This is one of a series of articles on our civil engineering heritage, part of ASCE's observation of the nation's Bicentennial celebration.

OTA: mixing technology with national goals

The Office of Technology Assessment (OTA), was established in 1972 to provide Congress with objective and independent information on potential technological developments. To date, successful studies on energy, health, transportation, and Outer Continental Shelf development have been completed.

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The need has developed in today's complex society for a broad multidisciplinary capability to assess technology—to develop valid information about the probable consequences, and potentialities of a technology, helpful, harmful or uncertain. Such assessments are needed prior to the making of decisions regarding the effects that may result from the application of a given technology.

OTA created

The Office of Technology Assessment (OTA), a specialized advisory arm of the Congress, was established in October, 1972, to aid elected officials in examining a broad range of problems. The function of OTA is to develop for the Congress a pertinent and unbiased information base for analyzing and anticipating the "increasingly extensive, pervasive, and critical impacts of technology—both beneficial and adverse—on our physical, biological, economic, social, and political environments."

OTA, utilizing the talents of experts drawn from diverse fields and diverse viewpoints, seeks to identify and evaluate the widest number of alternative approaches to technological questions on which Congress seeks information. It often acts as a clearinghouse to obtain balanced and impartial data for use by the Congress in formulating public policy drawn from the uses of technology.

Technology Assessment Board

The Office operates under the policy guidance of a 13-member Technology Assessment Board which consists of six Senators, six Representatives and the OTA Director. When a particular subject arises before Congress which requires analysis, any Congressional Committee Chairmen may ask the Board to have OTA study that subject. In addition, the Board itself may authorize an investigation, or the OTA Director—with the Board's approval—may initiate an inquiry.

Program areas defined

Given the pervasiveness of technology in our society, very few of the many issues facing Congress at any time fail to raise complex technological questions. In its first year and a half, more than 100 potential topics for assessment were identified in study requests forwarded by Congressional Committees to the OTA Board. A great many of these requests fit within the six central program areas—food, energy, the oceans, materials resources, health, and transportation—which the OTA Board has assigned high priority.

Energy

Energy, of course, is dominant among today's technological problem areas. Seeing the need to develop alternative energy sources and strategies, Congress created the Energy Research and Development Administration (ERDA) which became operational in January 1975. This organization combines within a single, broad agency the energy-related functions formerly performed by many governmental departments. From the outset, OTA has been asked to play a major role in assisting Congress in its responsibility to oversee ERDA operations to ensure such operations conform to the intent of the laws passed by Congress.

Reviews ERDA's fiscal program

Another function of Congress is to authorize funds to carry out federal programs. OTA was also deeply involved in this process with respect to the ERDA. On February 3, 1975, ERDA's proposed initial budget was submitted to the Congress. Rep. Olin E. Teague, Chairman of the House Committee on Science and Technology, asked OTA to prepare an analysis of the ERDA budget which would identify key issues and provide background information for the Committee's use in hearings held to examine whether ERDA should be provided the funds requested for the activities proposed. These hearings were scheduled to begin February 18.

OTA assembled the necessary expertise for an immediate review of the ERDA fiscal proposals. By February 15th, a preliminary analysis prepared by OTA consultants and staffers was presented to Rep. Ken Hechler of West Virginia, and Rep. Mike McCormack of Washington—chairmen of two key Congressional energy subcommittees. As the ERDA authorization hearings progressed, additional briefings for both Committee members and staff were conducted by the OTA energy team as new or modified issues arose.

What emerged from the OTA analysis and this process was far more than just another governmental study. There was an interchange of ideas. A

Bicentennial and engineering careers

What sort of career does engineering offer at this Bicentennial period and in coming years?

This is the second in a series of articles which explores that question. The series looks at American history and the impacts of technology on it, at predicted growth areas of technology in the next 25 years, and at career guidance and planning.

dialogue was established between Congressmen, committee staffers, advisory panelists, expert consultants, and the OTA staff. One member of the House Committee on Science and Technology, Rep. George E. Brown, Jr., of California, said that the OTA analysis "considerably raised the standards of the authorization proceedings, and . . . brought invaluable outside perspective to our committee work."

The immediate result of the Congressional hearings on the ERDA budget was a substantial increase in the funds Congress authorized ERDA to spend, with special emphasis being given, through increases by Congress in funds over the amounts sought, in the areas of energy conservation, solar energy, and geothermal power,—all of which were highlighted in the OTA analysis. The OTA energy report which resulted was subsequently used by several Congressional committees in carrying out their energy-program-related responsibilities.

