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Science, Technology, and Congress

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Members of Congress need good science advice, but their lifestyle makes it hard to get it to them. First, they are the targets of thousands of groups in and out of government who want to shape their opinions, actions, and votes. These groups devote millions of hours and dollars to their pursuit of members of Congress, who then often feel swamped with information. One study of congressional habits concluded that the average member has only eleven minutes per day for reading and even less time for reflective thinking. Yet, somehow they must deal with the vast array of national and local issues and assay or dismiss the information they receive so they can take a position, no matter how firmly or ephemerally held.

Members obtain the information they need to decide which way to vote on an issue from numerous sources, the most important of which are their perceptions of their constituents' views, their fellow members and congressional staff, and interest groups and party and executive branch officials. In making their decisions, they rely heavily on information they received earlier by scanning the mass media, data absorbed during debates on related issues, casual contacts, and especially trusted staff, advisors and friends. Their educational background is also a deciding factor.

The reading that members do, says John Kingdon, is never the determining factor in a member's decision (and rarely is it a major element). This fact is important because getting a member to request and read a detailed, balanced report presenting S&T advice on an emerging issue is generally an unnatural way to get information to a member. Few members of Congress

are scientists so the science and technology (S&T) advice Congress gets has to be imported from outside the chambers of the House and Senate. But once such advice is delivered and absorbed by members they can use it to inform their own actions and votes and to influence their colleagues. Once live S&T advice becomes part of a members knowledge base, it can be used in trying to sway other members' opinions and votes—in essence make national policy.

External Sources

For members of Congress, as for the general public, the mass media are the main source informing them about the events and issues of the time. Thus the mass media are a vital ingredient in stimulating and directing policy-related action and evaluating of performance. Media help shape the science and technology agenda of congressional members in numerous ways. Most pivotal is their role in affecting which issues will be brought up for consideration on the public agenda. Members of Congress are exquisitely sensitive to media coverage since it can affect their individual careers, their constituents' perceptions, the prospects of causes they are concerned about, and public and elite thinking on a broad spectrum of issues. With regard to the latter, members of Congress need to know what information the public and elites are exposed to by the media in order to know what they tend to be thinking. Information about others can be used to modify their own views and the way they present certain issues to diverse audiences, whereby their own political objectives can be reached.

How media coverage stimulates congressional action can be seen in the first Tylenol poisoning case. While anyone who had thought about it for a few moments could have realized that foods and over-the-counter medicine are vulnerable to random acts of poisoning that would lead to marketplace terror, practically no congressional interest in the subject was reflected in any hearings in the twenty years prior to the incident. Only when seven people died in 1982 did a flurry of congressional activity and inquiry ensue, including hearings tapping the technical expertise of drug manufacturers and packing researchers. Certainly many more people die from unspectacular causes (including 100,000 people a year from alcohol use), without eliciting much congressional fanfare or interest. But it was the national attention the media focused on this event that largely precipitated congressional interest, even though plenty of information about the risk and solutions to this problem existed before.

Media Influence

The media also affect congressional agendas by spurring constituent interest and mailings. Nowhere is this truer than in cases of environmental issues that have local repercussions. Intense local coverage of the environmental impact of a nascent Army Corps of Engineers project in a particular district led to a flurry of spontaneous constituent mail, prompting the representative from the district in question to stimulate the Corps to sponsor additional studies of biota to determine the effect of their planned project.

Just as the media may decide to cover a particular topic, they also may implicitly, and sometimes explicitly, decide not to cover a particular topic. Reporters generally steer away from cerebral or complex stories with limited appeal, preferring topics that appeal to the readers' heart. S&T-based stories are often cast so that, though their accuracy may not be diluted, they will appeal to a more general public.

Beyond content, opportunities do exist for getting media more interested in S&T issues, especially the print media. Generating such interest can have an enduring impact. Though national television usually has much greater impact, it is also much harder to stimulate and work with than general print media. The trade press is relatively easy to galvanize and influence. While popular science magazines have not prospered of late, leading newspapers have been expanding their coverage of science issues, notably among them the *New York Times*.

It might make sense for leaders of various scientific specialties to meet with local newspapers editorial

boards from time to time to stimulate even more coverage, encouraging them to present more S&T policy-relevant material to their readers and to report on S&T events from a local perspective. This in turn should attract the attention of congressional members, increasing thereby the probability that S&T-related issues will be added to the agenda.

