Organization for Science and Technology in the Executive Branch

The needs of public policy-making require complete presidential staff work and a variety of new arrangements.

A AAAS "White Paper"

In the last 2 years, since Presidential Reorganization Plan No. 1 of 1973, much has been said about the science advisory needs and arrangements of the White House or the Executive Branch (*1*).

This discussion has been largely preoccupied with organization and structure, and too little has been said about the requirements of complete presidential staff work, anticipatory planning, and the formulation of public policies toward science and technology.

Scientific advice in the White House must be viewed primarily in a substantive rather than an organizational context. A disembodied decision on structure is unlikely to serve well either the needs of science policy formulation or the quality of scientific research and development. Little would be gained by a political gesture restoring a seat at the table to the scientific community. It is a much deeper matter, which goes to the effectiveness of the national policy machinery in the decade ahead.

An examination of federal policy-making relative to science and technology must begin with the recognition that:

- National goals of every description depend significantly, although in differing degrees, on scientific and technological progress.
- The federal government's approach to R & D has been more tactical than strategic. (The most notable exception to this rule has been the National Science Foundation, which has consistently emphasized the long-term aspects of science.)
- Reliance on a tactical, crisis-type of scientific and technical response is wasteful and disruptive of human and material resources.
- Within the federal government, the financing of R & D is not yet viewed as investment, but only as discretionary expenditure.
- The institutional interactions among economic planning, international policy-making, national security planning, domestic social objectives, and science and technology are ad hoc rather than systematic, with predictable malfunctions of policies and outcomes.

Here, then, is the issue: *As we assess the position of the United States at home and in the world against the emerging concerns of the 1970's and 1980's, is there a clear need and opportunity to improve our national policy machinery by strengthening the role of science and technology in defining and meeting national goals? If so, how can we do this most effectively?*

The Array of Policy Problems

Science and technology policy in the mid-1970's operates in an environment which is different from that of the 1950's and 1960's. During the late 1950's to mid-1960's, the White House apparatus for science and technology policy evaluation and advice was largely directed toward space and military matters, and concerned with strengthening academic science and its infrastructure. The agenda is now tilted strongly toward consumer and public-oriented technologies in, for example, energy, transportation, health, education, natural resources, ecology and environment, and social systems.

This shift brings with it a powerful new set of issues, which must be addressed by the methods and results of the natural and the human sciences together with economics, law, politics, and public opinion research and analysis. Answers to questions of critical importance, such as, "Can federally supported R & D aimed at public technologies be responsive to marketplace needs and consumer preferences?" involve a frame of analysis very different from that used in military and space programs, where the federal government is both the producer and the consumer of the R & D work.

It is clear that most of the driving issues of the last half of the 1970's and into the 1980's will be related to major social problems of which scientific knowledge and technological development are pervasive and critical aspects. For the remainder of this decade, and into the 1980's and beyond, policy-makers will confront a formidable and changing array of problems, some examples of which are given below.

Social and economic problems

- Food requirements and supply.
- Widening disparities in living standards within different nations.
- Access to efficient, humane, and cost-effective health services.
- Development strategies for have-not nations.
- Maintenance of labor productivity and price-wage stability.
- Creation of jobs for an expanding and educated labor force.
- Rationalization of all, and especially higher, education.
- Aging, changing population distribution, and humane and effective social services programs.
- Ethical and social impacts of applications of biomedical engineering.

This article is based on a AAAS "white paper" on the matter of organization of science advisory structure within the Executive Branch of the federal government. The original statement, which differs only slightly from this article, was submitted on request to the director of the National Science Foundation and presidential science adviser H. Guyford Stever on behalf of the AAAS Board of Directors on 6 February 1975 by the Association's executive officer, William D. Carey. Dr. Stever promptly forwarded the document to Vice President Rockefeller, who has been asked by President Ford to study the question of rearranging the machinery for presidential science advising (*Science*, 10 January 1975, page 44), and for whom Dr. Stever's office has been collecting statements and suggestions from various sources.

