Technology Policy and Democracy

Is the proposed science court what we need?

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The group planning the return of science advisers to the White House has announced that it will institute, on an experimental basis, a new procedure for dealing with the technical aspects of controversial public policy issues—a "science court." This procedure has long been advocated by one member of the group, Arthur Kantrowitz, of the Avco Everett Research Laboratory. An article by Kantrowitz, "Controlling technology democratically" (*1*), sparked interest in the idea, and last January he was named chairman of a task force to implement it. Tentative guidelines developed by the task force were recently published in *Science* (*2*).

As proposed in Kantrowitz's article and described in the guidelines, the science court proceeding has three stages:

The first step is to identify the significant questions of science and technology associated with the controversial issue. The court will be concerned with these questions alone, leaving other questions—political, ethical, and so on—to subsequent consideration by other elements in the national decision-making process.

The next step is an adversary proceeding, presided over by a panel of impartial scientific judges, in which scientist-advocates debate the technical questions that are in dispute. In addition to presenting their own cases, they will have the opportunity to cross-examine opposing advocates and criticize their arguments.

Third, the panel of judges will issue its judgment as to the scientific facts pertaining to the disputed technical questions. This judgment will be made public except as restricted by national security considerations. Kantrowitz suggests that such a judgment "would provide the whole political community with a statement of scientific facts as currently seen by unbiased judges after a process in which opposing points of view have been heard and subjected to cross-examination. It is to be hoped that these opinions would acquire sufficient presumptive validity to provide an improved base on which political decisions could be reached through the democratic process" (*1*, p. 508).

What is the rationale for a science court? In Kantrowitz's view, it flows naturally from a few basic considerations: Scientists have special competence only in areas of their technical expertise and are no better qualified than other citizens in making political and moral choices. Hence the notion of separating questions of science and technology from political and moral questions and restricting scientists' special role in public policy decision making to the former. Further, the more expertise and experience individual scientists have in a given area, the more likely they are to have prejudgments and conflicts of interest relating to even strictly technical questions in that area. Thus, on the one hand the most expert are disqualified as impartial judges of the questions; on the other hand it would be unwise to exclude them from the debate because they are the best informed and likely to be the most effective spokesmen and the best able to point out flaws in opposing arguments. Hence an adversary proceeding with experts as advocates and judgments left to others. Who should be the judges? Not political leaders, because they "are unable to spend the time necessary to understand scientific debates in sufficient depth to distinguish the relative validity of positions taken by sophisticated advocates" (*1*, p. 507). Instead, the judges should be "established experts in areas adjacent to the dispute" (*2*, p. 653), "certified as unusually capable scientists having no obvious connection to the disputed issue" and found on cross-examination to be free of prejudice (*2*, p. 654).

This is an intriguing proposal which deserves careful examination. It has certain very attractive features that have previously been lacking in public policy development, including a more structured debate in an adversary format. Other features of the proposal, however, seem impracticable or unwise, including both the establishment of a separate forum for prior consideration of scientific questions and the idea of scientific judges. The science court is likely to be appropriate for at most a narrow class of regulatory issues. More useful kinds of adversary proceedings will be considered here. However, neither the science court proposal nor alternative adversary proceedings speak directly to the central problem of "controlling technology democratically" in America today.

A Significant Omission

The task force guidelines do not describe adequately how the science court proceedings would be initiated and how the issues to be considered by the court would be determined. Yet the practical effect of the proposal is profoundly dependent on what choices are made in this regard. The political context in which the science court would operate cannot be ignored. Issues like the ABM (antiballistic missile), the SST (supersonic transport), or nuclear power involve very large stakes for very powerful interest groups. One thing that can be said for certain about the implementation of this proposal is that interested parties would try to use it to promote their own ends.

Consider the question of when the science court would be brought into play. To get some feeling for the importance of this decision, one has only to look back to recent debates such as that over the ABM. If the science court had been functioning in the late 1960's, it might have entered the ABM debate at any one of a large number of critical times. By way of illustration, consider two possibilities:

In September 1967 Secretary of Defense McNamara announced that the United States would deploy a limited number of ABM interceptors, with the principal aim of protecting against a limited attack by Chinese missiles. Soon thereafter two physicists, Richard Garwin and Hans Bethe, published an article (*3*) criticizing the proposed system on the grounds that it could be penetrated by even relatively unsophisticated decoys that the Chinese could deploy. If opponents of the ABM could have brought this criticism to a science court, almost certainly the court would have found it

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valid. This would have been a great political setback for proponents of ABM deployment, perhaps undermining the credibility of the project altogether.

