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SCIENCE AND PUBLIC AFFAIRS

Scientific Advice for Congress

A veteran legislator suggests that current proposals are overlooking some realities of legislative life.

Clinton P. Anderson

One of the results of the growing federal involvement in science and technology has been a growing uneasiness in Congress about its own ability to oversee programs in these areas effectively. The number of inquiries into the general state of science-government relationships undertaken recently is a measure of this unrest, as is the variety of proposals put forth to improve Congress's capacity to judge scientific programs. There is no doubt that Congress does have to make some adjustments to changing patterns of federal expenditure, and all the proposals deserve to be taken seriously. But before a wholly new system for dealing with science is created, it would be well to examine both the source of Congressional interest in science and the kind

of advisory structure best suited to its needs.

There are at least three reasons for the interest of Congress in improving its grasp of science and technology. The first is cost consciousness—this year's federal R&D budget is about \$15 billion. Congress is concerned, however, not only about the amount of money spent on research and development (which has multiplied 100-fold since 1940) but about the relationship of cost to performance. How can Congress make intelligent decisions when budget costs are based on estimates which fail to hold true? The Air Force, for example, estimated in 1960 that Project Skybolt would cost \$893 million; in 1961 the estimated cost had reached \$1.9 billion, and by the summer of 1962—when Skybolt was scrapped—not only had the cost estimate climbed to \$2.3 billion, but Skybolt was a year and a half behind schedule. Another example is the project for the

nuclear-powered airplane (ANP). In November 1951, one contractor estimated that it would take \$188 million to deliver the nuclear power plant for mounting in an aircraft by May 1956. By 1961, when the project was cancelled, the costs of that one company had reached over \$527 million and the power plant had never been delivered. The total cost of ANP, when it was ended, exceeded \$1 billion.

It is true that the money supposedly "wasted" on the nuclear-powered plane may yet pay valuable dividends when some of its positive findings in metallurgy and instrumentation are applied to some future project, such as the supersonic airliner. Knowledge, however useless at the moment of its discovery, will someday find its place in the scheme of things and make its contribution. Nonetheless, a better way must be found to estimate the long-range costs of R&D programs; more accurate target dates for their completion must be determined. And Congress needs to be more accurately informed on both, not only for their implications for the budget and the sensible allocation of funds for R&D, but for their frequent implications for national defense as well.

Legislative Control

A second reason for Congressional attention to what Vannevar Bush has called the "endless frontier" is the belief among some members that Congress has lost the ability to oversee effectively the vast diffusion of R&D activities for

The author, U.S. Senator from New Mexico, is chairman of the Senate Aeronautical and Space Sciences Committee, and is a member of the Joint Committee on Atomic Energy and the Interior and Insular Affairs Committee. This article is based, in part, on an address delivered 20 November to the Atomic Industrial Forum.

which it appropriates funds. As proof, take the statement of Senator E. L. Bartlett (D-Alaska) when he recently proposed the creation of a Congressional Office of Science and Technology: ". . . At the present time," he said, "the Congress does not appreciate the importance of scientific decisions and as a result they are made, not in the Halls of Congress, but elsewhere, not by the elected representatives but by unknown administrative officials. . . . How is a popular elected government to control its own activities? How are elected officials to direct development of something they do not understand with implications they do not comprehend?" These questions go to the heart of our representative system.

And, third, there is concern that the procedures of Congress may not measure up to the demands of "big science." New techniques for obtaining information may be required so that Congress will approach parity of knowledge with the executive agencies—in other words, that Congress will have its own sources of accurate information apart from the agencies and that this source of information will better enable Congress to judge the merits of any particular research and development project.

All these concerns are serious, and I certainly agree that Congress needs advice on scientific and technical matters. But before we go about setting up a system, it is important to clarify the definition of what "scientific advice" is, and to figure out what kind of scientific advice Congress needs.