Despite national importance, mass media coverage rarely changes a member's vote, according to Kingdon. Their strongest impact lies rather in bringing issues to the agenda and in shaping the discussion within the agenda. Media coverage may catalyze a member to reflect on an issue or even make an inquiry, which might stimulate others to take action.

Some analysts have recommended making media reporters more scientifically literate so that they are better equipped to cover S&T issues. This is a difficult job though, since most reporters work on issues only very briefly, unlike professional science writer. Neither is it clear that more scientifically literate writers would do a significantly better job of covering science (in some cases it may even be a handicap). Even if they did, it remains doubtful that the policy implications of scientific information would be better transmitted to their readers. Efforts should be directed instead toward improvement of the scientific and technical curriculum taught in schools since that would probably be more cost-effective.

In terms of the media, it is important that scientists do more than talk and that they make themselves available to reporters, although this crucial task is ably facilitated by the Scientists Institute for Public Information (SIPI). Its Media Resource Service includes a database of 50,000 experts willing to talk to reporters. This can be bolstered further by an intermediary group that takes the initiative and actively helps reporters shape stories, similar to the media relations departments in large corporations. Thus the stories that are written will be better balanced and more incisive. This in turn may get insights to the public and the political leadership in a way that will improve the environment for S&T discussion in Congress. It might make sense to lodge such an intermediary function with professional scientific societies.

Constituent Input

Constituent opinions are important in governing members votes and in alerting them to issues they should be concerned about. Since most constituents are not familiar with S&T issues, their impact is minimal. However, elite members in the constituency may steer members to certain issues, S&T ones as much as any

others. Because most districts have relatively few resident scientists and engineers and since those who are among the constituency are probably not active in S&T policy issues, S&T advice is not usually drawn from that quarter. There are important exceptions to this pattern, but the exceptions frequently depend on a member's biographical idiosyncrasies rather than on the congressional district's demographic or institutional probabilities. In districts with large scientific communities (usually due the presence of federal laboratories, like Los Alamos or Argonne), greater interest in S&T issues exists, but usually from the employment growth or stability vantage point.

Federal Agencies

Federal agencies are the workhorses that provide Congress with the bulk of policy-relevant S&T information. Some of this information comes to Capitol Hill via reports prepared by agencies at their own initiative. Other reports are prepared by congressional mandate. These reports may be answering specific questions, monitoring situations, or alerting Congress to problems. They can be used to determine policy, to justify steps already taken, or even to delay having to make a decision.

Under the federal government's capacious umbrella are more than 380,000 scientists and engineers and 3,000 government research and development (R&D) centers, laboratories, experiment stations, and related research agencies and bureaus. Not only do these scientists and engineers help prepare tens of thousands of reports annually, some testify before Congress on various S&T issues whereby they directly convey advice and opinion to committee members. Federal agencies also make available their information to congressional staff upon request, and will even prepare briefings for staff and members.

Relations between federal agencies and Capitol Hill committees and members of Congress can vary from extremely close (and therefore more resistant to centralized policy direction from cabinet secretaries and presidents) to adversarial (in which case the agency is likely seek outside support from its clients or from other agencies). No matter what the relationship, an agency has its natural organizational interests, so it might not always give the most complete or most assimilable information to Congress. This situation is not only understandable, it is natural given the division of power. Advice quality suffers when an agency's head follows goals and approaches different from the goals Congress is likely to desire. The same is true in cases where Congress, aware of certain facts or perspectives, desires things to be done differently or initiates

inquiries that would make life more difficult for the agency. Difficulties crop up not only in the interpretation of the data—which Congress is relatively good at challenging—but also in the premises and assumptions that guide the collection and analysis of data. Here Congress is in a weaker position. The latter is in many ways more important, because assumptions have a profound effect on subsequent analysis and discussion, as illustrated by deregulation policy for commercial airlines.

Beginning with the Carter presidency, every administration has been committed to the precept that airline deregulation will benefit consumers. In 1990 the Department of Transportation submitted a report to Congress that showed that since 1978, when deregulation took effect, the overwhelming majority of the public (after accounting for inflation effect) was paying less for air travel. This conclusion seemed clear and difficult to assail, given the data. Subsequent debate on Capitol Hill revolved around whether safety had been degraded, if certain low-traffic routes were too heavily penalized by higher fares, and if small cities had lost service.