As it happened, however, this technical criticism went largely unnoticed by the public; and it might well have been insufficient to activate the court's attention. Another ABM issue did generate widespread public concern, however. In late 1968, citizens in several of the cities where the ABM's nuclear-armed interceptors were to be located became frightened by the perceived danger of "H-bombs in our backyards." If ABM proponents had been able to bring this issue before a science court, the court would almost certainly have found the chances of an accidental detonation to be exceedingly small. This judgment might well have defused public concern over the ABM right from the start and the congressional debate over the project might then never have taken place.

All this is speculation, of course. But it illustrates the potential political power that lies in the hands of those who decide what issues the court will consider and when it will come into play. All that the task force guidelines have to say about the question is that "it is important to have involvement of an agency in whose jurisdiction the issue falls so that it can help in formulating the issue" (*2*, p. 654) and "it is most important that the issue be stated in a manner as close as possible to the actual decision that must be made by the agency" (*2*, p. 654). The guidelines say nothing about who would decide when the court would become involved. As the ABM example clearly illustrates, however, this might greatly influence the issue the court would consider: in 1967, the decision before the Department of Defense was whether or not to deploy a limited ABM system; in 1969, the decision was whether or not to move the proposed ABM sites away from the cities. It is relevant to note in this regard that the agencies in whose jurisdiction the issue falls are rarely disinterested parties in disputes over technology policy.

Prior Consideration of Scientific Questions

Let us now turn to the principal new features of the court proposal. Consider first the practicability and desirability of separating out questions of science and technology for prior consideration. Is it possible to make such a separation? In matters of public policy are there questions of science and technology that are completely separate from political and value questions? Of course there are. In the case of the ABM many such questions could be identified, ranging from the two already mentioned to the vulnerability of the ABM radar installations and Minuteman missiles, the adequacy of the computer codes, the relative cost of additional Soviet missiles and U.S. interceptors, and so on. These questions are quite distinct from such political and value questions as how the Soviets would be likely to respond to U.S. deployment of ABM's, how important Minuteman vulnerability is if our other strategic offensive systems, the submarines and bombers, remain invulnerable, how many deliverable nuclear weapons are required for deterrence, how many civilian casualties would be "acceptable," and so on. Clearly there are many questions which can be identified as strictly technical, without reference to normative considerations.

But of all the possible technical questions the court will choose only those that by some process of selection are deemed the significant questions. Is this choice of the significant questions independent of political and value judgments? In general it is not.

For example, in the case of the ABM, for some participants in the debate the potential vulnerability of the U.S. Minuteman missiles was of grave concern. For others the additional U.S. strategic weapons systems, the invulnerable submarines and the bombers, by themselves constituted a more than sufficient deterrent; some even suggested that we unilaterally scrap Minuteman. Clearly, these individuals would differ over the significance of the questions of how vulnerable the Minuteman force was likely to become and how much protection for it the proposed ABM system would buy. Some would have judged these to be the central questions to be considered by the science court. Others would have thought them of minor importance.

The point is simply that political and value judgments will generally enter into the decision concerning which of the many possible technical questions associated with an issue the court will address. Thus, the very process of separating technical from political and value questions could well involve political and value choices. The conception of a linear process of first judging the scientific issues and then integrating this judgment into the political process overlooks these significant choices. It is well to be aware of the potential political power that lies in the hands of those who frame the questions the court will address.

According to the task force guidelines, the questions will be framed by "case managers" selected to represent opposing positions on an issue. The case managers each prepare "a series of factual statements which they regard as most important to their cases" (*2*, p. 654). But different candidates for case manager on a given side of an issue might well have quite different conceptions of which technical questions are most important. For example, consider the anti-ABM position in the 1969 or 1970 congressional debates. A case manager concerned about the vulnerability of Minuteman to a Soviet first strike would have considered very important the question of how much (or, from his point of view, how little) Minuteman protection the Safeguard system would provide. Another might have felt that the vulnerability of Minuteman was a highly peripheral if not virtually irrelevant question, and would have addressed instead the question of the vulnerability of the entire U.S. deterrent force, the submarines and bombers as well as Minuteman. It is clear from this example that implicit political and value choices will be introduced into the process with the selection of case managers.

Finally, there is an even more important question concerning the proposed separation of scientific and nonscientific elements of policy issues encompassing both: is it *desirable* to separate the scientific questions for prior consideration? In general it is not. For major public policy issues with technical facets, the political and social value questions are almost invariably far more significant than those relating to science and technology. If the science and technology questions are isolated for separate consideration by a science court, they are likely to acquire a greater political impact than they deserve.