"R&D" Distinction

Of the \$15 billion of federal expenditure which too loosely gets labeled as spending for science, only \$1.5 billion is for basic research. Another \$1.2 billion is for research and development facilities; and \$12.3 billion is for developmental hardware—not science, but engineering and technology. Most of this spending is accounted for by the revolutionary changes in defense systems which have taken place within the last decade. On these hardware items, engineers can give better estimates of cost and time than the producers of the scientific concept. The first point, therefore, is that advice on engineering must be included in the definition of scientific advice.

Another important consideration is that Congress needs to look on science not as an independent function such as agriculture or defense, but simply as a factor to be weighed in the solution of a variety of problems.

When Congressmen look at the test ban treaty, or water pollution by synthetic detergents, or the NASA authorization bill, they see issues of public policy on which decisions are made not alone, or even primarily, on the basis of technical factors, but also on many other considerations as well—administrative, economic, political, and social.

Ninety percent of the approximately \$8 billion the Defense Department spends for research and development goes to produce hardware for better transport, communications, weapons, and other equipment to give the military the wherewithal to fulfill its approved missions. Knowledge of science and technology is not required for Congress to determine whether this money is being spent in consonance with assigned defense responsibilities. The executive examines in great detail the way in which the Defense Department should operate; the detailed justification of the Defense budget reveals to the congressional committees what is hoped to be achieved with the funds. This can be measured against congressional understanding of military missions. Congress, for example, is fully capable of determining the roles of the Air Force and NASA in the total space program. It can weigh the broad missions of the Air Force and how best to accomplish them. These are neither scientific nor technical questions.

The kind of advice and information needed by Congress varies. At times, particularly where the major factor is technical in nature, we need the advice of the most prominent scientists we can obtain. A discussion by knowledgeable scientists of the earth orbit versus the lunar orbit as the best way to get men to the moon, for example, would have helped us better understand the choices before us, the limitations of the alternatives, and the probabilities of success or failure. A panel, on occasion, could assist in reviewing a particular segment of an agency's program, such as the adequacy of NASA's provisions for space sciences or the basic research part of the defense R&D budget. But I doubt if Congress could usefully employ such eminent scientists full time.

Needed: The "Generalist"

What Congress needs most, it seems to me, is the advice of the well-rounded "generalist" who, having a scientific or engineering background, is familiar with the workings of the Federal Government, and with a number of executive agency R&D programs, particularly with their management. Experience in coordinating the work and projects of others in terms of the over-all mission or goal would be valuable. He should be familiar with the scientific and technical community, so that he will know where to seek help when it is needed. He must have an appreciation of the values and ways of the legislative process, a feeling for public policy, and a capacity for sorting out public issues, competing values, and alternative solutions. Additionally, we need a person whose engineering background enables him to give us sound judgment on the costs of a project.

Proposals for a single source of advice to Congress do not take sufficient account of the committee structure. Each committee is restricted in interest and scope of responsibility, yet many areas of congressional interest cut across several fields. For example, we cannot really review water research and development, or oceanographic research, or total basic research, or scientific manpower resources, without cutting across committee responsibilities and looking at many executive departments. Likewise, scientific and technical advice is required from many disciplines. For Congress, or the Senate itself, to have a staff in a position to answer all of the inquiries of the various members and committees would require a duplication of the staffs within the executive agencies. It would require people with detailed knowledge of the missions and programs of all of the executive departments. This is impractical, it is too costly, and it has never been the intent of Congress. Furthermore, I do not think Congress needs it.

Filling the Need

I do not see how three or four scientists and engineers can provide even the Senate with the quality and quantity of advice needed by its committees. The demands on both their time and their talent would be too

great. Further, the general terms, science and technology, need to be broken down into scientific disciplines before we can analyze what kind of scientists and engineers we are talking about and whether or not they could meet our needs. How could a biologist, a chemist, and a physicist, either separately or in combination, assist the Senate Committee on Aeronautical and Space Sciences in determining whether to authorize funds for a deep space probe or a specific type of communication satellite system? If the physicist has a space background which enables him to be useful to one committee, then his time would presumably be taken up with that committee work and he would not be available to other committees. Similarly, if the biologist were busy assisting the Committee on Agriculture, he would not be available to help other committees during the time when hearings were being held simultaneously by several committees. How can one biologist assist with problems of pesticides, the pollution of air, land, and water, manned spaceflight, or radioactive isotopes for cancer research? For that matter how can any single man be the repository of all relevant knowledge about his own discipline? Men who are experts in naval reactors are not necessarily qualified to advise even on reactors for space propulsion. If the function of these experts is only to put us in touch with other experts, I should like to point out that this is what our permanent committee staff is already doing.

