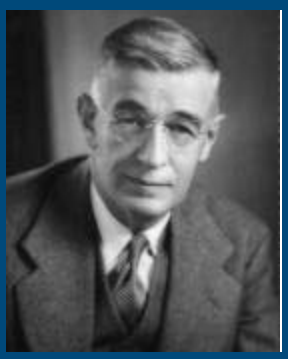
Federation of American Scientists

Flying Blind:

The Rise, Fall, and Possible Resurrection of Science Policy Advice in the United States

Henry Kelly, Ivan Oelrich,
Steven Aftergood,
Benn H.Tannenbaum



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The responsibility for this report rests solely with the authors.

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Occasional Paper No. 2
December 2004
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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

Executive Summary

The need for effective science and technology advice continues to increase while the infrastructure for providing such help is in a state of crisis. The President and the Congress are constantly confronted with decisions about new medical technologies, advanced weapon systems, wireless communication regulation, and other matters that hinge on technical facts. While technical analysis is almost never sufficient to make wise choices, absent competent, timely, targeted scientific and technical analysis, these decisions will depend on unchallenged assertions by special interests and ideologues. Programs are likely to be poorly designed and subject to costly mistakes. Even worse, lacking competent advice, the nation may fail to act on problems until they are costly and difficult to solve or fail to seize important opportunities to achieve public objectives in security, education, health care, the environment, or other critical areas.

This report develops options for improving the fundamental structures of science and technology advice based on examination of two cases where science and technology advice did not serve the nation well, interviews with many of the key figures in science and technology advice for Congress and the administration, and a review of recent literature.

Is Anyone Listening?

The strongest and most consistent statement emerging from these sources is that if the Congress or the President doesn't want objective scientific advice, no institutional solution can fix the problem. There is no way to force the President to meet with science advisors or to force Congress to base legislation on

careful scientific analysis. This report is designed to help a new administration or a new Congress interested in strengthening science and technology support to craft effective institutions. The recommendations are built with the clear understanding that technical advice must be combined with many other issues in shaping practical and effective policy. But the core assumption is that the principals involved are anxious to at least get the advice of technical experts before making a decision.

The proposals all assume that one goal of the reforms will be to create institutions that can endure and be effective through radical changes in national political priorities. Many of the options are designed to contribute to public debate and public understanding of technical issues making it more difficult for political leaders to ignore the issues.

Options:

Options are considered in three major categories: (1) strengthening science and technology advice for the Congress, (2) strengthening science and technology advice for the President, and (3) ensuring that individual citizens and non-government organizations have the information they need to conduct analysis and participate effectively in the public debate. Our recommendations are summarized below but the full report reviews a series of options for strengthening national programs in each of these areas.

1. The Congress

Findings: The gap created by the loss of the Office of Technology Assessment (OTA) in 1996 has not been filled. The National Academies are necessary but not sufficient for this role. Without remedying this problem, the Congress' ability to call upon a competent, independent scientific analysis in national decisions is gravely compromised.

Recommended Response:

- Start a significant (>$20 million/year) effort with OTA's ability to assemble external expertise and conduct detailed analysis of complex technical subjects as a distinct organization within GAO reporting directly to the GAO director. At least 25% of topics should be selected

by the director.

- Encourage formation of privately funded organizations such as the MacArthur Foundation's support for national security policy.
- The Appropriation Committees of the House and Senate should conduct a regular, government-wide review of federal research and development expenditures inviting administration and public witnesses to comment.

2. The President

Findings: Management of science and technology policy issues at the White House level is haphazard and lacks continuity. Compared with the National Security Council (NSC), science advice has little continuity between administrations, suffers from long gaps between appointments, has inadequate access to analytical capabilities, and has weak connections to the budget process.

Recommended Response:

- Legislation to (a) establish a strong National Science and Technology Council (NSTC) managed by a civilian executive secretary appointed by the President, formalizing the role of a Presidential Science and Technology advisor; and (b) reauthorize the Office of Science and Technology Policy as an office that would secure independent advice through independent advisory boards, conduct timely assessments of science and technology policy issues using both internal staff and sponsoring studies in the National Academies and possibly other organizations. At least one advisory board should have terms of six years to ensure continuity between administrations.
- Both organizations should be supported by an experienced staff, many of whom should have continuity between administrations.
- The NSTC should work with OMB to undertake a coherent review of the national science and technology budget. OSTP should prepare an independent review of S&T budgets on an annual basis that can be used as the basis for budget planning.

3. Public Information

Findings: Good government depends on holding public officials accountable to the public they represent. This means that individuals and independent private organizations must be able to evaluate the operation of federal programs. And this requires easy public access to the information needed to reach an informed judgment – including the technical information needed to do independent analysis. In recent years, it has become much more difficult for the public to get such information.

