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EMERGING TRENDS IN TECHNOLOGY ASSESSMENT

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EMERGING TRENDS IN TECHNOLOGY ASSESSMENT

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April 1974

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16. Abstracts The paper describes the organization and current activities of the Congressional Office of Technology Assessment and stresses its critical importance to future development of technology assessment, especially the extent to which it is able to resist inevitable political pressures. Technology assessment as a required activity in government planning may benefit from the energy shortage and other impending crises which underline the importance of anticipatory problem identification. Many Federal Executive Agencies are indicating new interest in technology assessment, but the only source of sustained government funding at present is the National Science Foundation. NSF-funded assessments cover a wide range of subjects, including social technology, and put emphasis on policy alternatives and public information; they encourage participation by universities, industry, profit and non-profit research groups. All types of organizations exhibit difficulty in achieving successful interdisciplinary efforts; each type has some advantages that other kinds of groups lack. The appropriate mechanism for public participation has not been resolved. Nevertheless, serious interest in technology assessment is developing in many countries and in international organizations and its further acceptance and development appear inevitable.

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This paper reviews recent and emerging trends and problems in Technology Assessment. In 1971 I conducted an extensive survey of T.A. activities.[1] Today I will update that study by describing what has been occurring in the last two or three years, as I have been able to observe it, and highlight some of the problems and issues which I see determining the future of Technology Assessment.

The bill establishing the Congressional Office of Technology Assessment was passed in October 1972. I begin with that Office, because I believe that what happens in and to that Office will be the critical factor in the future of T.A. The Technology Assessment Board, which is the policy-making organ, was appointed in February 1973. As most of you know, the Board consists of six Senators, three from each party, and six Representatives, again three from each party, and the Director, who is a non-voting member. (This is, I believe, the first time in more than thirty years that what is essentially a Congressional Committee has been established on the basis of party parity.) Senator Edward Kennedy is the first chairman, and will hold office throughout the 93rd Congress. The law provides that the next chairman shall be a Member of the House.

The Technology Assessment Advisory Council has also been appointed and consists of ten public members, whose names and affiliations appear on the attached list, along with the comptroller-General and the Director of the Library of Congress.

Mr. Emilio Daddario, who introduced the first bill to establish the Office in 1966 while a Representative from Connecticut, and thereby initiated the technology assessment movement, was appointed as the Director of the Office. The Associate Director is Daniel De Simone. Mr. De Simone had not been closely associated with technology assessment hitherto by those who had closely followed the developing movement. However, he had been the director of the large study, "A Metric America," while at the National Bureau of Standards, and had since moved to the National Science Foundation's Science and Technology Policy Office.

The Metric America study was in fact an assessment of social impacts of conversion to the metric system, relying in large part on public hearings and representation of interests--although the study was not called a technology assessment. Dan De Simone appears to have done his homework well and to have a good working understanding of technology assessment and what possibilities and pitfalls await the new Office.

Those pitfalls are, I believe, real and threatening. When the new OTA was first conceived by Mr. Daddario, he envisioned something like a much smaller GAO or Library of Congress; that is, an entity which would serve the Congress by supplying it with hard, reliable information, but which would be more or less independent of the internal politics of Congress. The new Office, unfortunately, much more closely resembles a joint committee, and thus faces the difficulties of accomplishing its work without appearing to violate the territory and jurisdictions staked out by other committees, of which it must at the same time attempt to serve the needs. A further difficulty and danger is that the present chairman of the T.A. Board is widely

viewed as a potential presidential aspirant. Without alleging in any way that Mr. Kennedy would attempt to, or would wish to, or would deliberately lend himself to, exploitation of the issues with which the Office must struggle in order to further his own political image, I fear that this potentiality will be another complication as the Office attempts to establish its initial role and record. The organization of the Office will lend itself to this suspicion. The T.A. Board has interpreted the establishing law in such a way that the Board has a small staff of its own, that is, a staff which serves the Board rather than the Director; Senator Kennedy's Science Advisor is the Executive Secretary of that staff.

