. However, industry remains skeptical that the product of such a joint planning effort would be competitive with derivatives of future passenger aircraft.

More efficient handling of cargo on the ground could have as much impact on future growth and profitability of air cargo as would the introduction of more efficient aircraft. It has been estimated that complete containerization of cargo and a high level of mechanized handling could reduce the cost of ground operations by as much as 70 percent.

The air cargo industry is undergoing a period of rapid change brought about in part by deregulation of air cargo in 1977, passenger airlines in 1978, and trucking in 1980. Several carriers are taking advantage of new opportunities under deregulation to offer single-carrier shipping using both air and ground modes of transportation.

The study points out that express package delivery—using conventional aircraft and ground handling systems—is the fastest growing and most profitable segment of the air cargo industry. This example suggests that while new technology can result in operating efficiencies,

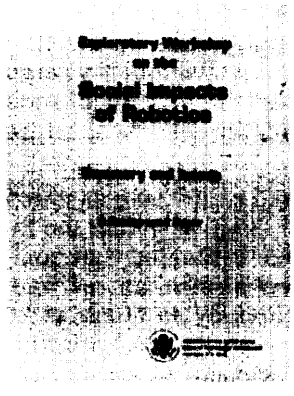
it is not a substitute for providing services carefully tailored to the needs of shippers.

OTA found continuing active interest in using lighter-than-air (LTA) or hybrid LTA vehicles as air cargo carriers. However, they are not likely to compete with conventional air and surface modes for the movement of goods over long distances.

The only Federal regulations of major consequence still in place following air cargo deregulation concern aircraft safety and noise standards. Two additional areas for continued Federal involvement relate to unfair foreign practice concerning U.S. carriers and international agreements on ratemaking. One potential problem area relates to the phasing out or elimination by the Civil Aeronautics Board (CAB) of reporting requirements. This has left both the Government and the public with no means of monitoring the flow of the air cargo portion of interstate commerce. The Air Freight Forwarders Association has requested that CAB reestablish some "minimal" reporting requirements to show where freight is moving and where traffic is developing.

Exploratory Workshop on the Social Impacts of Robotics (Background Paper)

OTA sponsored the workshop last summer in response to congressional interest in the rapid advances in computer technology and its applications, and public concern about the economic health of U.S. manufacturing industries.



A robot can be defined as "a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices, through variable programed motions for the performance of a variety of tasks."

The paper points out that primary U.S. interest in robotics stems from the belief that robots, along with other new automation technology, will be an important tool for improving the competitiveness of U.S. manufacturing. There is also concern about possible impacts of this technology on workers as it becomes more widely used.

OTA workshop participants—including robotics researchers and representatives from robot manufacturing firms and firms that use robot technology—generally agreed on the following points:

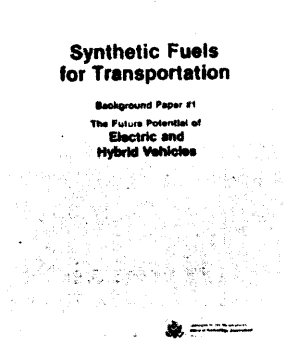
- the use of robots for industrial automation is growing rapidly, with heavy use likely by the end of the decade;
- robotics is only one of several technologies that contribute to the automation of manufacturing;

- any major impacts of robotics on productivity and employment within this decade will be attributable to the general trend toward computerized automation, computer-aided design, the use of information systems to control operations and support managements, and the integration of all these technologies into flexible manufacturing systems;
- robots, specifically, may have important longrun impacts as the technology develops toward computer-based mobile devices that can perform a variety of complex tasks and thereby substantially broaden the range of their potential use.

The workshop identified a number of issues concerning the robot industry relating to industrial organization, research and development, government use, definition and standards. Also identified were a number of social and economic issues which OTA groups into five sets: productivity and capital formation; labor; education and training; international competition and trade; and potential future applications of robots for defense, space exploration, and ocean mining.

The Future Potential of Electric and Hybrid Vehicles (Background Paper)

This is a Background Paper for the OTA report titled "Increased Automobile Fuel Efficiency and Synthetic Fuels: Alternatives for Reducing Oil Imports."



The report presents a comprehensive review of the future of electric and hybrid vehicles through the year 2010 in the United States. It discusses the technology, performance, and limitations of probable future electric and hybrid vehicles; the infrastructure necessary to produce and support them; marketability; and finally, effects on the Nation if used in large numbers.

The paper discusses the technology of electric vehicles, and what it may offer in the future. The technology of hybrid vehicles is also discussed because hybrids are an extension of electric vehicle technology which will probably reach the marketplace only after the appearance of electric vehicles, and only if satisfactory storage batteries and electric drive trains have been developed.

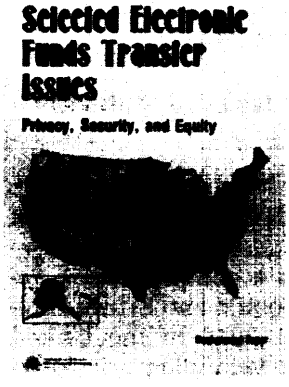
The paper considers the infrastructure required to support electrified travel. The principal elements of the infrastructure are the electric power system, which must recharge batteries; the materials industry, which must supply large quantities of materials used in batteries; and the automobile industry, which must both produce and maintain electric vehicles.