This is just the reverse of what is needed. Our present institutions for involving scientists in public policy decision making already tend to bring about this separation of and overemphasis on technical matters. This tendency is a major contributor to the current syndrome of crisis reaction, narrow technical debate, and piecemeal "technical fixes" which fail to address basic long-range problems. New institutions based on adversary proceedings are definitely needed, but they should have a broader rather than a narrower perspective. Through adversary proceedings the public could be exposed to debates by scien-

tists, engineers, and many others of the whole range of questions—political, social value, economic, and technological. That is what is required to promote public understanding of policy options, and in my view it is a more fruitful direction for new adversary institutions to take.

Scientific Judges

Also questionable are the desirability of having "scientific judges" and the notion that their judgments (along with those "statements of fact" on which the case managers agree) should be the principal published output of the court.

Kantrowitz makes a good case for dissatisfaction with the way scientists have contributed to recent public debates, suggesting that as a result legislators have been able "to hide political motivation behind a smokescreen of scientific confusion" (*1*, p. 509). One can only add that this practice is nothing new and is certainly not exclusively in the province of legislators. For a long time the Executive Branch has made a living out of overcoming congressional opposition to technology programs with an avalanche of expert opinion. The problem has only become visible recently when, for the first time, on such issues as the ABM, the SST, and nuclear power, a few other experts have come forward to challenge the administration's experts.

There is no doubt that this is an unsatisfactory situation. Scientists are functioning in public debate on a superficial level, as authority figures used to legitimize political positions. The question is what to do about it. The science court foresees two substantive roles for scientists: the role of expert-advocate arguing positions in adversary proceedings and the role of impartial judge weighing the conflicting arguments and issuing judgments which have "presumptive validity." It will be argued below that the first of these functions is very important and can, by itself, cut through the "smokescreen of scientific confusion," and that the second is excess baggage, unnecessary and inappropriate, and itself potentially subject to abuse.

To assert that scientific judges are necessary is to assume that politicians and other citizens are unable to weigh the claims of experts and judge for themselves. The notion that a scientific background is required is difficult to reconcile, however, with the evidence of recent debates such as those over the ABM and the SST. To be sure, the subjects of the debates are complex technological systems. But it is not necessary to master the detailed workings of these systems in order to judge even the technical points at issue if one has the opportunity to hear articulate advocates present their cases and respond to opposing arguments. A careful reading of the public records of the ABM and SST debates indicates that there is rarely significant disagreement over the "scientific facts." When apparent disagreements over these facts occur, they generally can be traced to differences in assumptions. For example, in the case of the ABM there was no serious disagreement about such questions as the ability of Safeguard to deal with decoys or other penetration aids, or about the blast resistance of the Safeguard radar. Differing estimates of how rapidly the Minuteman missile force would become vulnerable to Soviet attack could be traced to different assumptions about the blast resistance of Minuteman silos, the size of warheads on Soviet missiles, and the ability of the Soviets to retarget their missiles. A structured adversary process could have clearly exposed these differences in assumptions. These were the kinds of technical considerations that entered into the debate, and none of them requires a scientific background in order to be understood. It was the policy implications of these facts, not the facts themselves, which were the subject of strong differences of opinion.

In the SST debate there was again agreement on most of the scientific facts, including the amount of sonic boom and its physical effects and the level of noise emanating from the aircraft on takeoff. There was one notable case of uncertainty, however. Kantrowitz points to it as an instance where the science court would have been useful (*1*, p. 506):

> In the last few weeks before the Senate vote, experts came forward with the claim that the operation of a fleet of SSTs would deplete the ozone in the upper atmosphere, allowing more ultraviolet radiation to reach the earth, which in turn would result in an increase in the incidence of skin cancer. This possibility was denied by equally competent experts, and 100 senators found themselves faced with the necessity for deciding their vote in part on the basis of an extremely complicated set of scientific claims that were being vigorously disputed among the experts. To the extent that their decision was swayed by this issue, no one in the Senate was really equipped to make a reasoned judgment.

This issue arose when a Berkeley chemist proposed a mechanism whereby the nitrogen oxides emitted by the SST's would catalyze a series of chemical reactions resulting in the depletion of stratospheric ozone. How great an effect this might have on people depends on such factors as the rates of certain key chemical reactions and the relation between increased dosages of ultraviolet radiation and the incidence of skin cancer.

At the time, much of this information was not available. Even today, five years later, critical experimental observations are still being carried out. Had a science court been convened to consider this issue in 1971, it almost certainly would have concluded that there was insufficient information to decide on the magnitude of the danger. This would also have been clear to a nonscientist observing the court's adversary proceeding. The decision of the court would likely have added little if anything to the information available to the public from the adversary proceeding itself. What was needed at that point was not pronouncements with "presumptive validity," but rather more experimental data.