As with any Congressional Committee, OTA will be subjected to pressure as it begins staffing. Mr. Daddario's strategy has been to delay appointment of program managers until after initial program areas and major topics were selected. Whether he will be able to select people with both knowledge of the technological subject areas and in-depth familiarity with technology assessment concepts and methodology, or whether his choices will be constrained by political considerations, we can only wait to see. Those observers who had for months been predicting the first few appointments have so far been surprised every time. Public hearings were scheduled to have been held in January or February to hear testimony from the heads of Executive agencies about their technology assessment programs and plans, but those Hearings did not occur, for reasons which are not clear; they may be held later this spring.

When the bill was passed last fall it was not highly controversial, but neither did it evoke great interest in Congress. The bill provides that

the assessment activities of the OTA may be initiated "upon the request of" the chairman of any Congressional committee, acting for himself, for the ranking minority member, or for a majority of the members of the committee; or may be initiated by the T.A. Board or by the Director in consultation with the Board. The fact is that most committee chairmen have little or no understanding of what technology assessment is, or what the Office could do. Their temptation will be either to try to use the OTA as a quick response information service to augment their own staff, or to play secrecy games and resent any "intrusion" of OTA into their territory. Mr. Daddario has been diligently calling on committee chairmen to educate them and to solicit their views in an attempt to ward off these dangers.

The "Energy Crisis" has generated in some quarters new cynicism about the ability of the government to manage complex technological issues or to prepare for problems which it has been possible to foresee for some time. At the same time, again in some quarters, the energy crisis has fueled a reaction against the environmental movement, or pushed environmental concerns into lower priority. This kind of facile cynicism, however, appears to be less important and will probably be less long-lasting than a much more important effect, a widespread realization that those who raise hard questions about national priorities, conservation of resources, and the necessity of exerting some public control and direction over economic and technological development can no longer be safely ignored or brushed away. This change in attitude may in the long-run cause the OTA to be treated with more seriousness than would otherwise have been the case, and if OTA can, in its first year or two, produce studies of demonstrable excellence,

insight, and value it will establish a credibility and influence that can make it a major innovation in the American governmental system. Certainly, although the Office itself lacks the usual levers of power hitherto considered absolutely necessary in Congress, it has leadership of great integrity, knowledge, and influence in its Board and in the Directorships and it is, above all, in the right place, at the right time in history.

The first task the Office has accomplished is to select six areas of emphasis for their first year ($2 million is to be committed before July 1, 1974). Obviously the OTA had some obvious criteria--they presumably wanted to fund technology assessments in areas which were important in terms of potential impacts, areas in which Congress must in the near future make decisions (but areas in which the major decisions for the next five to ten years have not already been made, or will not have been made before an assessment could be completed). One would also suppose that OTA would wish to choose areas in which its assessments might have a strong influence and the Office thereby establish prestige and credibility. OTA did make use of four NSF-funded studies of T.A. priorities.

The six areas chosen for technology assessments are: technologies related to food, energy, materials resources, oceans, bioequivalence of drugs, and international trade. Now Mr. Daddario, Mr. De Simone, and their (so far very small) staff will begin the task of problem and program definition within those six general subject areas.

There are a number of ways OTA may go, and a number of obvious mistakes they may make. If they tie themselves too closely to the immediate needs of the other Congressional committees, they may ask for assessments only of technologies which are already widely used but controversial--

such as off-shore oil drilling, pesticides, or strip-mining. It is true that in many such subjects comprehensive assessments are lacking and urgently needed. But too much emphasis on relevance to already obvious decision-making needs may lead them to ignore the decision needs which will arise in the future--that is, to overlook the more speculative and uncertain technological options and possibilities which will then catch us unprepared at some future time. OTA will then be trapped in the behavior Congress has always exhibited--reacting to today's crisis, solving yesterday's problems, and backing rumpfirst into the future.

OTA also runs the risk of concentrating too much on areas which, however important, are chosen because they are now a matter of public concern and thus already are generating action programs. It is unfortunate when action programs are initiated, and continue, without both a prior and an on-going assessment of their impacts. Nevertheless, to have a strong effect on decision-making, it is too late to begin a comprehensive assessment after a "crisis" is evident and action programs become the order of the day. By then directions have already been chosen--or dictated, political and economic capital has been committed, bureaucracies have been generated, and interests have been mobilized. If only very limited resources can be allocated to assessments, they should be more, not less, anticipatory--to maximize the opportunity to lay a grounding of objective, authoritative information before the subject becomes controversial.