Analyzes ERDA plan

Building on this initial examination of the ERDA budget, OTA conducted an intensive analysis of the ERDA Plan—a formal statement of the agency's research and development objectives, which was submitted to the Congress on June 30, 1975. To review the programs contained in the ERDA plan, six panels of highly-qualified energy experts were brought together to work with the OTA staff. These panels were instructed to confirm those aspects of the ERDA energy program which were reasonable, and to identify any omissions, unrealistic assumptions, or hidden cost factors in the ERDA plan.

The OTA energy panels were structured to contain a balance of viewpoints. Authorities were drawn from major manufacturing industries, power-supply firms, academic research centers, professional engineering, architectural, and legal societies, public health disciplines, and environmental protection groups.

Five of the panels addressed specific aspects of energy research—fossil fuels, nuclear energy, advanced technologies including solar and geothermal power, energy conservation, and the environment and health. A sixth and final panel, which included the chairmen for the first five groups, was assigned the task of providing a coordinated review. The analysis which resulted from this work will be used to support hearings on the basic ERDA plan. Since ERDA is in the first year of its activity and in a formative stage of development, the effects of this review should be highly beneficial.

ASCE to hold technology assessment workshop

An ASCE workshop on technology assessment has been scheduled in Washington, D.C., for April 22-23, 1976, with alternate dates of April 29-30, 1976.

The primary function of the workshop will be to disseminate knowledge of technology assessment policies to the Society membership, and to show how ASCE can and must become involved.

Emilio Daddario, Director, OTA, and Dr. Edward Wenk, M. ASCE, member of the OTA Advisory Council are among the tentative speakers.

Some of the topics will be:

- Role of technical societies and technology assessment
- Obligations of practioners in the use of technology assessment and professional practice
- Application of technology assessment at the local level

In addition, several Congressmen will be asked to share their experiences in cases already considered by OTA.

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Oceans Assessment Program

Energy-related technologies pose major public policy questions in the coastal regions of America, where seven out of every ten Americans live. The OTA Oceans Assessment Program has undertaken several studies of such issues including the January 1974 decision by President Nixon to instruct the Secretary of the Interior to increase outer continental shelf (OCS) oil and gas drilling and production leases by 10 million acres starting in 1975. The effect would more than triple the amount of OCS acreage currently under lease to oil drillers and producers.

In the ensuing months, OTA received inquiries concerning ocean-related topics from the House Judiciary Committee, both the Senate Interior Committee and the Senate Commerce Committee, and the National Ocean Policy Study of the Senate. In response, OTA established a broad-based project staff which analyzed existing studies, monitored on-going hearings, and inspected North Sea oil drilling sites and staging areas at first hand.

Site studies N.J.—Delaware shore

Recognizing that the U.S. coastal shelf, from Alaska to Maine, is far too vast and varied to permit a generalized study, the OTA staff began a "site specific" study of a single coastal region, the New Jersey-Delaware shore. This area which is near an undersea feature known as the Baltimore Canyon, was chosen for several reasons. It was apparent that this region would be among the first affected by the enlarged oil leasing program that had been proposed. The adjacent New Jersey-Delaware coastal zone already is the site of extensive industrial, commercial and residential development. Additionally, this coastal region is considered a prime candidate for the location of both deepwater supertanker ports and an offshore nuclear plant.

OTA's assessment of "New Use Demands on the Coastal Zone and Offshore Areas of New Jersey and Delaware" will be completed by the end of 1975. However, interim findings from this study have been used to meet more immediate Congressional needs for information. These inputs have included a basic primer of policy issues raised by increases in ocean shipments of petroleum, including the rapidly expanding use of supertankers; a report which examined the possible separation of exploration and production activities, and a study of accelerated leasing proposals.

How have the specialized OTA studies been used? Last January, preliminary information from the OTA tanker study was used to help prepare a Senate Committee for hearings on supertanker operations. The OTA analysis of accelerated OCS leasing plans was printed as a background document for the information of members of the Senate Commerce Committee and the Senate National Ocean Policy Study.

Alternatives for OCS exploration

The OTA task force analysis of alternatives for OCS exploration provided an information base for joint hearings on offshore oil leasing conducted by the Senate Interior Committee and the Senate Commerce Committee and was frequently cited during a Senate floor debate on this issue.