As in the case of the SST, many technological policy decisions have to be made at a time when the answers to important technical questions are uncertain. It is important to clarify the nature and extent of the empirical uncertainties, and that can be accomplished by adversary proceedings without judges. Where there is likely to be significant disagreement is not on the uncertainties in technical knowledge, but rather on what policies to adopt in light of these uncertainties.

Another point should be made about the ABM and SST debates. It relates directly to the question of whether decision makers and citizens have sufficient time to study such issues. We currently lack adequate forums for systematic, illuminating public debate of technology policy questions. The closest thing to a comprehensive record of pro and con arguments is that developed in hearings before congressional committees, but the hearings generally leave much to be desired, with respect to both systematic analysis of the issues and genuine confrontation of opposing views. In the format traditionally employed, witnesses testify sequentially or appear on panels where there is little interaction among them. Opposing witnesses are heard, but too often they fail to speak to each other's arguments. The resulting hearing record is often like a collection of jigsaw puzzle pieces: an argument here, a counterargument 50 pages later, various considerations intermingled in an unsystematic way. It takes considerable time and effort to arrange them into a coherent picture.

It is imperative that we develop fo-

rums with better procedures than those of the traditional congressional hearing. We need ways to generate a more succinct, systematic record that will allow people to make informed judgments without having to wade through volumes of testimony. This will involve more planning and structuring of the presentation. It will also require more effective means of promoting genuine debate; certain kinds of formal adversary proceedings would be useful in this regard.

If such forums can be developed, there will be no need for scientific judges. The record of the proceedings will be far more useful in allowing each individual to decide than the authoritative pronouncements of a science court. Citizens can then make up their own minds, superposing their own priorities on the facts they hear. The less "presumptive validity" a democracy has to rely on the better off it is. The attractive feature of the science court proposal is the adversary hearing itself. The substance of the hearing, not the judgment of the court, is what should be made public.

One caveat should be appended to these remarks. They are addressed to broad public policy issues like the ABM, the SST, or nuclear power. For specialized, narrowly defined questions of a largely technical nature, such as the determination of the risks of certain products, perhaps a science court makes sense. Even in such instances, however, the adversary proceedings themselves may be more valuable to the interested public than the judgments of the court. In the case of product safety, for example, they would provide a basis for the individual consumer to make an informed judgment on whether or not to purchase the product. They would also provide a useful record for possible further action in Congress or the courts. Consequently, the adversary proceedings should be open to the public and a record of these proceedings as well as the judgment of the science court should be published.

In this regard it is interesting to note that whereas the rhetoric about the science court often refers to its potential utility for such broad issues as nuclear power—for example, "it is hoped that a developed Science Court will be able to contribute to the making of public policy even on as divisive and pervasive an issue as nuclear power" (*2*, p. 653)—the task force is considering much narrower issues for its experiments. In choosing topics for the experiments, it will require, for example, that they be issues that are before a regulatory agency and be such that there are only two well-defined sides so that "two case managers can fairly represent all facets of the controversy." Perhaps this suggests that as a consequence of practical considerations the court will naturally evolve into a forum for only a very narrow class of regulatory issues.

Public Adversary Processes

Public forums in which advocates of differing policy options appear together, argue the case for their respective positions, and have the opportunity to question each other's arguments could have a number of useful effects:

First, they would promote the evaluation of expert opinion. Experts generally bring more intellectual baggage to technology policy development than just technical knowledge. They frequently have had the opportunity to think deeply about the social and political implications of a new technology and are attuned to the nuances of these issues. Their long association with the area of technology under consideration may also bring with it strong biases, such as long-time commitments to certain policy judgments, or conflicts of interest, such as a personal stake in the outcome or association with others who have such a stake, but in this they are likely to be little different from the other most active participants in the policy process, including politicians, bureaucrats, lobbyists, and representatives of public interest groups. Even those experts from other fields who have not taken hard positions on a given issue cannot be assumed to be objective. Like everyone else in the real world, they have political and ethical predispositions that significantly color their judgments.

The message of these considerations is not that we should restrict the experts to technical matters or disqualify them on the grounds of possible biases. Rather, their insights into the social and political implications of new technologies should be welcomed, but in the framework of institutions in which their objectivity is not assumed. As Kantrowitz has recognized, this is precisely what adversary processes can do. By bringing experts into the process as advocates, we eliminate the need to be concerned about their biases. Public adversary processes offer the best hope for a democratic alternative to "presumptive validity." In the words of John Stuart Mill (*4*):

> The only way in which a human being can make some approach to knowing the whole of a subject is by hearing what can be said about it by persons of every variety of opinion, and studying all modes in which it can be looked at by every character of mind. No wise man ever acquired his wisdom in any mode than this; nor is it in the nature of human intellect to become wise in any other manner.