The fare data themselves were not challenged until the Economic Policy Institute, a Washington think tank, released a study demonstrating that fares were actually higher. This study not only calculated for inflation but also included factors for increased aircraft engine efficiency and, something that had been ignored in every previous analysis, the 50 percent drop in aircraft fuel prices since 1978. None of the earlier studies, it seems, considered these factors in calculating base-fare price levels. This was a rather substantial oversight that an outside body was able to correct for Congress. While the merits of airline deregulation can be debated, this example leaves little doubt about the utility of fully specifying, reviewing, and correcting assumptions of the S&T advice that is presented to Congress.

To minimize these problems and to assist Congress with absorbing information, improvements should be made in the format of the S&T advice. In terms of format, it might be advisable to either formally require or informally move to a system that would allow S&T advice to be more understandable and explicit in terms of the underlying premises and trade-offs. High-level summaries are of course necessary, but so are the technical details in appendices or in separate reports.

It is important, though, that the technical information is made readily obtainable by Capitol Hill staff. Ideally, these reports should be in language that is clear, understandable, and concise (with charts and

graphics wherever possible). In addition, S&T advice can be more effective if it includes: 1) specification of the assumptions upon which the analyses and recommendations are based; 2) the degree of uncertainty and a professional consensus attached to each assumption; 3) a laying out of the major alternatives to an option and why they were rejected; and 4) cost/benefit analyses if appropriate with cross-generational and other subtle components wherever possible.

The revolution in communication technology, epitomized by desktop video production and multi-media electronic mail, should allow innovative summaries of such S&T advice. The federal government has the resources to produce them in technologically diverse formats. Audio tapes, for example, can be listened to while riding in the car or waiting for a plane. Video tapes can be viewed at home in the evenings or on weekends. Ultimately though, it must be stressed that trust is a crucial element in the congressional advisory world, more important than the particular source of advice, whether constituent, agency intermediary, lobbyist or academic scientist. The human element and matters of taste should not be underestimated—interpersonal chemistry counts.

Scientific Community

Personal contact, trust, and congeniality between the people involved are important ingredients in the transmittal of advice on S&T issues, no less than on any other topic. A personal rapport often facilitates advice giving by scientists to politicians. A most famous example was the relationship between science advisor Jerome Wiesner and John F. Kennedy. Such close relations have done much in the past to shape programs with high S&T components. Past successes have even prompted calls for putting a scientist at the elbow of every politician or on the staff of every congressional committee.

Yet, the euphoria over the sporadic achievements through personal contact as a method of science advice delivery—and there have been remarkable ones—has to be tempered by the realization that scientists and politicians inhabit different universes of discourse with different norms of conduct. Often they have different values that prevent easy communication and understanding. One problem in particular has to do with the fact that scientists are deeply impressed with technical competence and achievement. Many leaders in a field derive their authority and leadership from their technical brilliance, but lack of requisite social skills may be counterproductive in their contacts with political leaders.

This happened in a meeting of a Nobel prize winner with a congressional staff director, which was set up for the purpose of relating the exciting technical innovations on the benches of his lab and which were just waiting for the chance to serve the broad public, if only there were a well-funded public program. But this was not the message that was conveyed during their meeting. Rather the staff director gained the impression that there were some really difficult problems in the Nobel laureate's field, which could not be explained clearly. However, if billions of dollars were spent on some gadgets the scientist knew about, the world would be a better place.

Further, the scientist apparently had no evidence that these gadgets would actually be of any use to anybody, except to cite his own opinion. Had there been a rapport between these two men, the scientist might have been able to gain some influence. But the conclusion the staff director drew was that this fellow was a "political time bomb" and that he had better steer clear of him. Despite such recurring problems, notable opportunities exist to bring scientists and political leaders together in ways that can enhance the quality of S&T advice.

A second important problem derives from the fact that scientists, by virtue of their professional training, are not likely to be sensitive to the political aspects and implications of technical information and scientific advice. Scientists and engineers are taught to be rational and critical, not to heed tradition for its own sake. They find it difficult in many cases to bow to sentiment at the cost of efficiency. They tend to view favorably the advantages of progress for society without weighing the costs such changes might impose on particular groups within society. The idea that sometimes people have to support something bad or stupid in order to get something they want—the frequently necessary practice in politics of "logrolling"—can be repugnant to scientists who are taught to pursue truth and accuracy regardless of personal costs. The socialization process of becoming a scientist and engineer makes it inherently difficult for professionals to "adulterate" their advice with information about seemingly irrelevant, irrational factors that are the sine qua non of the exercise of democratic political power.

