

How scientists advise the Congress

Science and technology resulting from applications of scientific knowledge require a great deal of legislative attention. Some of the reasons for this are obvious. Readers of *PHYSICS TODAY* are probably aware of the Atomic Energy Act of 1954, the National Science Foundation Act of 1950 and the National Aeronautics and Space Administration Act of 1958. These laws, currently on the statute books, deal explicitly with science and technology.

But new technologies affect the legislative process in more subtle ways as well, for their widespread implementation tends to upset the *status quo* of society. This means that new technologies require regulation.

Consider, for example, the automobile. There is regulation of the performance of automotive research and development—tax treatment of auto industry R&D expenditure, for example. Regulations are needed for the direct application of automotive technology, such as the licensing of drivers and the setting of speed limits. There is also regulation of the indirect or side effects of this particular technology, for instance, no-fault insurance and the setting of emission standards for nitrogen oxides.

Historically, we can find evidence of similar interaction between Congress and the scientific community as early as the beginning of the 19th century. The steamboat and the steam locomotive were beginning to make dramatic imprints on the economic fabric of the US. The citizens of this agricultural country, however, became alarmed over the tragic toll of human lives that boiler explosions began to take. Regulation was needed, but was difficult to implement since there was a fundamental lack of knowledge concerning how steam and iron behave under high pressures, so that no one seemed to know why boilers burst.

On 4 May, 1830, the House of Representatives passed a resolution direct-

ing the Secretary of the Treasury to report on guarding against the dangers arising from the bursting of boilers on steamboats. The Franklin Institute in Philadelphia cooperated in carrying out a study, which included experiments on a model steam boiler equipped with glass windows and monitoring equipment.

The activities of science and technology need fiscal support, and this need also brings them to the attention of legislators. The process of authorization and appropriation of funds for research and development programs is well known to every Congressman and Senator, and Federal subvention for programs that generate scientific knowledge has largely replaced private sponsors. Some of the areas in which this has taken place include not only the boiler research previously cited, but defense, space, health and energy.

However, it is not just science that receives attention from legislators. Scientists themselves have played prominent roles in a number of legislative decisions, and in some cases their influence has not been limited to that of an expert witness. Recent examples include the extended debate on the antiballistic missile program in the summer of 1969 and debate over continued funding for the supersonic transport in 1971. In these two cases, prominent scientists were arrayed on opposite sides of the same issue, and in both cases, major questions arose concerning specific scientific and technological issues.

Who advises Congress?

Members of the scientific community are well aware of the formal scientific advisory apparatus in the Executive Branch of our Government, which, until recently, included a science advisor to the President and the President's Science Advisory Committee. Any agency that even thought about scientific or technological problems had dozens or even hundreds of scientific advisory committees.

What about Congress? As an institution, Congress has depended on its

standing committees, on the General Accounting Office and on the Congressional Research Service of the Library of Congress for technical expertise and advice. But where do these groups get their scientific advice? Do they have advisory committees or staffs, or more informal arrangements?

With the exception of the House Committee on Science and Astronautics, no standing committee of the House or Senate has formal advisory groups. Many of the approximately forty standing committees rely on the Science Policy Research and Environmental Policy Divisions of CRS, as well as on the relevant Executive agencies, for scientific advice.

The Committee on Science and Astronautics has two advisory panels. Its panel on Science and Technology is composed of 16 prominent scientists and engineers, mostly from the "hard" sciences. From the period 1960 through 1972, this panel met annually to discuss with the members of the committee broad issues related to those legislative questions that had deeply ingrained scientific or technological characteristics. These included issues such as the management of information and knowledge, and applied science and world economy.

The other advisory committee of Science and Astronautics is its Research Management Advisory Panel, which is composed of seven prominent research managers from the industrial and university communities, and advises the Committee in a more informal manner on a number of subjects. In 1969, for example, they met to discuss the effects of Section 203 of the Defense Authorization Act of 1970, which requested that all defense research activities be "relevant," and in 1972 and 1973 they discussed how best to organize and finance a national energy research and development effort.

In 1964, the Subcommittee on Science, Research and Development of the Committee on Science and Astronautics published a study "Scientific-Technical Advice for Congress: Needs and Sources," in which the Com-

J. Thomas Ratchford is Science Consultant to the Committee on Science and Astronautics of the US House of Representatives.