On July 30th, 1975, when the Senate considered amendments to the Outer Continental Shelf Management Act of 1975, it adopted a provision to permit the Secretary of the Interior to "conduct . . . or contract" specialized

TA and the civil engineer

New technologies produce two types of consequences. The first are intended, and relate directly to the purposes for which the technology was developed. The second-order consequences are indeterminant, often unsuspected, and frequently intangible as well. Take automobiles, for example: The original intent was personal, reliable, economic transportation. The unintended consequences are enormous—urban sprawl, new businesses of great economic vitality and impact, generation of noise and air pollution, increasing death and disability by accident, and changing patterns of courtship. Some of these may be regarded as good, some bad; some were predicted, but the overall impact on social, economic, and environmental values was unforeseen.

Evolution

One of the earliest examples of governmental need for technology assessment occurred in the early 19th Century. Public concern over steam boiler explosions prompted a request for congressional action.

Lacking the expertise necessary, Congress referred the case to the Treasury Department which in turn channeled it to the Franklin Institute in Philadelphia. The Institute, devoted to the promotion of mechanical arts, formed a working committee on steam boiler explosions. After canvassing steam engineers for probable causes of explosions, model boilers with glass windows to conduct experiments were built.

The attempt to introduce federal legislation did not end the explosions nor disagreements over the cause of them (See photo).

It's importance, however, lay in the pioneer step of gathering outside sources, on the part of the federal government, to effect regulation in the general interest.

In 1911 a local government effort was made to incorporate different state regulations on boiler construction into one body. The American Society of Mechanical Engineers (ASME) aided in this codification by the formation of a Committee on Boiler Codes.

Dams and freeways

Dams have long been considered beneficial to rural areas providing flood control, irrigation, power, etc. Conservationists argue however, that dams are harmful: causing nitrogen supersaturation that destroys fishlife, relocation of communities, and natural disasters. In 1970 after failure of the Baldwin Hills Reservoir in California, attention was called to the importance of dam and reservoir safety and the need for supervision. A task committee of the U.S. Commission on Large Dams (USCOLD) developed a "model law" to ensure safety through effective supervision of dams and reservoirs. The law was referred to all state governors for ratification and possible adoption.

NEPA/EIS

Environmentalists in the 1960's persuaded Congress that secondary impacts were so consequential as to warrant the formulation of Environmental Impact Statements. In 1969, the passage of the National Environmental Policy Act demanded that any proposal significantly affecting the quality of the environment, include a statement on the environmental impact of the proposed action. The act requested that agencies advise as to what adverse environmental effects could be expected. In addition, that they define alternatives, short-range, long-range, irreversible and irretrievable effects. EIS, thus, became a precursor of technology assessment.

Editor's note: Part I of this sidebar draws from "Technology assessment

services including, under specific circumstances, exploratory drilling.

The question of government involvement in exploratory oil and gas drilling raised controversy on the Senate floor. The analysis of the effects of separating oil exploration from production activities became an important element in the ensuing debate. Sen. J. Bennett Johnston, of Louisiana, a foe of the exploratory drilling amendment, said the program was too expensive. Citing OTA data, he offered an amendment to establish a spending limit.

"I sent my amendment to the desk because I had to have some vehicle to elicit what the limits of the amendments are, . . . That the authorization shall not exceed $2.19 billion," Johnston noted. "That figure came from the OTA when they assessed the three different options, that is, the limited drilling program, an intermediate program, and a full drilling exploring program."

Sen. Hubert Humphrey, of Minnesota, a member of the Technology Assessment Board, relied upon the OTA analysis that the projected costs of an exploratory government drilling program were not out of line with the possible benefits to be realized from the information to be attained.

"I am on the Board of the OTA," he stated. "We made the assessment and it is a reasonable estimate."

Several other Senators also called upon the OTA findings during the debate. Sen. Henry Jackson, of Washington, said the OTA analysis "concludes that the government could conduct a limited program." Sen. Paul Fannin, of Arizona, also credited OTA with producing "an objective, bipartisan analysis," but stated that his evaluation of the OTA findings led him to oppose the amendment to allow exploratory government oil drilling.

The fact that information developed by OTA was considered useful and credible by both opponents and proponents of the amendment in question is quite significant. It illustrates the fact that OTA's most important function is to provide better and more complete factual information upon which Congressional decision-makers can base their decisions.