Marketability of electric and hybrid vehicles is reviewed. The critical role of the cost and availability of liquid fuels for heat engine vehicles is examined along with the possible effect of incentives for electric and hybrid vehicles which may be provided by governmental action.

The study concludes with a review of the benefits and costs, monetary and nonmonetary, which might accrue if electric and hybrid vehicles were to be widely used in the United States.

Selected Electronic Funds Transfer Issues
Privacy, Security, and Equity
(Background Paper]

This paper focuses primarily on user privacy, system security, and consumer equity, and briefly discusses other questions and issues related to electronic funds transfer (EFT). Relevant EFT developments since the completion of the work of the National Commission on Electronic Funds Transfer are considered.



The paper is one of four components of the OTA assessment of Societal Impacts of National Information systems. An OTA report released last fall, "Computer-Based National Information Systems: Technology and Public Policy Issues," provides a comprehensive overview of the assessment.

EFT includes a cluster of technologies that allow financial transactions to be made electronically rather than by the use of cash or checks. Examples are automated teller machines (ATMs) and telephone bill payment. The term EFT is also used to refer to the electronic transfer of information critical to financial transactions, such as credit authorization and check validation.

Although most EFT technologies are no more than 15 years old, they are already having a significant impact on payment systems, banks, and other financial institutions. Within the next two decades, it is possible that EFT will transform the way Americans carry out their day-to-day commercial activities and personal monetary transactions, according to OTA.

In addition to the financial institutions that have traditionally provided payment services (commercial banks, savings and loan institutions, mutual savings banks, and credit unions), the key actors in the development of EFT are Government institutions such as the Federal Reserve, the U.S. Treasury, and regulators of financial institutions, as well as retail stores and employers.

EFT, in common with other national information systems, raises new issues of privacy, security, and equity. In general, greater concern is

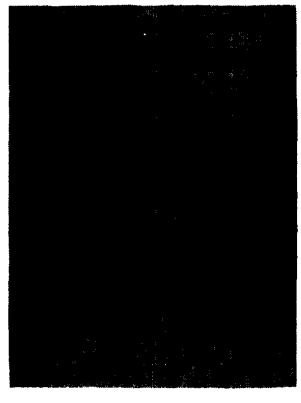
expressed about privacy in EFT that in older more familiar systems. The OTA paper examines these concerns and also looks at the ways in which EFT can enhance the privacy of financial transactions. The recommendations on privacy made by the National Commission on Electronic Funds Transfer in 1977 are compared with the present status of existing and proposed legislation.

Any payment system or financial institution must be able to guarantee, at least to some reasonable degree, the safety of assets entrusted to it. The security implications of EFT systems are discussed by OTA. Although the average loss per theft appears to be greater in EFT systems than in paper-based systems, there is no evidence that EFT systems to date have experienced a crime rate that is higher than average. They do, however, have some vulnerabilities that are different from paper-based systems. Financial institutions are generally reluctant to call attention to EFT security problems or to encourage public discussion. As a result, there is a paucity of information about EFT security.

In modern society, the ability to carry out basic financial transactions is essential. EFT offers benefits in terms of customer convenience and reduced costs, as well as increased productivity for financial institutions. However, to the extent that some forms of participation in EFT become mandatory or inescapable, or to the extent that EFT significantly displaces or raises the costs of alternatives, some groups could experience a loss of equity of access to financial services.

The implications of Cost-Effectivness Analysis of Medical Technology (Background Papal

Analyzes the feasibility, implications, and usefulness of cost-effectiveness analysis [CEA] and cost-benefit analysis [CBA] in health care decisionmaking, including the current and potential use of CEA/CBA or related techniques in six health care activities: reimbursement programs, Professional Standards Review Organizations, health planning market approval for drugs and medical devices, research and development programs, and health maintenance organizations.



In addition to the main report (published in August 1980), there are five background papers: 1) ***Methodological Issues and Literature Review,*** published September 1980; 2) ***Case Studies of Medical Technologies,*** consisting of 17 individual case studies, 15 were published in 1981. The final two case studies (listed below) were published in 1982; 3) ***The Efficacy and Cost Effectiveness of Psychotherapy,*** published October 1980; 4) ***The Management of Health Care Technology***

in Ten Countries, published October 1980; and 5) ***Assessment of Four Common X-Ray Procedures,*** published in 1982.

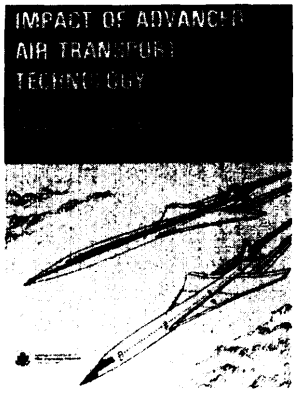
Case Study ***9:*** The Artificial Heart: Cost, Risks, and Benefits. -Discusses the potential societal benefits, costs, and risks of continued investment in the artificial heart. Provides an opportunity to address policy questions concerning the distribution of research funds for treating heart disease, the equitable distribution of medical technology, and the potential costs to society before this life-saving technology is available for therapeutic use.