How technical issues sometimes become concatenated with political and social ones may be seen in 1990 debates over the clean air act. To get better air, the proposed legislation promulgated standards that would lead to reduced demand for high-sulfur coal. Progress on the bill, which ideally would have been a simple technological and econometric modeling

exercise, was held up by Senator Robert Byrd (D-West Virginia). He wanted compensation for coal miners who would lose their jobs due to lower demand for high-sulfur coal as directed in the bill. The clean air act's purpose was to set standards and look for ways to achieve them, not to deal with equity and welfare issues. The areas became fused as the legislation progressed. Thus frequently irrelevant factors combine in the legislative process and dealing only with the technical issues in the advisory process is simply not sufficient. This broad sensitivity is not something scientists are trained for and they generally should not, as professionals in another field, be expected to have expertise in this one. But broad sensitivity to political factors is required for meaningful, trustworthy advice, and scientists who become close political advisors should have it.

At the same time, the technical expertise scientists have is not likely to translate into authority outside their field of specialization. Scientists should not be expected to supplant other advisors nor should they try to provide members of Congress with a full array of considerations on a particular issue. Scientists must not forget the sheer breadth of the congressional agenda, which includes numerous competing claims that extend far beyond well-established or even controversial scientific claims on any particular issue. Indeed, it may generally be best for scientists to resist the temptation of going beyond their field of knowledge and offering specific political or social-impact advice.

A reciprocal problem occurs when scientists do get the ear of a congressional member. A limited expression of interest on the members' part—usually related to reaching an immediate goal—can be taken by scientists as a sign that at last the policy relevance of their discipline is being recognized. They then immediately press for more meetings, more funding for their discipline, and even for setting up of a new congressional committee to deal with their discipline and its application, as was done by a group of statisticians whose input was sought by a senior Senator. Congressional staff and members immediately recoil from such self-promotion, since their objectives at this point diverge from those of the scientists. Both sides then get turned off and become wary and disappointed.

Scientists who wish to become involved in the political game should be apprised of this potential problem and avoid harboring expectations beyond what is likely to be realized. No matter which mechanisms are formulated to improve S&T advice delivery, they should include a method of orienting and acculturating new scientist-participants to the psychological dimensions

of this commitment-disappointment cycle. Besides the sometimes important dynamics of personal interaction between scientists and political leaders, there is an array of institutional arrangements, actual and potential, that can get S&T advice to the policymaker. These range from professional scientific associations to universities.

Think Tanks

The non-profit research sector, "think tanks," constitute an invaluable resource to Congress, both directly and indirectly. The studies they undertake often focus national attention on specific issues and furnish a good research perspective. Think tanks provide a home for intellectuals who can be just as expert in an area as their academic counterparts, but who have more of a policy focus in some cases. They advise congressional staff on emerging issues and give expert testimony. They may also serve in horizon scanning and issue identification functions whereby they sometimes catalyze shifts in the S&T-based public policy agenda.

A prime example of how think tanks may affect the legislative agenda is the work of the Conservation Foundation, which spearheaded identification and reconceptualization of soil, water, and air pollution. The Foundation's analysis showed that the then-prevalent sectoral approach to pollution control Congress had laid down was not working, since it only shifted pollution from one medium to another. A water treatment plant "bubbled off" volatile substances to clean the water, but in the process the vapors polluted the atmosphere. In a similar instance, toxic substances that were "scrubbed" from atmospheric emissions at hydrocarbon power plants and subsequently buried would sometimes leach into ambient soil and then into the ground water supply. An integrated approach to pollution control was lacking. Congress (and the EPA leadership) had to be educated about this heretofore unrecognized problem, and the Conservation Foundation took the lead with substantial results.

Generally speaking, think tanks have a comparative advantage as sources of advice relative to universities because, unlike universities, they are explicitly policy-oriented while still having ties to an intellectual base—even if not as deep as that of universities. Their relative advantage over contract firms comes from the fact that their reports tend to be intellectually sounder and more carefully reasoned. Yet, they tend to be slower in getting their products out than contractors and the products themselves may also be more costly due to their intellectual overhead. Another problem

arises from the fact that think tanks are free to pursue their agendas, which may elude the unwary reader or distort the terms of discourse. The nonprofit sector is financially healthy and is put into effective use by Congress. Continuing support of R&D across the board indirectly keeps this sector viable. This also suggests that it would suffer commensurately from a general decrease of R&D support.