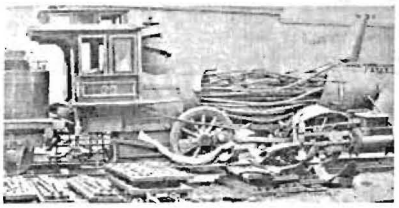
For example, the argument focused on specific consequences, including projected costs, developed by OTA which both sides accepted as accurate. The debate thus focused on the merits and justifications of concrete issues, rather than on generalized expectations or predictions.

Auto safety regulations

Another issue on which Congressional reliance has been placed in information developed by OTA involves the question of automotive safety regulations. The House and Senate Appropriations Committees called upon OTA to evaluate a request from the National Highway Traffic Safety Administration (NHTSA) for funds for the collection of automobile crash data. The two committees wanted to know whether such additional information was needed, and whether a NHTSA proposal to install crash recorders in automobiles was valid.

In issuing reports to the full House and Senate, the respective committees cited OTA's study on the crash recorder question in support of their recommendation that NHTSA be granted its request for $7.2 million for

in public policy," by Edward Wenk. Dr. Wenk, M. ASCE, has been one of the nation's foremost activists at the interface between technology and public policy. He was Congress' first science advisor, then technical assistant to the President's Science Advisor in the White House. Presently he is one of 12 members on OTA's Advisory Council. Readers are referred to his paper with its interesting history of the SST debate. —NIC



A cry for federal legislation arose in the 1830's when the explosion of boilers on steamboats and steamlocomotives began to take human lives. A U.S. Experimental Commission to investigate the explosions was created by act of Congress on March 3, 1873. This explosion occurred in Boston around December 1875, on the Fitchburg R.R. System.

In the 1970's: Excess pressure built up inside this boiler probably caused the head to explode and shoot right through the wall. Boiler shown, is being removed from building after the explosion.

Construction of freeway 20 (Northbound), intersecting I-80 (Westbound), (X), which was designed to run the perimeter of the Passaic River near Paterson, N.J. (Y), was halted (Z), in the early 70's, because of public protest against the proposed route through a historic district, and potential loss by property owners. A Multidisciplinary Committee under Mayor Kramer was formed to restudy alternatives. An initial environmental assessment will be presented to the people of Paterson at a public meeting in early 1976. Feedback will then be incorporated into an EIS before construction is resumed.

the collection of more adequate automobile collision data. However, in agreement with OTA's findings, the Committee urged that alternative strategies for acquiring this data be used, including the possible development of a low-cost crash recorder to be used in a much larger sampling of automobiles than envisioned in the original NHTSA proposal.

Automated mass transit

Anoter transportation-related analysis developed by OTA has figured prominently in Senate appropriations actions. This report, was cited in detail by Sen. Birch Bayh of Indiana during deliberations on the Senate floor. In this instance, the OTA analysis examined new, automated mass transit technologies, such as the shuttle and loop transit systems now used in airports and amusement centers. Citing the OTA findings, the Senate Appropriation Committee urged that the Congress provide $2 million in new program funding to determine whether such systems could have wider urban uses.

The examples given here illustrate cases where technology assessment has been used by the Congress as it has developed national policies. But what about the future? Alvin Toffler has noted that we are not only becoming a more technologically oriented society, but that the pace of technological advancement is increasing. It is inevitable, for this reason, that the need for and use of technology assessment will expand.

At the same time, technology assessment is not, in itself, a "cure-all" for the many problems we face. Technology assessment is a part of the process of free debate—not only by the Congress, but by other policy-making bodies as well. It can enable decision-makers to ask better questions, from which better policy may be developed.

Toward policy and progress

The Office of Technology Assessment provides an on-going pipeline through which the Congress may seek specialized information. OTA is one of many sources available to the Congress, but as an "in-house" center of analysis and consultation, it has a unique opportunity to serve the federal legislature. OTA's function is to assist the Congress in its efforts to match technological progress with national policy, a function of increasing importance in this age of rapid change. By establishing OTA—the first Office of Congress developed since the General Accounting Office was created in 1921—the Congress has given additional recognition to the growing interrelationship between technology and national policy. Such increased emphasis is another important step in permitting full and responsible technological growth in an open society.

Editor's note: The OTA report "An Analysis of the ERDA Plan and Program," based on the ERDA program submitted to Congress, was published in October 1975, and is available from the U.S. Govt. Printing Office. ∇

Emilio Quincy Daddario was a member of the U.S. House of Representatives from 1959-71 and chaired numerous committees including the Subcommittee on Science, Research and Development. He has been Director of OTA since 1973.