The Congressional Office and what happens to it appears to be critical because Executive agencies will take their direction accordingly. To fully appreciate that, it is necessary to recall how the concept of

technology assessment originated. The 1960's were a time when the cumulative effects of technological advance burst into public consciousness in the form of alarms over alleged hazards to health and safety from industrial byproducts or unexpected physiological effects of chemicals such as thalidomide. Rapid economic growth and a national program of highway and airport building suddenly intruded into the suburban sanctuary of the affluent middle class, bringing pollution, noise, and competition for residential land. In the cities Black and ethnic communities, newly politicized, began to resist disruption of settled neighborhoods. Court battles resulting in costly delays to projects, and aroused constituent pressure, brought response from Congress--new requirements for planning, community participation, agency coordination, and, above all, demands that Congress be furnished with more comprehensive information. The development of technology assessment as an interdisciplinary, policy-oriented class of studies was one result. A closely related result was the National Environmental Policy Act and the requirement for environmental impact studies. I found in the survey which I mentioned that executive agencies--reacting to these demands--in the ensuing five-year period began significantly to broaden the processes by which they plan, program, and evaluate technological projects, although the extent and pace of improvement varied considerably from agency to agency. This improvement is clearly a defensive reaction to Congressional, and ultimately to public, pressure. There has been little or no pressure for better management from the top echelons of the Executive branch and there is not likely to be. Hence the agencies--the only possible source of sustained funding for T.A.--will take their lead from the Congressional OTA and take

its activities as a model or a challenge.

Rumors are circulating widely, and I believe they are well-founded, that the Office of Management and Budget has directed Executive agencies to minimize the direct support they give to OTA. Presumably this is a direct effect of the political problem I have already mentioned, i.e., the Presidential potentiality of the Chairman of the T.A. Board, although I believe the reason given is that OTA might "raid the research budget" of the agencies. If these rumors are true, the effect may nevertheless be minimal, because the agencies have not only to defend their budgets and programs to OMB but to Congress. In the present situation in Washington, the Executive Office is not able to keep as strong a hand on the bureaucracy as it could a short time ago.

In the last two years there have been small but significant signs that some agency officials believed Congressional pressure would continue. From time to time RFP's appear in the Commerce Business Daily with the words "Technology Assessment" in the description and solicitations for evaluative studies commonly use the phrase "including social impacts." The AEC now has at least one employee with the job title "Technology Assessment Specialist." The Federal Highway Administration uses the acronym "SEES" or "social, environmental, economic impact studies." The Department of Commerce has a "Technology Assessment Office" (in fact a misnomer), and most of the agencies have had conferences, seminars, or requested briefings on technology assessment for their staff. This protective reaction, it seems to me, comes almost entirely from the middle management echelons where program justification and defense must be prepared, and is resisted or ignored by the upper echelons and the lower operational echelons respectively. In a number of other agencies, there are on-going

studies which constitute technology assessments. To mention only a few examples: There is the major study proceeding in DOT, Climatic Impacts of Atmospheric Pollution, which has a broader scope and greater depth than its title might suggest. DOT is also studying the impact of alternatives to the internal combustion engine, and the impacts of railroad electrification. The Environmental Protection Agency is studying the potential impacts of electric automobiles on the Los Angeles area.

The National Science Foundation, chiefly through the Office of Exploratory Research and Problem Assessment within RANN, is still the only source of sustained funding for comprehensive technology assessment within the Federal government. This is in fact probably the best site for this activity. One of the recommendations which emerged from my study of Federal T.A. was that, while all agencies should be pressed to incorporate T.A. concepts and techniques in their day-to-day planning and evaluative procedures, comprehensive and credible T.A.'s were best sponsored by a source which had no operational responsibility for the programs and projects being assessed, in order to provide a broad scope for potential assessments, reduce institutional bias and maximize public access to the results. NSF had $2.1 million for T.A. in FY '74 and expects to have $2.7 million for FY '75. The range of topics in which NSF has funded technology assessments is broad...