Advocacy Groups

Other valuable sources of advice and analysis are public interest associations and groups. Their representatives often testify against administration or industry positions and thus provide Congress with a useful counterbalance to the positions of groups representing vested corporate or governmental interests. Of course the advocacy groups themselves often represent their own vested interests. Sometimes staff will contact advocacy groups to get an "inside scoop" or "second opinion" about what they are told by government officials. At other times these groups supply reports that will bolster a member's position, but which the member's office could not have prepared with its own limited resources.

Another way in which advocacy groups serve Congress is by taking the lead on an issue and allowing members to follow. This is particularly helpful when a member belongs to the president's party but opposes the president's position. An example is the Clinch River Breeder Reactor controversy which occurred during the Reagan administration. An advocacy group, the National Resources Defense Council, attacked the Department of Energy's environmental impact assessment and issued its own critique. Along with critiques by other advocacy groups, like the National Taxpayers Union and the Union of Concerned Scientists, it gave several Republicans justification for working against a project they personally opposed but which had the support of President Reagan. It not only supplied them with ammunition but also with a protective cover that would minimize the political consequences for opposing the administration.

This unique advisory source should be bolstered through more federal support to public interest groups that can provide alternatives to industry association and executive agency advice. While money (perhaps distributed through the National Science Foundation) would not be targeted for direct support to congressional need for S&T advice, it could be used to create a richer infrastructure from which such information can be drawn at the appropriate moment. This support program might benefit from following the lines

of a more carefully thought-out version of the "science-for-the-people" style initiatives that had been in vogue in the late 1970s.

Another model, albeit inexact, might be the consumer advocate offices that many public utility commissions authorize as an integral part of their rate setting and policy analysis procedures. Funding could come from a levy on major controversial high-tech projects which would go to support independent alternative analyses. Finally, federal contractors might be encouraged, or required, to establish public-interest advisory bodies for some of their large projects, which could create niches for people to undertake low-budget but challenging alternative analyses. The information could then be fed to Congress.

Concerns that such analyses would support a political agenda or ideology rather than an alternative source of advice—in particular advocacy groups formed on the liberal wing of the political spectrum—are not supported by empirical evidence. While these groups often have an agenda, their advice may be even more, rather than less, useful to members of Congress.

Contractors and Consultants

Research contractors and consulting firms sometimes provide congressional staff with free advice. They may visit Capitol Hill with the intent of stimulating legislation and oversight activities conducive to their interests. But these activities are informal and sporadic. Congressional rules and internal budgeting procedures prevent committees and members from directly paying consultants and contractors for S&T analysis and advice, thus cutting members off from a potentially valuable source of support. However, the problems inherent in allowing direct payments to consultants would probably outweigh the benefits. Members of Congress are so closely tied to constituent concerns, they would be subject to great pressure for favoritism or overt political influence were they to select the contractors. This would add to the burden of frequent importuning which members now face, without necessarily getting markedly improved advice.

Perhaps the greatest difficulty is distinguishing between high and low quality consultants and their products. Any attempt to create a supervisory arrangement to assure quality products would clash with a member's right to make independent judgments without being criticized or overridden. A bureaucratic solution, which might insulate against such problems, would duplicate the work of the Office of Technology Assessment (OTA). Even though OTA is one step removed from the intimate advising I would recommend, it may

make sense to look for ways to pay and supervise consultants to congressional committees via OTA. A program along these lines that would tap the expertise of research contractors and consulting firms would also increase the resources available to Congress on a quick-response basis and improve the quality of S&T advice.

Of course, this program would have to be designed very carefully to avoid abuse. Yet, there are some valuable resources among these units and arrangements for their use could certainly be made. Such efforts are likely to encounter resistance from congressional support agencies that see themselves as already providing such inputs. Some committees need to commission detailed, targeted studies without the constraints they face in using congressional support agencies. Effort should be devoted to specifying how such a mechanism might work for committees.

Corporate and Union Contributors

Companies and trade unions are already providing Congress with a plethora of S&T advice through informal contacts between congressional members and corporate leaders or industrial scientists serving on OTA panels on a pro bono basis. Trade unions provide studies and are generally happy to share ideas with staff on the telephone. These sectors also channel information indirectly via advocacy groups such as the American Enterprise Institute and Scientists and Engineers for Secure Energy. Companies and trade unions should be encouraged to increase their efforts through communications from Capitol Hill and from high-prestige leadership groups like the Conference Board.