Formal advisory groups are few, but the legislative branch is seeking assistance through informal channels to an increasing extent.

J. Thomas Ratchford

mittee's Panel on Science and Technology advised that a permanently employed group of highly trained scientists and technicians could best fulfill the need for scientific advice in the Congress. By the end of 1964, the Congressional Research Service had created a Science Policy Research Division, and in September 1969 it established an Environmental Policy Division. There are now about 70 professional staff members associated with these two divisions of CRS.

CRS does not have any formal scientific advisory groups of its own, nor does GAO. CRS specialists seek advice from colleagues and personal contacts within the scientific community, and GAO relies on its own staff for most of the science advice it needs. Both CRS and GAO employ consultants on an infrequent basis.

In 1972, Congress established an Office of Technology Assessment in the legislative branch. OTA was funded for the first time in fiscal year 1974, and its first director, Emilio Q. Daddario, is now launching this exciting new departure in getting scientific advice for Congress. OTA does have a twelve-member advisory council, mostly scientists and engineers, and they are expected to play an important role in guiding the initial technical inquiries of this new office.

Informal advice needed

It should by now be obvious that Congressmen and Senators don't depend very much on formal scientific advisory groups. But there are a multitude of ways for offering and receiving informal scientific advice—informal in the sense that it comes from no advisory group organized for that purpose.

A not uncommon role for scientists to play is that of witness before a standing Congressional Committee. An invitation to testify as an expert on specific subjects under consideration implies that Committee members or staff are aware of the scientist's work and reputation or that someone who has contacts with Committee



Ratchford at the South Geomagnetic Pole. About \$25 million for antarctic research are included each year in the funds that the House Committee on Science and Astronautics authorizes for the National Science Foundation. Earlier this year Ratchford, science consultant to the committee, visited major US and Soviet antarctic research stations.

members and with staff has called him to the Committee's attention. He may represent an executive agency or some other vested interest, such as a scientific or educational organization. Alternatively, he may volunteer on his own to testify, or submit a written statement for the record, because of his personal interest in the political issue or technology under consideration.

How does one know beforehand about impending hearings? There is no unique answer to this question. Many newsletters, both subscription letters and those published by interest groups, keep track of scheduled Committee hearings for their readers, and these newsletters are often available in libraries. Other common sources for this kind of information include the *Congressional Record* and periodicals such as the *National Journal* and *Congressional Quarterly*. Telephone calls to the appropriate Committees or to the local office of your own Congressman or Senator can also be useful in keeping abreast of what is going on before Congressional Committees. Any special relationship with a Committee or an individual Member of Congress can serve as a conduit for inserting scientific advice into the legislative process, for example personal friendships

with Members or staff. Or the relationship may simply be due to the position the scientist holds in his role as a constituent—university department chairman, professor, industrial researcher, or just a registered voter in the state or district.

Congressmen and Senators are extremely busy individuals. All of their contacts with constituents and the public serve an educational function, whether the situation is a science seminar, cocktail party, PTA meeting, or political fund raiser. As a politician he listens—and these are all opportunities for offering informal scientific advice.

Special opportunities occur when the views of the scientist coincide with those of a Member on a particular issue that has high technological content. In this case one can volunteer to help the Member's staff in researching and justifying his position. This not only opens an avenue of communication on a specific subject, it may also establish a relationship that can provide an entree to the Member and his staff on other issues as well.

In the organizations related to Congress—GAO, CRS and OTA—opportunities exist for informal advice. A willingness to provide high-quality ad-

vice to a CRS staff member, for example, will usually result in further correspondence or phone calls when questions on similar subjects arise. These CRS experts speak freely of their "invisible college" of policy and technical experts—a college that is always in need of expansion.

Another, but more limited, possibility for advising Congress falls to Executive Branch employees. A Congressional Committee sometimes borrows an individual from an agency for a short time to work on a specific project. Personal contacts and an understanding of how the "system" works can lead to continuing informal talks in the future. The hearing process as well as social contacts can also lead to "unauthorized" discussions between Executive and Legislative Branch personnel. Although these relationships can sometimes drive Congressional liaison officials up the wall, they help assure the kinds of information interchange needed to produce legislative decisions that are based on adequate data.