- alternatives to the internal combustion engine
- solar energy
- geothermal energy
- off-shore oil and gas exploitation
- energy conservation measures

- weather modification (snowpack augmentation)
- integrated hog farming
- biopesticides
- conversion to the metric system
- alternative work schedules
- remote sensing
- videophone
- cable television
- electronic banking

NSF has also funded some supporting work in T.A.: the survey which I conducted in Federal agencies, the comparative study which Martin Jones has described,[2] another survey of technology assessment activity including the state and local and private sector, four studies of priorities for T.A., and several workshops and conferences on technology assessment.

There are several additional points to be made here.

NSF has apparently decided not to fund further studies of a strictly methodological nature, but to encourage experimentation with a variety of techniques and methods appropriate to the technology being assessed--in other words, to let the configuration of the technology drive the research design.

The techniques of technology assessment are considered to be equally appropriate to social technology as well as physical and biological technology; note that alternative work schedules is a social technology, and that several of the other subjects (the metric system, integration of hog farming) have important elements of both physical and social technology.

While none of the areas picked by OTA for its first year is purely a social technology, Mr. Daddario and Mr. De Simone have stated that they

expect to choose such areas in the future.

Nearly every technology assessment which has been done reached a similar conclusion either explicitly or implicitly--namely, that institutional obsolescence, maladjustment, or inadequacy is critical in problems arising from or foreseen for technological development; or that new institutional arrangements must be invented in order to direct or control the direction of development or minimize undesirable side-effects.

Even when sponsors of assessments have explicitly directed the performers not to make policy recommendations, such findings seem inexorably to emerge. Some organizations and researchers have refused or resisted the opportunity to carry out the logical final steps in technology assessment considered as support for policy making--that is, to lay out policy and action alternatives and assess their comparative impacts. It is often claimed that such tasks intrude the "values" of the assessor into the decision-making process. But technology assessment is intended to support and inform the decision-making process, and the public cannot be expected to understand, nor the decision-makers to have the time, to penetrate a dense technical report and work out the implications for alternative policies and actions in order to make a wise choice. Either the assessors themselves must draw out and elucidate these alternatives (without intervening in the final decision) or some other entity such as OTA must provide the translation. NSF has recently required that a substantial portion of the funding be allocated to providing a popular version of the technical report which is both accurate and easily readable by the layman, and to providing a plan for popular dissemination of results through publications, filmstrips, broadcast

media, and open conferences. This is a substantial and significant departure for NSF, which in basic research grants can rely on scholarly publications and peer group interest to get research results to users.

An interesting trend has developed in would-be contractors and grantees responding to NSF program announcements and to some extent to competitive solicitations for assessments by other agencies: the formation of consortia of universities, or of universities, non-profit and profit-oriented research organizations, and industry research and development units. Most organizations cannot within themselves meet the requirements that more and more become apparent as experience with technology assessment accumulates.

It is interesting that industry, which has not rushed to perform or sponsor technology assessments of technological developments which it may be pushing, should respond to Federal initiatives. Those companies which have done so usually have a potential interest in the potential technology being assessed, and evidently saw this as an opportunity to perform an assessment and gain valuable information which the corporate structure would not be willing to pay for (and even make a slight profit to sweeten the deal), but also saw it as an opportunity to learn a skill which it may be necessary to possess in the future. In many cases the industry group chose a University research team as subcontractor or joint participant. In all likelihood the sponsoring agency will get full and valuable return on this investment by tapping into expertise and experience (in the technology) which industry has in abundance. The University teams on the other hand have a queasy foreboding that--having absorbed the knowledge and experience the University group has developed in assessment--industry will go it alone the second time around and

attract the lion's share of future T.A. funding.

Technology assessments should (a) be widely interdisciplinary, (b) include or have access to both data from advanced basic research and experienced applied, problem-oriented researchers, (c) be free of the taint of or suspicion of institutional bias, (d) be protected from pressure by client, constituents, political activists, (e) be well-managed and coordinated, and (f) be sensitive to the real needs of the ultimate user (who often does not know his needs). To have the desired impact (that is, to be in a position to support and inform decision-making) technology assessments should also have credibility, visibility, and a means of communicating the findings to the public.