To motivate scientific and technical employees to seek out opportunities of service to Capitol Hill, companies might form a policy that public service of this nature would count in promotion and salary considerations. While self-service is certainly a prominent underlying concern on both sides of the advisory fence, the contribution of corporate and union experts to elucidating S&T policy-related issues has been immense, if often unnoticed. Corporate contributions tend to be played down in part because of the negative connotation corporate influence holds in the minds of many people. It would serve neither the interest of the members of Congress nor that of the corporations to publicize their relationship.

As beneficial as this source of advice may be, a potential conflict remains between individual assessments of what is correct and complete advice and what heads of institutions deem correct and complete. Because of the oftentimes sensitive nature of advice

that comes from companies and trade unions, it would be good if all parties understood the rules of the road as well as the ethical implications of various courses of action. Testimony or advice that goes against a company's or union's position can (and has) translate into employment difficulties for the testifier.

Trans-Governmental Organizations

Trans-governmental organizations (TGOs) have indirect ways of contributing S&T advice. For example, the International Energy Agency (IEA) does comparative studies on energy conservation which it passes on to the Department of Energy, which in turn informs Congress of the results. TGOs help gain a long-term perspective on S&T-related issues and their commitments to international bodies can be useful to members of Congress if they wish to stimulate or justify a particular action with their colleagues. However, the peculiar nature of international organizations and the bureaucratic format of their reports require interpretation of their findings for members. The international liaison units of federal agencies, and especially of the State Department, could help leverage findings into the policy process.

Attention might therefore be given to building the international scientific components of federal agencies while at the same time being sure that good channels of communication exist between agencies with international scientific involvement and Capitol Hill. The latter goal could be furthered by expansion of the executive branch agency's congressional liaison offices to cover activities of the TGOs at a high level. Liaison officers could then act as a conduit to Capitol Hill.

Policy Conferences

There are a variety of non-profit organizations that are essentially in the business of organizing conferences. Groups like the National Issues Forum, Keystone, and the Aspen Institute have as their central purpose the holding of policy-oriented conferences on critical issues. While members of Congress may on occasion attend such conferences, staff are much more frequently among the participants and the audience. Conferences are often excellent sources for gathering and organizing S&T advice and focusing it on major issues of congressional concern. More could be done along these lines in the future.

If members are not directly involved, a conference can be held between staff and specialists and a great deal of sophisticated information may be distilled and fed into the policy process. If congressional members are involved, the same can be accomplished with the

added cachet the member's presence lends to the proceedings, making it more attractive to non-Capitol Hill scientists who wish to become involved in the policy process. A conference in 1983 on the Census, inspired by a sub-committee staff member and endorsed by its chairman, brought together for the first time several Senators and leading academic statisticians for an exchange of ideas. Although their presence was not required, five senators and two congressmen participated with the result that Congress increased its Census Bureau oversight in preparation for the 1990 census and allowed in-depth consideration of the merits of sampling versus enumeration as the preferred method of census data collection.

While conferences generally run only a few days at most, thought should also be given to prolonged research-based discussions. Such detailed discussions might even be expanded into three-month summer study groups which will assess problems of particular interest to congressional committees. Of course, such complex undertakings would require significant sponsorship. Funding may be obtained from NSF/NAS or by private foundations. Recruitment should be from among the best and brightest young scientists, including top doctoral candidates, who would tackle problems for committees. NASA's use of the summer study format for detailed cross-disciplinary analyses of a space station could serve as the model. This introduction may prompt many young scientists to take a greater career interest in legislation and advising. The Jason summer studies groups organized by the Department of Defense have also proven effective in obtaining short-term, in-depth advice. Even though some Jason work was controversial, the same need not hold for Congress. Besides controversial findings might be good from the viewpoint of some members.

Strategies of Presentation

Underlying this proposal for getting S&T advice to Congress is the philosophy that mechanisms that alter the environment within which members work, rather than attempts to alter their interests and behavior, have the greatest likelihood of success. Any attempt to improve the delivery and use of S&T advice must be based on the recognition that S&T inputs are only one element in a complex equation leading eventually to a decision. Explaining to John Kingdon on why he voted against a surtax extension when economic experts were united in their support of it, one member of the House commented, "As a congressman, I have to consider what burdens we're imposing on people and how they're reacting to it. The economists all said to

vote for it. But they don't have the same perspective I do." To the extent that links can be forged between S&T considerations and other aspects members must face, the relative impact of S&T advice will be greater.