Fellowships in Congress

Several formal programs currently in existence enable scientists to work closely with Congressmen and Senators for a period of a year or so, and then return to their academic or industrial research positions. The American Political Science Association has sponsored a Congressional Fellowship program since 1953 and about 40 Congressional Fellows are selected each year. They include political scientists, reporters, law professors, and Federal employees. Typically, one of the 40 Fellows is a scientist, usually a Federal employee.

The Commerce Department has since 1964 sponsored a Commerce Science and Technology Fellowship program for its employees. A few scientists from this program have worked with Congressional offices during recent years.

In 1972 the American Society of Mechanical Engineers announced a Congressional Fellowship program sponsored by the Society. The first ASME Fellow began his stint on Capitol Hill in January 1973, a year that saw a rapid expansion of scientist-oriented Congressional Fellowship programs. The American Association for the Advancement of Science appointed three Fellows; the American Physical Society selected two, and the Institute of Electronic and Electrical Engineers designated one. This group of scientists began their year on the Hill in September 1973 and are working for a number of Congressional Committees, Senators and Congressmen. The AAAS provides overall coordination for the APS and IEEE programs as well as



The author in a Trackmaster vehicle, en route from the old US Research Station at the South Geographic Pole to the new research station that is presently under construction.



On the annual ice shelf, with the Ross Sea in the background, during the author's recent tour of research stations in the

antarctic. He is flanked in this photograph by Robert Clark of the Senate Appropriations Committee and an Adelie penguin.

taking care of its own programs.

The initial experience of the professional societies with Congressional Science Fellowship programs has been good. There has been a great demand by Congressional offices for the services of these individuals, and the Fellows have generally found their activities in this unusual milieu to be stimulating and rewarding. It remains to be seen how many of the Fellows will return to the less frantic environment of the laboratory or classroom.

Perhaps the major problem facing Congressmen in getting information and ideas from scientists is that of impedance matching, because Congressmen and Senators do not usually have a scientific or technical education. Most have legal training, and only two classify themselves as scientists. They are generally bright, pragmatic extroverts whose most scarce commodity is time. Consequently, they can rarely go into much depth on any subject. They, and most Congressional staff members, are not familiar with the specialized terminology common to technical specialists.

Scientists, on the other hand, find it difficult to communicate without using the symbols and jargon with which they are familiar. Academicians, and scientists in particular, are comfortable

with their precisely defined nouns and verbs, and many disdain to express their ideas in terms that an intelligent but extremely busy layman can understand. This difference may reflect the fact that scientists tend to deal with hard data, which they usually present to a small and very selected peer group, whereas the peer group to which the Congressmen must submit their work for review is the electorate.

Conventional wisdom states that scientific advice for Congressmen and Committees is no problem. The Chairman, Member, or staff just calls up some prestigious organization such as the National Academy of Sciences or the president of the Member's state university and finds out the answer to his problem in a minute or two.

Unfortunately, this does not happen very often, since the logistics are complex: The Member or responsible staff person must characterize the scientific aspects of the problem, remember which expert or organization to call, locate the person so identified, expound the question to him and determine whether he or his staff has adequate time to devote to generating an answer.

In practice it is much easier for Congressmen and Senators just to ask someone nearby—staff or other close advisor. This emphasizes the need for

an in-house scientific capability in Congress, composed of people who understand the laws of both nature and human nature, and have a certain political sensitivity. Only in this way can the required impedance match between scientific information and the legislative process take place.

Scientists should play a much larger role in legislative decision making than they have heretofore. I have described some specific ways in which this can occur. The participating scientists, however, must maintain a perspective that considers technical issues within the context of the many factors that can contribute to the resolution of broad public policy issues. These scientists must be prepared, temporarily or permanently, to cease practicing their professions in the traditional sense. In a more fundamental way they remain scientists, since science is really a method and outlook, rather than a collection of facts or quantitative relationships. The result can be a better informed Congress and a strengthened legislative process.

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The views expressed here are those of the author and do not necessarily reflect those of the Chairman of the Committee on Science and Astronautics or of any of its Members.

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