The statement was prepared by William D. Carey (to whom all correspondence should be directed) and Richard A. Scribner of the AAAS staff. The statement has been reviewed by members of the AAAS Board, which includes Roger Revelle (chairman), Margaret Mead (president), William D. McElroy (president-elect), William T. Golden (treasurer), Richard H. Bolt, Kenneth B. Clark, Emilio Q. Daddario, Edward E. David, Jr., Ruth M. Davis, Ward H. Goodenough, Frederick Mosteller, and Chauncey Starr. The AAAS Committee on Science and Public Policy was also asked to comment on the statement in draft form; members of that group include: Raymond Bowers (chairman), Don Kash (vice chairman), Brewster Denny, William Drayton, John Logsdon, Dixon Long, Mack Lipkin, Jr., Derek de Solla Price, Jurgen Schmandt, Harvey Sapolsky, Jessica Tuchman, and Christopher Wright.

- Transformation of human settlements.
- Impacts of population and resource imbalances on political and other institutional adaptations.
- Economic, political, and social implications of changes in the global climate, in the context of population growth and resource constraints.

Environmental, technological, and institutional problems

- Land use planning and management.
- Environmental regulation.
- Air and water management and regulation.
- Oceans policies.
- Consumer product safety and performance.

Technological innovation

- Energy supply and utilization.
- Reduced dependence on foreign imports of basic materials.
- Technology and balance of trade.

National security

- The limits of détente relative to safeguarding national security and scientific and technological leadership.
- Weapons assessment and arms control.
- Nuclear proliferation.
- International implications of technological changes.

The national security issues in policy-making obviously require independent and critical staff work. Choices among military hardware systems aside, the real dimensions of "national security" have assumed a wholly new scale and character. They concern the uses of the sea, the environment, and the resources of the planet. They address the equities of resource allocation among developed and developing societies. They confront choices as to population stabilization, and the uses of science and technology in creating alternative social and economic structures which can help to reduce dissatisfactions leading to conflict. These are presidential issues, and our national security is tied to them. For these reasons, we believe that any realignment of the science advisory process must provide for direct involvement, within that process, in the staff work on the *trans*national problems on which global security will depend in the future.

This indicative enumeration of policy problems comprises a formidable menu for policy-making. Many are long lead time problems rather than quick response issues. To deal with them, policy analysis cannot rely on ad hoc improvisation. The national policy machinery must be equal to them.

While science and technology alone will not have all the answers, they certainly will have important roles in illuminating questions of choice, feasibility, and alternatives. For that reason, we believe that the national policy machinery must have an effective science and technology component which functions in concert with other policy support staffs.

The emphasis, accordingly, is on ensuring complete staff work for policy analysis and decision-making. Of course, the mere existence of policy staffs does not guarantee results or head off bad choices, and it certainly does not substitute for political accountability. Staff work may be used well or badly. Its quality may be excellent or third-rate. If it is to count, policy-makers must demand and obtain the full measure of its capabilities.

The Structural Problem

Within the context of the preceding assessment of the federal government's needs relative to science and technology, we see three distinct but complementary Executive Branch staff support roles:

1) The science and technology policy advice role.

2) The R & D management and coordination role.

3) The science and engineering advocacy role.

We believe that the first two functions can best be performed within the Executive Office of the President, and the third, while very much needed, is best kept out of the White House or the Executive Office and quite distinguishable from the others.

The science and technology policy advice role. There are two dimensions of science policy advice. The first involves frequent inputs to the traffic of *short-term* policy-making. The second involves *strategic planning* for the contribution of science and technology to national goals and objectives. Together, they require involvement in dealing with the problems of allocation of resources for science and technology, determining priorities among multi-agency programs, evaluating the quality of agency R & D programs, and fostering long-range planning for technology assessment, health of the scientific community, and other matters bearing on science and technology.