Case Study 13: Cardiac Radionuclide Imaging and Cost Effectiveness.—Examines the rapidly expanding diagnostic technology of cardiac radionuclide imaging used for the diagnosis and management of heart disease. Discusses the market and the industry, users and uses, costs and charges, clinical efficacy, analyzes cost effectiveness, and policy implications for this new technology.

Background Paper #5: Four Common X-Ray Procedures: Problems and Prospects for Economic Evaluation.—The medical profession has recently been debating the appropriate use of X-ray procedures, and whether the benefits are worth the risks and costs. This paper reviews the problems and prospects for economic evaluations of four common X-ray procedures, which together constituted almost half of all diagnostic X-ray procedures performed in the United States in 1970. These procedures are chest X-ray, skull X-ray, barium enema study, and excretory urogram. The paper discusses the influence evaluations have had on the use of each of the procedures, and how evaluative research might increase its impact on medical decisionmaking.

Financing and Program Alternatives for Advanced High-Speed Aircraft (Backgrond Paper)

This paper identifies and examines the potential financial and managerial barriers to carrying out a large-scale program to create a 1ong-range commercial air ‘transport using new technology.



The study looks at the technological, market, and financial risks of such a program and the ability of the U.S. aerospace industry to assume them.

Among the issues associated with the development of advanced technology commercial air transport programs are:

- the structure of the aerospace industry and the attributes of aircraft markets;
- the financial capacity of the aerospace industry; and
- the appropriateness and the potential level of Federal involvement in the aerospace research and development.

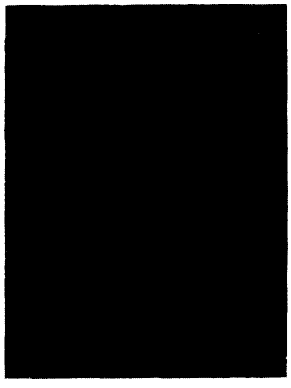
OTA also describes alternative strategies for implementing advanced air transport projects.

The paper is the fourth and final publication of a broad assessment of new aircraft technologies. Specifically, it supplements the earlier OTA report, ***Impacts of Advanced Air Transport Technology: Part I–Advanced High-Speed Aircraft,*** requested by the House Committee on Science and Technology. In addition to covering advanced technology aircraft (subsonic and supersonic), the overall assessment includes those aircraft used in providing service to small communities and in transporting air cargo.

Mandatory Passive Restraint Systems in Automobiles: Issues and Evidence

(Background Paper)

The automobile serves as a prime example of the complexity of modern technology's role in health. Its invention introduced an era in which the time distance between a health crisis and curative medical care would be reduced by critical minutes, in which timely rescue from a burning building would become increasingly feasible, and in which distribution of life-sustaining food and medicine would occur ever more rapidly and inexpensively. Accompanying these health benefits of motor vehicles, however, have been the significant health costs of street and highway travel, and the deaths and injuries which reflect the size, structure, and velocity of the vehicles, as well as characteristics of the roads and of the operators of the vehicles. The disproportionate impact of motor vehicle accidents on the young is particularly tragic, as thousands of lives are cut short in their prime and healthy bodies are committed to decades in beds and wheelchairs. The economic costs of treatment and rehabilitation as well as lost future productivity are substantial. The emotional toll is enormous. It is toward reducing these burdens that the technology of passive restraints is directed.



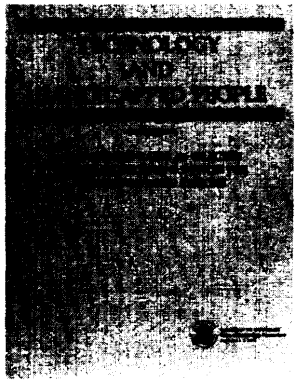
This paper examines issues in the debate on whether passive restraint systems—air bags and automatic belts—should be required in all new automobiles sold in the United States. In 1977, Federal Motor Vehicle Safety Standard (FMVSS) 208, as amended, decreed that all new cars would have to have a passive restraint system capable of meeting a 30-mph crash performance requirement by September 1, 1983 (1984 model year), with phase-in beginning with the largest 1982 model cars by September 1, 1981.

On April 9, 1981, the National Highway Traffic Safety Administration announced a delay of 1 year in implementation of FMVSS 208, and new hearings were held in August 1981 to consider whether the (delayed) rule should be put into effect or one of three alternatives should be adopted. Two of the alternatives involved a reordering of implementation dates for the various sizes of cars; the third involved elimination of the passive restraint requirement.

This is background paper #1 of OTA's report on "Technology and Handicapped People."

Selected Communication Devices for Hearing-impaired Persons (Background Paper)

This study provides background information on the hearing-impaired population in the United States, and reviews the history and development of technologies, particularly teletypewriters, to aid hearing-impaired people. The paper also discusses the issues surrounding the use of such technologies, including cost, distribution, and Federal support of the industry's growth.



This is background paper #2 of OTA's report on "Technology and Handicapped People."