A second effect would be the creation of a genuine debate. Our present institutions for developing a public record on technology policy issues frequently fail to probe critically the arguments presented. This applies to high-level scientific advisory committees, whose reports have traditionally been consensus documents, which avoid dissenting opinions (a practice based in part on the notion that dissent would negate the aura of objectivity of committee statements and thereby detract from their political effectiveness; it necessitates some care in prescreening committee members to select out those who might dissent). It also applies to the hearings of congressional committees. Committee members are supposed to ask tough, probing questions and get witnesses to confront opposing arguments, but their performance in this is frequently disappointing. Consider the attitude expressed in 1973 by Senator Pastore, chairman of the Joint Atomic Energy Committee, in introducing the testimony on reactor safety of the then chairman of the Atomic Energy Commission, James R. Schlesinger (*5*):

> I wish at some time somebody would come before this committee and tell the committee categorically a nuclear reactor is safe or it isn't safe so that the public will know exactly where it stands. The public today is absolutely confused. The public is not being told in categorical terms "Yes" or "No." We are imagining in many instances a catastrophe that might have a probability of occurrence of one in a billion or may never happen. We are being told that the electrical generating capacity has to be cut down. We are being told by the environmentalists that we are going too far. . . . One of the men that I have met in my life who can say it as it is is Dr. Schlesinger. I am glad that you are here today to tell John Pastore and this committee "yes" or "no."

It is clearly unrealistic to believe it will be that easy. Experience shows that on almost any issue different advocates can present convincing arguments for opposing points of view. It takes effort to bring out unstated assumptions, undocumented assertions, selective presentation of evidence, and the rationale behind differences in emphasis. This is what certain kinds of adversary processes are especially suited to do.

Third, the availability of such processes would further a tradition of public dialogue. Not long ago Herb Klein, then director of communications in the Nixon White House, expressed the ideal (*6*, p. 93):

One of the major things which we have enacted in the Nixon Administration to try to attack the problem frontally has been the concept of what the President had in mind in what we call "open government." . . . Our attitude is that we want the cabinet officers to be in various parts of the country explaining to the American people what happens in their departments. We want them on television as much as possible. We want them to grant interviews, press conferences, things of that kind. Our theory is that the more the American people know about government and the more they know about the functions of their own government affairs, the better the government will be able to function and the more believable it will be.

But long before, the sociologist Max Weber described the practice (*7*):

Every bureaucracy seeks to increase the superiority of the professionally informed by keeping their knowledge and intentions secret.

Nowhere does Klein's remark sound more strange and Weber's seem more apt than in the area of contemporary technology policy. These days in the United States, information concerning new technologies can be shielded from the public eye by a variety of formal procedures: the bureaucracy can classify it; industry can declare it proprietary; congressional committees can meet in executive session. Or, less formally but as effectively, it can be cloaked in robes of obscurity: in the early R & D stages the implications of new technologies may be apparent only to the few government and industrial researchers who are working directly on them, and those individuals are not encouraged to alert the public. What public discussion there is can be couched in highly technical language, an effective deterrent to public understanding.

Occasionally this veil of secrecy is pierced by disclosures of concerns about potentially deleterious consequences of new technologies. Such "whistle blowing" often prompts sensational and simplistic media accounts of dangers to the public. This practice is unsystematic in its selection of technologies and it may lead to overreaction in public policy. Yet it is perhaps the only effective mechanism that is currently available for bringing such issues before the public.

It is essential that we develop institutions to combat the practices of secrecy and render whistle blowing unnecessary. We need a tradition of public dialogue concerning the implications of developing technologies. Those who are aware of these implications should be obligated to come forward and discuss them at an early stage, before so much money and resources have been invested in projects as to render them effectively irreversible. Adversary proceedings are natural forums for creating such a tradition of meaningful public dialogue.

The Use of Television

Television now does a superficial job of reporting the substance of public policy controversies, and it has an unprecedented potential for manipulating public opinion. Nowhere does this pose more of a problem than in controversial technology policy issues. Pressure for more time for public affairs will have to come from the Federal Communications Commission (FCC), which licenses each station and network. In principle, this is what the FCC stands for, according to its 1974 "Fairness Report" (*8*):

The Commission has . . . recognized the necessity for licensees to devote a reasonable percentage of their broadcast time to the presentation of news and programs devoted to a consideration and discussion of public issues of interest in the community served by the particular station. And we have recognized, with respect to such programs, the paramount right of the public in a free society to be informed and to have presented to it for acceptance or rejection the different attitudes and viewpoints concerning these vital and often controversial issues which are held by the various groups which make up the community.