Short-term policy-making should focus on (i) budget allocations, (ii) evaluation of proposed legislation, and (iii) major program decisions or choices, such as the amount and distribution of R & D for energy, appropriate levels of expenditure, and best mix of civilian and defense R & D, or the treatment of multinational corporate R & D expenditures under proposed tax rules of the Internal Revenue Service. These are critical functions which require timely and informed science policy advice. If the policy advice role does not involve participation in them, it will have no clout or impact, and will be merely ad hoc.

The second dimension is distinct from the short-term policy-making discussed above. It is addressed to a long-standing gap in our national policy machinery.

The strategic planning dimension requires deliberate attempts to develop assessments of the quality and productivity of science and technology and to develop long-range goals for them in relation to the position and needs of the United States at home and in the world. The importance of this role is obvious if science and technology are to be approached in investment terms rather than simply as year-to-year work programs. Establishment of this role implies that government recognizes the character of the discovery process, accepts its long lead times, and means to create multiyear perspectives which will help to define and forecast the policy environment within which science and technology can be carried on.

An important dividend which should emerge from the planning and assessment roles is an annual guidance statement of the Office of Management and Budget (OMB) defining the ranges of new budget authority and outlays for the federal R & D effort, to be used as planning benchmarks in the preparation of the Executive budget. These guidelines should be consistent with the medium- and long-term economic, social, and international policy objectives of the Administration, and they should reflect the context of the real world in which budgetary choices have to be made. The development of the annual guidance statement does not preempt the role of the OMB in rationing resources among rival needs, but instead provides a rational framework which can help to extricate budgeting for science and technology from

the constraints of incrementalism and inequities of "crash" R & D funding.

Whether both of these activities—short-term staff support and longer-range strategic planning—can be handled effectively by the same group in the Executive Office is arguable. However, it should be tried, because the realism of strategic policy planning will be fortified by immersion of the advisory staff in current decision-making with OMB and agency heads on the touchy issues which confront political executives from one day to the next. The danger to be guarded against is that long-range policy planning may be driven out by demands for quick response staff work for the White House. This problem can be met, in part, by using the National Science Foundation as a major support arm for science policy studies.

Both of these advisory functions must be situated in the Executive Office to have the necessary ad hoc policy input and the leverage required to set long-term science and technology goals. They must be accepted and tied into the delivery of staff work, and they must be headed by presidential appointees. Finally, they must be accessible to the outside world, where science and technology are largely initiated and performed, and not screened from "real life." The science and technology policy advisory staff would establish working relationships with the Domestic Council, the National Security Council, the Office of Management and Budget, the Council on Environmental Quality, and the operating departments and agencies.

It is not necessary to dramatize the personal involvement of the President as the chief client of the science advisory staff. There will be times when a President will need and want advice. He has to be the judge of this. The main objective, however, is to deliver sound, timely, and informed advice to the centers of the national policy machinery in and around the Executive Office—to make it an arm of complete staff work, so that facts, judgments, arguments, and alternatives work their way up the line. This is the best way to help the President. In organizational terms, this means that the restoration of a science advisory system need not necessarily require a personal science adviser to the President; it may be enough to provide the staff capability to work on even terms with the White House and Executive Office staffs and the heads of agencies.

Finally, a degree of institutional tension is one of the risks that a staff activity must run. Science advice includes the responsibility to criticize or oppose policy trends, *within the White House staff system*, when the grounds for doing so are within the competence of science and technology.

The R & D management and coordination role. While the administration of federal R & D programs must remain the responsibility of the mission-oriented departments and agencies, there is great need for "cross-cutting" coordination and oversight. This problem has never been handled well in the past. Interagency committees are poorly suited to the task. The OMB is necessarily concerned with issues of program content, cost-effectiveness, and dollar cost and, while some measures of oversight can be exercised through budgetary reviews, the process is selective, targeted, and may lack a balanced perspective.