Many members and their staffs play an entrepreneurial role, seeking opportunities to advance new ideas or tackle new issues that will change the status quo and win recognition for their positive impact. This aspect of congressional politics can be leveraged to aid delivery of S&T advice. What is required, though, is showing a clear link between S&T advice and the rewards that may be garnered from successful entrepreneurship. At the same time, those who wish to enter the fray must be nimble. Drawing a member's attention to S&T issues can be a hard won victory which is easily be forfeited in the competitive environment of Capitol Hill.

Limits of Advice

Even those who should be allies in delivering good S&T advice might not serve as such. Staff of congressional support agencies, like any other staff, have their own positions to worry about: satisfying their line management, presenting their agency in a favorable light, desiring pet programs to prosper, obeying the rules, and delivering services to other offices. Thus they might, for policy reasons, be unhappy with the proposed S&T advice. Perhaps, too, they are thinking about a prospective job with another agency that could be won or lost because of some action they might take regarding the issue in front of them. These are not uniquely pernicious factors, but they are liable to crop up in the struggle for political influence and bureaucratic survival everywhere.

Members of Congress are agenda-driven, but agendas can fluctuate dramatically. The phrase "as interesting as yesterday's newspaper" captures the ephemeral nature of many political leaders' concerns. Certainly issues with S&T components are often perennial, but the attention members pay to them generally is not. From a pragmatic view, advisors should press the results of careful analysis of issue X into the members hand on the morning of the day issue X reaches the headlines of the newspapers. This is not the textbook way on how advice should be weighed. Ideally research and advice should drive the agenda and the members' interests. But sometimes the best is the enemy of the good, and this may be the case for S&T advice.

Of course, there are important exceptions. Some members want to "horizon-scan" and weigh in-depth information before reaching the decision. S&T advi

sons can be instrumental in this process. But the fact remains that the Capitol Hill environment stacks the deck against this way of proceeding. Different types of information are useful at every stage in the decision cycle; no one solution will optimize efficiency during the widely varying tasks required for decision making and consensus building. The array of desired information and the time required to access and absorb it are greater while the issue is in its formative stages; here more traditional mechanisms are appropriate. At the later stages, compression can be amazing. One staff specialist told me his Senator, not atypically, would ask for a thirty second briefing and recommendation concerning an S&T issue during a ride on the Senate subway prior to casting his ballot. Obviously, this point in the decision cycle calls for a different form of advice acquisition and transmission.

Another vector of concern is the cognitive processing of members. In this regard it is useful to minimize the conflict of cross-cultural communication inherent when the cultures of science comes in contact with politics. Scientists and engineers should avoid proposing activities that impose burdensome time demands on members. Otherwise even good procedures will get squeezed out due to time pressure, leaving in their wake cynicism, disappointment, and a disinclination on both sides to try again. False hopes are often raised in the breasts of scientists when they are tapped for participation on Capitol Hill, as seen in the case of statisticians who wanted special committees formed dedicated to their discipline. Once again, attention needs to be paid to proper socializing and selection of scientist-advisors.

Consumable Information

Members are swamped with information. While detailed studies are important in forming the opinions of those who transmit information to members, the studies are with rare but significant exception deadly boring to the member. Information has to be compressed and fit to the needs, interests, and cognitive style of a particular politician. The best advice is the most carefully prepared advice. But careful preparation does not only mean that the work must be as factual, thorough, and up-to-date as possible, it also needs to be readily digestible and must fit in clearly with a member's cognitive and temporal limitations. This requirement by itself results in much useful information not being used by members; the encapsulated advice format simply precludes it.

Moreover, S&T advice should be politically and policy relevant. Any recommendation derived from

S&T advice invariably has a political consequence. One course or another has implications for members in terms of their districts, role with peers, and advancement of particular policy agendas. The best advice includes information about its political relevance. In scientific debates, the goal is to be objective; in political debates it is to present one's side. It can be argued, therefore, that information should have an explicit viewpoint. Many observers hold that the best advice is neutral and not biased by self-interest or a particular perspective. But information that is placed within a position or sets forth an argument is usually more useful for Congress, provided it is done explicitly and does not invoke pseudo-neutrality. Valuative advice that is focused minimizes irrelevant material and lets members understand the perspective from which the arguments derive. Since most members have legal backgrounds, they are comfortable with seeking the best course of action by observing two opposing sides in a conflict. If they are persuaded by the account, they will be strengthened in their belief; if not, they are free to gather alternative views. This mode fits in with the way members now get other forms of advice: from colleagues, lobbyists, and staff. It also fits with the management adage, "Don't present your boss with a problem, present your boss with a solution!"