Interdisciplinary research is and has always been a problem for universities except in extraordinary circumstances. The chief difficulties, as Jack White has pointed out,[3] are the reward structure and the inability of experts in one field to communicate information and insights to experts in other fields, especially where the disciplines differ widely in assumptions, theories, methodology, terminology, and acceptable degree of uncertainty. The reward structure for interdisciplinary studies of the T.A. type is slowly improving. In part this is a result of the emphasis on relevancy during the past decade, but its practical manifestations are the emergence of interdisciplinary journals (offering the opportunity for publication), the development of interdisciplinary degree-granting programs (job-opportunities, promotions, and prestige), a growing opportunity for consultantships for social scientists, experienced "generalists," and applied methodology experts. When, as has been the case with the University of Oklahoma's off-shore oil and gas assessment, the study receives wide attention from Federal agencies and Congress, a new (for academics) reward

structure comes into play. It is noteworthy that large independent research organizations appear to have their own difficulties with interdisciplinary studies, a point not often recognized. Internal organization of any information-oriented bureaucracy (as good a definition of both universities and research organizations as can be found) seems to have an irresistible tendency to harden along disciplinary lines. This probably results from the fact that advanced knowledge and training becomes ever more specialized. There is probably no way to overcome this tendency except by interdisciplinary training, or, more likely, interdisciplinary experience on the part of more scientists. Social scientists are usually poorly educated in natural sciences, even in an understanding of the physical laws of the world they live in ; physical scientists seem to have two parallel deficiencies: an inability to deal intelligently with uncertainty and low probability, and an inadequate understanding of how people react with, and use and misuse, technology.

Universities have an even more serious problem. Theoretically they can draw on a wide range of disciplines, and have an advantage over independent research organizations in that they do not become constricted to those areas well supported by long-term clients, but they almost invariably lack management capability. Management of a university interdisciplinary research team should not be located within one of the participating departments, but should be outside of the academic structure and supported by a core staff which is not tied to the vagaries of the university teaching calendar; even so, by the nature of the beast, to the extent that it utilizes faculty and students (and is not simply a think-tank grafted onto the university) authority and discipline, to impose coherence and deadlines, will still be difficult. The University, on the other hand,

has some additional advantages for technology assessments--it can provide ready access to basic research at the developing edge of a science or technology; it generally enjoys both the substance and the reputation for objectivity and neutrality; it can exploit trained personnel (graduate students) at outrageously low costs with good conscience since it is offering them a valuable commodity in return, real world experience and a chance to build a track record.

The role which public participation should or can play in technology assessment is not yet resolved. (Here I am not raising a question as to the role of public participation in decision-making; that it must and can play such a role is indisputable.) But technology assessment is not decision-making--its function is to provide an objective base of information for decision-makers--as nearly complete and neutral as human capability can aspire to. Some argue that public participation is also vital in that step, to ensure that all affected parties and all potential impacts are detected and evaluated. Others would argue against that proposition on the grounds that

- "the public " by definition can add nothing to, and lacks the specialized knowledge to evaluate, the scientific and technical knowledge that must be brought to bear during the analysis;

- public participation converts the analytical process into an adversarial process (or political process) which consists of balancing or weighting obvious interests rather than detecting and tracing unsuspected impacts;

- the interests represented will be only short-term and narrow interests; since no one speaks for the community or society as a whole or for the long-term future, such concerns will be outweighed and downgraded;

- public participation generates and solidifies opposition (or support) too early in the evaluative process, before sufficient data is available; later information tends not to overcome the political and psychological "investments" already made (i.e., minds are difficult to change);

- some segments of society can rarely or never be involved in "public" participation; also, assessors may make biased choices of the "public" who are to participate, or may co-opt their support for later implementation.

The development of technology assessment, in which the U.S. has led the way, is not a national but a multi-national development. Several international conferences have been held, bringing together those interested in technology assessment in both industrial and developing countries. Groups of government, industrial, and academic representatives from western and eastern Europe, Scandinavia, and Japan frequently visit the U.S. to discuss technology assessment. The International Society for Technology Assessment, which held a major conference in The Netherlands last spring, is now planning a more specialized conference in Tokyo in conjunction with the Japan Techno-Economic Society. OECD has an international group actively studying technology assessment. One of the most promising trends to be noted is the way in which assessors and planners in many countries with different forms of government, legal systems, ideologies, and economies are experimenting with the same techniques and methodologies and grappling with the same problems--such as how to communicate and make the results of assessment more useful to decision-makers, how to develop scenarios of the future in which technological impacts will be manifested, and how to deal with and manage the inevitable uncertainties of assessment. What is emerging here is a kind of cooperative effort which transcends language, politics, and ideology in an effort to come to grips with common practical problems.