What is needed, we believe, is assurance as to the priority, quality, balance, and end utilization of R & D. Crash programs, especially, call for objective evaluation and quality assurances, as in the case of cancer research and energy R & D. This evaluation requirement is particularly needed when these programs are supported by high and growing budgets while other fields of science and technology are relatively constrained by a lower support level. To make this kind of assessment, it will be necessary to reach out for help from organizations and individuals whose insights, skills, and experience will inject freshness and objectivity to the evaluation, including groups which can communicate the values and preferences of a diverse society.

Serious and unresolved questions exist as well with regard to the efficiency with which the nation's R & D capabilities are being employed; examples are failures to define R & D objectives in concert with industrial and other users of the results, disarray in the arrangements for handling scientific and technical information, contradictory practices among federal agencies with regard to patent rights, policy barriers to joint or cooperative R & D by industry, the absence of system-wide oversight of valuable federal laboratories and research centers, and costly practices in competitive proposal solicitation. Priorities for R & D will emerge from agencies' missions and roles, but good science policy requires these priorities to be reviewed and coordinated to make them realistic in terms of feasibility, manpower requirements, timing of expected results, available funds, and well-defined objectives.

Equally important is the need to manage the federal government's discordant impacts on technological vitality in the United States. The attitude prevails at all levels of government that technology is the result of market forces and the decisions made in the private sector. What is not recognized adequately is that the government's policies and activities have a tremendous influence on the rate of technological investment, innovation, and risk-taking. Nor is it clear that government understands the importance of lively technology in maintaining a positive international trade balance, in improving productivity, and in generating jobs.

Yet, the federal government influences the rate of technological enterprise in ways that are critical: through its regulatory and standard-setting activities (which need a sound scientific base), through its massive procurement operations, through its R & D expenditures, through its tax policies, through its trade and monetary policies, through its economic policies, through its personnel policies, and through its educational and research policies. The aggregate effects of these disparate interactions on the directions and the scale of technological enterprise are unseen but great. No focus now exists in the public policy structure for coordinating policies and decisions relative to technological thrust. No analytic focus exists for considering the impacts of changing policies or regulatory actions on technological risk-taking, or for evaluating the impact of government on the marketplace in which decisions that affect technological risk-taking must be made.

An Executive Office focus is needed to deal systematically with these problems of management policy, to carry out special projects and R & D management audits, and to deal with issues which today go by default. The National Science Foundation has tried heroically to address most of these needs, but its resources are inadequate and its position in the Executive Branch bureaucracy too low to be fully effective.

Managerial oversight of any multi-billion-dollar diversified enterprise, including federal R & D, is no part-time affair. Federal agencies need a great deal of help to improve their programs.

Large industrial corporations with substantial R & D activities have developed management systems which get the job done without strangling R & D initiatives or the incentives for research creativity and technical innovation. Some "technology management transfer" of this kind from industry to government would not be out of place.

This role is distinct from the advocacy and advisory roles, and should be kept distinct.

The science and engineering advocacy role. Because scientific research is long-range in nature—it is a discovery process whose benefits and costs must be inferred rather than quantified —its claims on resource allocation are often difficult to establish. This difficulty means that scientific research—especially basic research in the physical, biological, and social sciences—cannot compete for support on equal terms with the short-run operational responsibilities of government agencies. Budget levels for these short-run operations are resolved by bargaining and level-of-effort compromises. Year-to-year changes in budget policy erode the continuity of research and induce chronic uncertainty, while inflation forces up the costs of research manpower and laboratory investigation.

While science, as a claimant for federal support, cannot be exempted from the "ends-means squeeze," neither can it be expected to maintain its vitality under conditions of open-ended uncertainty. As a comparatively weak claimant on limited resources, science needs to have responsible champions to help its case to be heard, to identify and argue for pursuit of emerging opportunities, and to press for the maintenance of a lively and productive scientific enterprise. What must be guarded against is the creation of a special interest lobby for science, or what might be perceived as a lobby. The advocacy role within government must not be a partisan or special interest one: it should be selective and well supported with analytic assessments of the nation's research enterprise, judgments on the balance of effort among fields of research, and evaluation of the scientific and social merits of new opportunities in science. This is the kind of information which should be brought effectively to the attention of the Executive and Legislative branches and the general public.