Rob McCord of the Congressional Clearinghouse of the Future described the experiences of eliciting congressional staff interest for emerging technological issues: "In the past, some wanted to rush into the offices of a member and give them absolutely new issues to look at without connecting those issues to current congressional concerns. But they frequently met with apathy because members have such a long menu of things that they really have to address."

Attention must be devoted not only to content, but to form as well. S&T advisory products should be tailored to the particular cognitive styles of members. Many members prefer reading terse one-page fact sheets, some an oral briefing, and a small minority relish plowing through select piles of reports, penning detailed marginalia as they go along. Formats should assist the member in absorbing and manipulating information and should leverage off their styles. With expanding technology, the variety of ways of packaging information grows. The concomitant opportunities for S&T advisors to entice and attract important readers should not be ignored.

Those desiring to build a better S&T advisory base might also consider a forum or resource center through which advisors can share their experience of formatting and delivering advice. In this way, a knowledge

base about what is likely to work, what fails, and what used to work but does no longer can be built. Such a forum should be dynamic and help make systematic adjustments as needs require. It would buttress those massive, one-time approaches to improving S&T advisory mechanisms that by necessity leave much work undone, many important details unresolved, and that cannot return to spotlight problem areas. An on-going forum could transcend these limitations and make dynamic adjustments as the advisory environment evolves.

Most members are remote from convenient, trusted sources of S&T expertise, especially expertise that can be attuned to a member's unique situation. A solution, as well as a tool for better political socialization of scientist-advisers, would be to encourage local scientists to form small volunteer advisory committees on an independent basis. These committees would work closely with the district representative and staff in a confidential, informal manner and be drawn from industry, academia, and the public sector. They would be familiar with the unique problems of their particular legislative district. Of course Congress as the legislative branch is not charged with carrying out directives or administering programs, so it has little to gain and much to lose from a large bureaucracy.

The dearth of time-sensitive guidance Congress receives on science and technology matters can be significantly corrected through supplementation rather than bureaucratic expansion. A role should be created for scientists that would have them, as it were, put one foot into the political arena while keeping the other and the bulk of their weight in the scientific arena. Such a role would permit them to contribute to effective science advising while retaining their primary allegiance to and attention on scientific research.

Incentives for Members

Members of Congress, like most of us, tend to rely on methods of getting information they have found useful in the past. Conventional sources, such as colleagues, staff, media, are important conduits for channelling S&T advice to members. The principle is to enrich and supplement the way members ordinarily work rather than trying to get them to fundamentally change their habits of acquiring information. Any new system of S&T advice delivery should include compelling reasons why members should want the advice. An important avenue

through which incentives can be applied to enhance the delivery of S&T advice is via constituent relations. Suggestions have already been made about increasing media coverage and thereby stimulating inputs. Other strategies might also be considered. Local units of scientific and engineering associations might ask for their representative to attend their annual meetings in order to exchange views on science policy. Also, in a given district, concerned scientists could initiate meetings with the member and the Washington staff to inform them of impending issues and letting them know how the scientists can be of substantive help.

At the same time, scientists and engineers should not view the relationship as a one-way street. Efforts should be made to show appreciation for positive steps the member takes. There should be meaningful expressions of gratitude for the contributions a member makes toward having good S&T advice available to present to Congress. Being a member is generally a thankless job; those interested in good S&T advice for Congress should not make it any more so.

Many valuable delivery methods are now in place for S&T advice to Congress, most notably, the CRS and OTA within the congressional umbrella and some organs of the scientific community on the outside, such as the National Academy of Sciences. These and others have had impressive successes in conveying complex, obscure information on occasionally touchy topics to members, often in policy-useful formats. The widest gaps in the delivery system that need to be filled are timeliness, format matching, relevance, and ease of access.

Three principles should be kept in mind when designing better mechanisms of S&T advice delivery: 1) creating more usable advice in the members proximate environment; 2) delivering that advice to members in ways that fit with their work styles and needs; and 3) giving members incentives for using S&T advice.

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