I have said that what happens to the U.S. Congressional Office of Technology Assessment is a critical factor in the behavior of Executive Agencies, but I do not mean that it will be the determining factor in the further development of technology assessment. That development, as a practical and useful, albeit only a first and uncertain, approach to dealing with the problems of increasingly complex society, is not only "an idea whose time has come," but an idea which is logically inevitable.

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1. Vary T. Coates, Technology and Public Policy, Summary Report (Rept. No. NSF/RA/X-72-003S, July 1972). A Study performed at The George Washington University Program of Policy Studies in Science and Technology, for the National Science Foundation. Available through NSF, Office of Exploratory Research and Problem Assessment.

2. Martin V. Jones (Director, Impact Assessment Institute, Bethesda, Md.), "Technology Assessment: A Framework for Comparison," Paper presented at the Annual Meeting of the American Association for the Advancement of Science, San Francisco, February 28, 1974 (Sessions on Science and Public Policy).

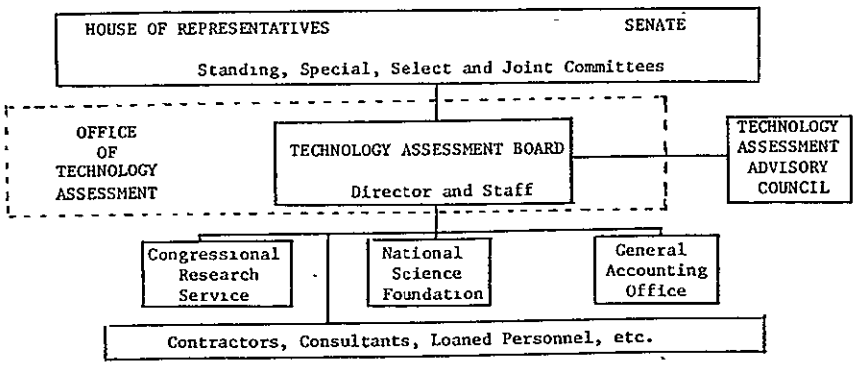
3. L. (Jack) White (Science and Public Policy Program, University of Oklahoma), "The OU Technology Assessment of OCS Oil and Gas Operations," Paper presented at the Annual Meeting of the American Association for the Advancement of Science, San Francisco, February 28, 1974 (Sessions on Science and Public Policy).

TECHNOLOGY ASSESSMENT BOARD

	Republicans	*Democrats*
Senate	CASE (N.J.)	KENNEDY (Mass.)
	DOMINICK (Col.) *	HOLLINGS (S. Car.)
	SCHWEIKER (Penn.)	HUMPHREY (Minn.)
House	MOSHER (Ohio)	DAVIS (Ga.)
	GUBSER (Calif.)	TEAGUE (Tex.)
	HARVEY (Mich.)	UDALL (Ariz.)

* Senator Stevens of Alaska has been appointed to replace Senator Dominick, who resigned from the Board.

ORGANIZATIONAL RELATIONSHIPS



TECHNOLOGY ASSESSMENT BOARD
CONGRESS OF THE UNITED STATES

November 29, 1973

RESOLUTION ON APPOINTMENT OF
TEN PUBLIC MEMBERS TO ADVISORY COUNTIL

The Chairman is hereby authorized to effect the appointment of the following ten public members to the Technology Assessment Advisory Council:

Harold Brown	President California Institute of Technology
J. Fred Bucy	Executive Vice President Texas Instruments, Inc.
Hazel Henderson	Author and lecturer on environmental and social issues
J. M. (Levi) Leathers	Executive Vice President DOW Chemical Corporation
John McAlister, Jr.	Associate Professor Department of Engineering-Economic Systems Stanford University
Eugene P. Odum	Director Institute of Ecology University of Georgia
Frederick C. Robbins	Dean Case Western Reserve University School of Medicine (Nobel Laureate)
Edward Wenk, Jr.	Professor of Engineering and Public Affairs University of Washington
Gilbert F. White	Director Institute of Behavioral Science University of Colorado