These roles, we believe, should be carried out within government primarily, but not exclusively, by the National Science Foundation, working with the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. However, ours is a broad and pluralistic society, and openings must be made for the advocacy of views from many groups and organizations which reflect crosscurrents of change and the articulation of emergent needs. The strength of our national science and engineering endeavors will be enhanced if strongly held views on health research, applied social science, environmental science needs, basic research, and technological innovation and development, to name but a few, can find a ready, but critical and evaluative hearing within the federal government.

Furthermore, there is need for an Executive Office annual report on science, technology, and national policy addressed to the Congress. Such a report, prepared by elements within the Executive Office, but with inputs from several parts of the Executive Branch, should assess the health of science and engineering endeavors and project long-range goals for science and technology applicable to the needs of the United States. Such a report could provide a degree of guidance to the scientific and engineering communities and be the focus for a continuing appraisal by the National Science Board and the director of the National Science Foundation, as well as the Academies, and such broadly based organizations as the American Association for the Advancement of Science, of critical questions affecting science and technology and requiring governmental attention.

Recommendations

The essential point is that the Administration must decide its posture toward the function of science and technology in the total national policy picture. Our view of the future persuades us that the country's goals and objectives are linked closely to science and technology, and that the arrangements for policy analysis, planning, resource allocation, and management should reflect that linkage.

The aim is not to aggrandize the image of science and technology, but to improve the quality and performance of public policy. If the Administration shares this view, we assume that it will take steps to put new machinery in place. If the Administration believes that our view is overstated, it should not adopt recommendations just because we make them. Otherwise, the disorder will only be compounded.

In summary, the AAAS Board of Directors believes that the needs of public policy-making require enhanced staffing and better organizational structures than currently exist. Science and technology policy considerations need to be integrated in a regular and recognized manner into the decision-making process in much the same way as economic, legal, political, and social factors.

Thus, it seems clear that a variety of new arrangements is called for and not just a simple reversion to an earlier model or the creation of a single new body of which too much is expected. The focus of the examination of federal science and technology must not be on transient questions of organization. What matters is what we are doing with and to science and technology, and how they can best help to define the direction and quality of our public policies.

In the context of this discussion of needs and functions, the Board believes that some of the suggestions already made for organizational arrangements have genuine merit. The Board would welcome an organizational initiative comprising the following elements:

1) A Council of Science and Technology Advisers in the Executive Office, headed by a strong chairperson, to provide continuing staff advice on scientific and technical aspects of domestic and foreign policy-making together with long-range policy research, planning, and public investment for the uses of the nation's scientific and technological resources in achieving major goals and objectives. We believe that a council composed of knowledgeable individuals is a workable mechanism for accomplishing the planning, policy goal-setting, and assessment and monitoring functions essential to effective staff work. At the discretion of the President, the head of the council could also serve as science adviser to the President.

An alternative to a council would be a single presidential appointee, assisted by a carefully chosen staff. This alternative would be appropriate in circumstances where a President might find a council unwieldy and slow-moving, and would prefer a simpler arrangement.

To ensure a strong and in-depth capability for planning and assessment to support policy-making, the Executive Office elements should be able to look to the National Science Foundation to mount and carry out a substantial level of science policy research, analysis, and reporting.

What matters, to repeat, is not so much the organizational mechanics but rather the explicit provision for lively and complete presidential staff work—staff work which captures and gives weight to scientific and technical considerations in the examination and choice of policy alternatives and program strategies. This is what the current issue is primarily about. The purpose of the organizational decision is to focus—visibly, clearly, and effectively—the initiative and accountability for delivering such staff work with continuity and impact. The organizational answers should match the demands of the assignment, and should be seen as doing so.

2) An Office of Research and Development Management with the responsibility to evaluate programs, set priorities, provide quality assurance, see to policy coordination, and stimulate new initiatives. This office can be either a separate unit in the Executive Offices or an element in the OMB headed by a presidential appointee.