In the last analysis it is the collective wisdom of Congress itself which counts most in making important decisions. No decisions can be made in isolation, on a completely scientific basis, by disinterested officials. Congress will consider the scientific aspects of a proposal and pay attention to the facts assembled by the engineer. But in addition, Congressmen must ask some further questions: What will the impact be on our economy? What effect will the proposal have on our foreign relations? Will it contribute to the health and welfare of the nation?

It is said that Congress, because it has maintained certain rituals for years, is a 19th century body faced with 20th century problems. I disagree. Precedents and practices of Congress may have been maintained that are perhaps archaic in this age of science and technology. But the minds of Congressmen are products of the 20th century.

There is no relationship between the rituals maintained by an institution and its mental capability. Congress could legislate as well in the 20th century if its members still wore powdered wigs and capes instead of Ivy League clothes.

Congressional Initiative

There are numerous examples from the area of atomic energy when Congress spurred momentous decisions, in the face of inconclusive advice from experts, which have withstood the challenge of history and have proved right:

- 1) The decision to proceed with the development of the hydrogen bomb against the advice of the General Advisory Committee of the Atomic Energy Commission;

- 2) The decision to plan a broad weapons program which required the development of large quantities of fissionable materials, even though predictions were that this country could never provide the uranium-235 and plutonium needed;

- 3) The development of the *Nautilus* and the nuclear submarine fleet, against determined opposition;

- 4) The development of a variety of power reactors.

Early in the 1950's there was some discussion about the potential benefits of multiple purpose reactors. Coming from the arid southwest, I had some acquaintance with the problem of developing new sources of water for a rapidly growing population, and I found the possibilities quite fascinating. As a member of the Senate Interior Committee, I had had a hand in legislation accelerating the work of the Office of Saline Water in demonstrating techniques for converting brackish and sea water into potable water; I knew that the drawback of known conversion processes was that the expense of the large energy requirements for desalinization made the end product economically unattractive.

In 1955, in response to a request, I received a letter from a technical employee of the Los Alamos Scientific Laboratory outlining the potential benefits of a multipurpose reactor. I was not interested in, and certainly not qualified to judge, the "how" of the reactor. I was interested in the "why" of the concept, and whether we should invest in its development.

Reactor Proposal

The letter from Los Alamos, written in simple English, described a type of reactor with three different characteristics: it would produce electrical energy, it would breed more fuel than it consumed, and its by-product heat could be used to distill saline water. Clearly, there was a good deal of economic appeal in this. But reactor technology then was not up to the task. Some congressional prodding was required to get the AEC to move forward with studies of multipurpose reactors.

As a result of that prodding we will in time develop nuclear electrical energy at a cost of a 1½ or 2 mills per kilowatt hour and water at a cost of about 15 cents per 1000 gallons instead of the present cost of \$1.25. This will be a practical result arising from the action of practical men urged on by scientists who are called in by a member of Congress for advice, but who do not become members of a congressional staff.

Perhaps this illustrates how a legislator can help shape—I hope intelligently—decisions on science and technology. The process of cross-pollination, exposure to a range of problems through various committee assignments, can supplement the advice of experts in helping Congressmen reach decisions. So can the process of osmosis, through which, over a period of time, members of Congress, through their committee assignments and awareness of the world around them, absorb some familiarity with the language and problems of scientists and technicians. Since science is only one factor in shaping the good society, I would paraphrase Clemenceau: science is too important to be left solely to the scientists.

I do not want to leave the impression that Congress has been infallible in its decisions on science and technology. Congress has made mistakes. In many cases, it has pushed programs too hard. But our scientific advisers have also made misjudgements. And we cannot count on one group to do the whole, difficult job.

Instead, we should try in a variety of ways to overcome the problems involved in the relationship of Congress with the "endless frontier."