The FCC has adopted the "Fairness Doctrine," which requires that "if there is a presentation of a point of view on a controversial issue of public importance over a station (or network), it is the duty of the station (or network), in its overall programming, to afford a reasonable opportunity for the presentation of contrasting views as to that issue" (*9*).

In practice the Fairness Doctrine has inhibited programming on controversial issues. At least television officials give fear of violations of the doctrine as an excuse for inadequate coverage of controversial topics. But adversary forums can automatically satisfy the requirements of the Fairness Doctrine. The FCC could go beyond its lofty rhetoric and require effective implementation of the doctrine. Encouraging adversary processes on television is an obvious solution to this alleged problem.

There is an even more important reason for establishing a tradition of adversary forums for presenting controversial issues on television. In the words of Abraham Lincoln (*6*, p. 53):

With public sentiment, nothing can fail. Without it, nothing can succeed. Consequently, he who moulds public sentiment goes deeper than he who enacts statutes and pronounces decisions.

There can be no doubt that television in America has ever-increasing capacity to mold public sentiment. Yet, as Spiro Agnew pointed out when he was Vice-President, "a tiny, enclosed fraternity of privileged men elected by no one . . . wield a free hand in selecting, presenting, and interpreting the great issues of our nation" (*10*). Two days after Agnew uttered this charge in Des Moines on 13 November 1969, there was explicit evidence of its validity: the television networks changed their plans and did not carry live a march and rally in Washington where approximately a half-million people had gathered to protest the Vietnam war.

For the purposes of the present argument, it does not matter whether it will be television executives or sponsors or government officials who determine television programming. Nor does it matter whether or not this privilege has been abused in the past. What does matter is the clear potential for abuse in the future. It would be wise to develop safeguards now. A tradition of dealing with controversial issues on television through adversary forums would greatly reduce the potential for use of this medium to manipulate public opinion.

New Adversary Forums

The preceding discussion suggests that new adversary forums concerned with technology policy issues should address all questions relevant to a choice among policy options, political and ethical as well as scientific and technological. There should be no judges other than the American people and their elected representatives. To be sure, the proceedings should be structured so that technical questions are isolated and discussed, but in such a way that their significance to competing holistic perspectives can be understood.

Two promising approaches would be a new kind of adversary hearings in Congress and adversary forums on television. Congressional hearings can provide the most depth, and television can reach the most people. However, there is likely to be considerable institutional resistance to such proceedings. To illustrate, let us consider congressional hearings.

Congress has traditionally relied on administration witnesses to provide expert advice on technology policy questions. This is exemplified by Senator Pastore's plaintive appeal to James Schlesinger, already quoted, and by his remark on the Senate floor in 1972 during a debate over the Trident submarine (*11*):

As we agonize over these problems, what do we do? When a man is sick he goes to see his doctor. He does not try to cure himself because, after all, he has not had the training. When we . . . want to get the best advice on subjects we ourselves have not been trained for, what do we do? We go to the experts. . . . So, in this moment, what does John Pastore do? He looks for the expert. To whom does he turn? He turns to the father of the nuclear Navy, Admiral Rickover . . . his name will be immortal when American history is written. . . . So, this morning . . . I telephoned "Rick," as I call him, and I said, "Admiral, on the Trident, give it to me, and give it to me straight."

Beginning about the time of the ABM debate in 1969, congressional committees concerned with new technologies did begin to recognize opposing viewpoints. Opponents of new weapons systems are now heard by the Armed Services Committees, and environmentalists appear before the Joint Committee on Atomic Energy. Sequential testimony by witnesses, however, often does not result in a joining of the issues. In the aftermath of the ABM controversy, for example, Senator Henry Jackson lamented (*12*):

One often wishes that advisers with different points of view could confront each other directly and in public so that hidden or untested assumptions could be revealed and the different modes of analysis explored.

Even in the highly publicized debates over the ABM and the SST the advocates largely talked past each other.

Congress would benefit from a new kind of hearing format in which expert advocates of different policy alternatives appear together, present their views, and then respond to each other's testimony. However, it will take considerable planning and a relatively structured format in these hearings to force debate and produce a concise, digestible public record. It takes more to generate debate than simply bringing advocates of opposing policies together. More often than not they will talk right past one another. This happens frequently in congressional hearings organized in a panel format; it happens all the time these days in debates over nuclear power. To make the advocates in an adversary hearing respond to each other's arguments will require a planning process in which points of agreement and disagreement are anticipated and the reasons behind differences over policy options are understood. The adversary hearings can then be structured to identify areas of consensus and to force the advocates to speak to their differences. Such a structured adversary hearing would produce a more useful public record than the traditional congressional hearings do. In fact, it would be a natural sequel to the congressional hearing, for the information generated by the latter is just what is needed for the planning process.