3) Principal reliance on the National Science Board and the director of the National Science Foundation, working closely with other federal scientific and technical agencies, for assessments of the nation's needs and opportunities for the advancement of science and education for science and engineering. Effective outreach should be maintained with the National Academy of Sciences and the National Research Council, as well as with scientific, professional, and public interest groups.

Closing Comments

Organizational inventions tend to lose vitality over time, and to become preoccupied with problems of the past rather than the future. Organizational lag is one of the afflictions of bureaucratic life. We believe that our suggestions are appropriate for as far ahead as we can look, but we strongly recommend that future administrations keep an open mind and open options as to the character and appropriateness of any set of science policy and managerial institutions. Events may call for different arrangements, and the national policy machinery must have the ability to recognize the need for change and revitalization.

References

1. A selected few of the large number of articles and statements which have appeared on the subject of science advice for the Executive Branch over the last 2 years are: U.S. House of Representatives, First and Second Hearings before the Committee on Science and Astronautics, *Federal Policy, Plans, and Organization for Science and Technology* (93rd Congress, 1st session, July 1973, and 2nd session, June and July 1974) (see also Interim Staff Report of the Committee bearing the same descriptive title and issued May 1974); Ad Hoc Committee on Science and Technology, *Science and Technology in Presidential Policy-making—A Proposal* (National Academy of Sciences, Washington, D.C., June 1974); G. B. Kistiakowsky, *Science* **184**, 38 (1974); D. W. Bronk, *ibid.* **186**, 116 (1974); E. B. Skolnikoff and H. Brooks, *ibid.* **187**, 35 (1975).

NEWS AND COMMENT

Edelin Trial: Jury Not Persuaded by Scientists for the Defense

Boston, Massachusetts. The manslaughter trial of Kenneth C. Edelin is over now. It dragged on for six long weeks in Suffolk County Superior Court here and ended on Saturday, 15 February, when an all-white predominantly Roman Catholic jury returned a verdict of guilty. The jurors convicted Edelin, a black physician, of killing a black "baby boy" during the course of a legal abortion at Boston City Hospital. After the verdict, Edelin attributed his conviction to jury bias and called the trial a "witch-hunt."

The question of race was not raised during the trial; nor did it figure prominently in pretrial discussions of the case by either defense attorney William P. Homans, Jr., or assistant district attorney Newman A. Flanagan, chief prosecutor. But it was raised rather dramatically after the verdict was in when alternate juror Michael Ciano quoted an unnamed juror as saying, "That nigger is guilty as sin." Other jurors denied there had been any racial slurs, and some said that they did not know that Edelin, who is light-skinned, is black.

This is the third article about the Edelin trial to appear in the News and Comment section. The first (25 October 1974) discussed the origins of the case and some of the complex medical and legal questions involved. The second (31 January) discussed the opening of the trial and its emphasis on connotative language, the prosecution referring to a "baby boy" or "male child" while the defense spoke about a "fetus" and the "products of conception."

On Tuesday, 18 February, Judge James P. McGuire, in an action that Edelin called "extremely fair," imposed a sentence of 1 year's probation. After that, the trustees of Boston City Hospital issued a statement of support for Edelin, calling him an "outstanding physician" whose "actions and medical practice have been consistent with the highest prevailing standards of medical care." They asked him back to work; he went.

The trial may be over now, but the case is not closed and the issues it raised are not resolved. Edelin is appealing his conviction. In one motion now before Judge McGuire, his attorney is asking the judge to overturn the verdict on the grounds that the jurors misunderstood and misapplied the law. Homans is basing the motion on an old state law and citing as precedent a 1944 decision that reads:

> It is the right and duty of a trial judge to set aside a verdict when in his judgment it is so greatly against the evidence as to induce in his mind the strong belief that it was not due to careful consideration of the evidence, but that it was a product of bias, misapprehension or prejudice.

Homans is emphasizing "misapprehension" of the law on the jurors' part,