- 1) We should strengthen the staffing of all committees which deal with science.

2) These committees should make intelligent use of *ad hoc* groups to give counsel on technical problems.

3) There should be an easier flow of information among the congressional committees themselves so that Congress avoids needless duplication in repetitious hearings and over-burdening of witnesses.

4) Representatives of the executive agencies should improve their method of presentation to congressional committees. In discussing purely scientific problems, there is no coloration of "executive" or "legislative" science. It is science for the nation as a whole. There are a limited number of people available with the broad knowledge necessary to give Congress advice on purely scientific questions. Although the Office of Science and Technology is an arm of the President, it would be most helpful if its staff could testify fully and adequately before congressional committees. The separation of legislative and executive powers in this regard can be carried to an extent that does damage to programs in which

both branches have a mutual interest.

5) The channels for gathering information through the Legislative Reference Service of the Library of Congress should be expanded, and greater use should be made of such existing organizations as the National Academy of Sciences-National Research Council and the National Science Foundation.

6) Congress should receive an annual report on the state of science and technology. Each year we receive from the President a message on the State of the Union, a Budget Message, and various other reports. The President transmits to us through the National Aeronautics and Space Council a report on the year-long activities in space and aeronautics. Perhaps the National Academy of Sciences, through its various committees, could prepare a report by itself or in association with others such as the Office of Science and Technology. The report would briefly discuss the major programs in science and technology and would set forth what problems might be on the

horizon which would require congressional attention. Separately, but more effectively, in conjunction with the National Academy, the National Society of Professional Engineers might report on the state of engineering since engineering is such a large part of government R&D programs.

There are no magic ways or easy devices to solve the problem of providing Congress with adequate advice on science and technology. Any approach that some would view as ideal would still be a long way from perfection and could also produce undesirable effects upon both science and government. As H. L. Mencken said: "An idealist is one who, on noticing that a rose smells better than a cabbage, concludes that it will also make better soup."

But those who are the doers of science, and we, in political life, have a mutual responsibility to improve the relationship of Congress and the "endless frontier." As concerned individuals and collectively as members of society, we have a stake in this task.

News and Comment

Scientific Gloom: Congressional Actions Have Stirred Pessimism but Little of It Is Justified

During the past year or so, as Congress has come to regard research more like a skeptical banker than an indulgent patron, a fair amount of gloom has spread throughout the scientific community.

The gloom is nourished by the widespread, though erroneous, impression that Congress has "cut back" on federal support of research. And it is further nourished by the very existence of a number of congressional inquiries into government-supported research programs. Both in and out of Congress, it is said that "the honeymoon is over,"

which is no doubt the case. But, at times, the thickness of the pessimism suggests belief in H. L. Mencken's assertion that "whenever a husband and wife begin to discuss their marriage, they are giving evidence at a coroner's inquest."

Furthermore, for those seeking facts to suit their anxieties, there can easily be found congressional utterances reflecting something less than sympathy for certain scientific pursuits. Last summer, for example, Representative Howard Smith (D-Va.), chairman of the Rules Committee, cited a research grant of \$64,000 "to study resistance to persuasion." Said Smith: "Some of us thought Adam and Eve had settled that question with the apple, but it seems

like we have to go over the same ground again at a cost of \$64,000."

Thus, it is not at all difficult to piece together evidence to support the expectation that the axe is about to whistle through the air. However, without being pollyannaish or blind to the fact that serious problems have recently developed, it is perhaps worth noting a number of things that help put the congressional-scientific relationship into a realistic perspective.

First of all, Congress did *not* reduce federal support for research. It did reduce the rate of growth that had prevailed in recent years, but when the final accounting was in, *every* major federal agency that supports research received more money in fiscal 1964 than it had received in the previous year. And everything indicates that when Congress completes action on the budget for the fiscal year starting next July, the process will have been repeated.

The grand heading "research and development" is not too meaningful, since it can include anything from laboratory motor pools to electron microscopes, but for what it was worth, the total R&D budget rose from \$12 billion in fiscal 1963 to \$14.9 billion in the current