In the past, congressional staffs have lacked the time and technical capability to perform this planning function. With the recent influx of scientists to staff positions and the creation of the Office of Technology Assessment (OTA), Congress now has a much enhanced capability to analyze technology policy issues and to plan adversary hearings. Such a planning function would be appropriate for the OTA, which is supposed to assist the congressional committees without itself endorsing particular policy positions. With these new resources Congress today is much more capable of challenging the Executive Branch, if it so chooses.

There are two formidable barriers to implementing this proposal: reluctance on the part of many congressional committees and reluctance on the part of the Executive Branch. As suggested by Senator Pastore's comments, there is often a very sympathetic relationship between a congressional committee and a federal agency it is supposed to oversee. For example, Pastore's own Joint Committee on Atomic Energy has over the years been at least as staunch an advocate of nuclear power as the Atomic Energy Commission has been, and the relationship of the committee and the agency is very close indeed. Such a sympathetic relationship militates against the committee's creating a public forum where the policies it strongly supports might be effectively challenged.

However, Congress is not totally monolithic. When several committees share jurisdiction the possibility of critical scrutiny by one of them is enhanced. Of particular significance in this regard is the new congressional budget process, which has led to the creation of budget committees in both House and Senate. As these committees are charged with overseeing the entire budget, they may hold hearings on the budgetary policies of any federal agency.

This past year the Senate Budget Committee instituted an informal seminar format for its hearings. Committee members, witnesses, and some staff all sit around a table, a few general questions are posed, and aside from brief statements by the witnesses the session is devoted to discussion. At least in principle, this allows for considerable interaction among the witnesses. The experience of this committee is sometimes otherwise, however. Two sessions were originally planned on defense matters, with hopes for a real debate at both. At the first, on 13 March 1975, participants included Malcolm R. Currie, the Pentagon's director of research and development, and Richard L. Garwin, physicist, former science adviser to the White House and the Defense Department and critic of the B-1 bomber, the Trident submarine, and other defense programs. The two obviously disagreed, but the session was too informal and too unstructured to force Currie to respond directly to Garwin's criticism.

The second session, scheduled for the following day, was supposed to bring together Secretary of Defense James Schlesinger and former Assistant Secretary of Defense Paul Warnke, a critic of Schlesinger's policies. At the last minute Schlesinger's staff informed the committee that he would not appear and objected to the hearing format. After a week's negotiation with Schlesinger, another session was arranged; on 21 March Schlesinger was to appear with former Budget Director Charles Schultze for a critical examination of the defense budget. This time Secretary Schlesinger did arrive; but he refused to appear with Schultze. He made his statement, answered some committee questions, and departed before Schultze spoke.

As the hearing resumed after Schlesinger's hasty departure and a brief recess to allow the TV cameras to be removed, a member of the committee, Senator Walter Mondale, observed (*13*):

. . . now the cameras are gone and the key issues are yet to be joined. I think it underscores the basic failure of our present structure of truth seeking. I guess we offered the Secretary debate format with Mr. Schultze and, of course, we were told that you cannot have a Secretary demeaned by such an environment. . . . Mr. Schultze is here now but, of course, the cameras are gone, so the public will not hear these arguments. . . . I do not know how we are going to get to these issues unless we can really have a kind of adversary proceeding with second and third and fourth and fifth questions. . . .

The point is, of course, that an agency's programs advance more smoothly without close scrutiny by Congress. One Defense Department official familiar with the incident explained Schlesinger's reluctance to appear with Warnke or Schultze: "It wasn't a winning situation," he said.

Schlesinger immediately brought his concerns about the matter to a meeting of the President's Cabinet. The danger of requiring administration officials to defend their policies in public was apparently recognized by President Ford himself.

On 28 March 1975, the President, through Cabinet Secretary James E. Connor, issued a directive which states in part (*14*):

> The President is concerned that such a procedure [seminars or panels matching government and non-government witnesses] profoundly alters the traditional relationship between the executive and legislative branches of government . . . the President has no objection to the seminar-type of hearings as they have been conducted so far, but he does not wish Executive Branch witnesses to appear jointly with non-government witnesses.

If allowed to stand, this policy would preclude participation by Executive Branch employees in the kind of adversary hearings proposed. Of course, Congress could effectively challenge the policy, since it controls the Executive agencies' purse strings. Whether it will do so remains to be seen. Many influential members of Congress are quite satisfied with "the traditional relationship between the executive and legislative branches of government."

Controlling Technology Democratically

It is true that we now lack democratic control of technology, but the science court, and even the proposed alternative adversary forums, speak only obliquely to the problem. Among the necessary conditions for the democratic control of technology are (i) that the public have access to the information necessary to make independent judgments on technology policy issues, and (ii) that the decisions be made openly by individuals accountable to the public.

Neither of these conditions is well satisfied in the United States today. To illustrate the problem, consider a specific example of an emerging technology—laser enrichment of uranium.

Recently, the Energy Research and Development Administration (ERDA) and the Exxon Corporation have been supporting research on the use of laser techniques to separate the isotopes of uranium. This technology has potentially great benefits; it may provide a much less expensive, much less energy-intensive means of obtaining fuel for nuclear power plants. However, it also carries great risks; it may provide a much cheaper, much easier way for countries to obtain enriched uranium for bombs.

The decisions to proceed with this research were not made openly by accountable policy makers, with a balanced weighing of the risks and benefits. They were made in private by administrators at ERDA and Exxon and scientists at ERDA and Exxon laboratories, with the concurrence and support of members of the Joint Atomic Energy Committee of Congress. Given the responsibilities and perspectives of these individuals, it is only natural that the principal considerations behind their decisions to support this research have been a concern with an adequate and economic fuel supply for nuclear power plants and with potential commercial gain. In this closed process, the proliferation risk is not given much weight.

This is to assert not that the issue is simple or the answer straightforward but that the process is undemocratic. Furthermore, it is typical of the way technology policy decisions are made in the United States. It is a myth that we do not have long-range planning for technology. There is plenty of long-range planning going on, but it is dominated by alliances of bureaucrats in federal agencies, technocrats in industry and government laboratories, and their congressional patrons; and these alliances have relatively narrow parochial perspectives. Kantrowitz views the science court as a means for "providing the whole political community with a statement of the scientific facts" so as to "provide an improved base on which political decisions could be reached." But this assumes that the "political community," that is, accountable individuals, is responsible for the important technology policy decisions. Unfortunately, this is frequently not the case.

The science court and other proposed adversary processes are directed explicitly at improving the quality of information available to the public. But public awareness and discussion tend to occur, if at all, well after the fact of the important decisions. This is evidenced today by the nuclear power debate; it may be evidenced a few years hence in public concern about the proliferation implications of a then-developed laser enrichment technology. A serious effort to bring about more democratic control of technology will have to go beyond mechanisms to promote public understanding; it will have to deal directly with the nature of the decision-making process per se, in particular with the influence and accountability of the technology policy alliances.

References

1. A. Kantrowitz, *Am. Sci.* **63**, 505 (1975).
2. Task Force of the Presidential Advisory Group on Anticipated Advances in Science and Technology, *Science* **193**, 653 (1976).
3. R. L. Garwin and H. A. Bethe, *Sci. Am.* **218**, 21 (Mar. 1968).
4. J. S. Mill, *On Liberty*, reprinted in *The English Philosophers from Bacon to Mill*, E. A. Burtt, Ed. (Random House, New York, 1937).
5. *Nuclear Reactor Safety*, part 1, Hearings before the Joint Committee on Atomic Energy (Government Printing Office, Washington, D.C., January 1973), p. 5.
6. R. W. Lee, Ed., *Politics and the Press* (Acropolis, Washington, D.C., 1970).
7. Cited by A. Schlesinger, Jr., in *Government Secrecy*, hearings before the Subcommittee on Intergovernmental Relations of the Committee on Government Operations, U.S. Senate (Government Printing Office, Washington, D.C., May 1974), p. 40.
8. FCC 74-702 (18425), 12 July 1974, cited in E. W. Lefever, *TV and National Defense* (Institute for American Strategy Press, Boston, Virginia, 1974), p.5.
9. *Public and Broadcasting*, Federal Communications Commission, Washington, D.C., 5 September 1974, cited in *The Broadcast Industry*, R. H. Stanley, Ed. (Hastings House, New York, 1975), p. 244.
10. Quoted in E. Barnouw, *Tube of Plenty* (Oxford Univ. Press, New York, 1975), p. 443.
11. *Congressional Record*, 1972, 11995, cited in A. H. Cahn, *Congress, Military Affairs and (a Bit of) Information* (Sage, London, 1974), p. 40.
12. *Planning-Programming-Budgeting, Defense Analysis: Two Examples*, Subcommittee on National Security and International Operations of the Committee on Government Operations, U.S. Senate (Government Printing Office, Washington, D.C., 1969), p. III.
13. *The 1976 First Concurrent Resolution on the Budget*, vol. 2, hearings before the Committee on the Budget, U.S. Senate (Government Printing Office, Washington, D.C., March 1975). p. 1118.
14. Letter from James E. Connor, Secretary of the Cabinet, to members of the Cabinet, dated 28 March 1975.