Recommended Response:

- Remove controls on unclassified scientific information,
- Create new internal checks on secrecy,
- Adopt an affirmative disclosure policy,
- Mandate routine publication of advisory committee reports,
- Direct agencies to proactively disclose deliberative records when possible.

SECTION 1

Introduction

Most public policies and political decisions depend at least in part on some scientific or technical analysis, whether the allocation of publicly-owned spectrum, voting technology, the risks of climate change, debates over intelligence on weapons of mass destruction, or the ethics of reproductive research. While there are few cases where technical analysis alone is adequate for making a decision, almost all participants in these debates recognize, or at least have to publicly agree, that complex decisions are improved if they are informed by sound scientific and technical analysis.[1] This is often a difficult process. Differing perspectives result in different weights to risks, costs, and benefits in any decision and resolving those differences is, naturally, a large part of any healthy political debate in a free society. During the past few years there has been increasing concern that the institutional infrastructure for providing this advice has been seriously eroded. The disappearance of the congressional Office of Technology Assessment (OTA) created concerns about the scientific and technical advice available for the Congress, [2], [3] and the quality of advice provided to the Executive Branch has been called into question by a number of groups. [4] [5] There has been particular concern about the apparent decline in the influence of the office of the President's Advisor for Science and Technology and the absence of a clear replacement for the congressional Office of Technology Assessment.

The diversity and stature of critics expressing concern demand that the issue be taken seriously. Complaints are of two types: (i) policy decisions are being made without the benefit of serious, timely, unbiased analysis; and (ii) high quality analysis is available but ignored, manipulated, distorted, or suppressed.

No one can force the President or the Congress to pay attention to the advice they get, but objective analysis released to the public can at least inform the debate. On the other hand, advice is often most effective when it is provided in private where it can be easily included in the practical political calculus of real decision making.

Box A
Science and Policy

- How can we ensure that the U.S. retains leadership in nanotechnology? What research partnerships will be most effective?
- How can we best use new information technology to ensure that Americans are prepared for technology-based jobs, and retained efficiently?
- What technologies and policies are needed to ensure the security of communication and computer systems critical to the economy?
- Are we underinvesting infectious diseases?
- What kinds of stem cell research should be permitted?
- How can we guarantee the safety of biosecurity research?
- Can we streamline testing and commercialization of new drugs without compromising safety?
- What strategies are most effective for reducing greenhouse gas emissions?
- Can hydrogen make a significant impact on America's energy future?
- What are the security risks of increasing world dependence on nuclear power?
- How should DoD research and development priorities change to reflect post-cold-war threats?
- What can be done to detect movement of weapons of mass destruction and their components?
- What research is needed to detect a biological attack and respond effectively?
- What can be done to accelerate development and use of biometrics?

Decision makers are obviously not elected or appointed simply to follow the advice of technocrats. A technical analysis may well conclude that the best solution to transportation energy problems, without imposing politically favored technologies, is to impose a high tax on gasoline. This may well be true in a technical sense but a politically useful analysis should also review second and third-best options.

This report will not attempt to determine causes or motivations for the deterioration in the apparatus of science and technology advice but instead focus on practical steps to strengthen the existing system.

e began with the assumption that this should not be a theoretical discussion but one firmly rooted in the reality of national politics in 2004. While we have reviewed the literature on the subject, most of our conclusions are based on conversations with individuals from many political backgrounds who have been on the front lines trying to inject scientific and engineering concepts into the rough game of Washington policymaking. The proposals are designed to be specific and actionable.

We have elected to focus on what we believe to be the largest gap in the existing structure of science and technology advice: analysis that involves a major, controversial national policy problem and that requires an extensive, interdisciplinary effort to address fairly. Some examples of issues that have arisen are listed in Box A.

The work often requires inputs and insight from many different academic disciplines and different corporate and stakeholder groups. And many of the projects span the jurisdictions of several federal agencies or congressional committees.

This report, however, does *not* address many other important and related issues, such as the concerns within the scientific community and elsewhere about the appointments and function of scientific advisory committees at the agency level, meddling by non-scientific White House staff at the Council on Environmental Quality and the Office of Management and Budget, in scientific analyses and reports on climate change and other controversial issues, or growing morale issues in the ranks of career agency scientists at the Environmental Protection Agency (EPA), the National Institutes of Health (NIH) and others in the wake of political control of their research and travel. These areas require increased congressional oversight but are beyond the scope of this report.

1.1 Why Are Organizations Dedicated to Federal Science and Technology Advice Important?

No one with power in Washington suffers from a lack of advice. Congressional and executive offices are inundated by studies and opinion pieces on

every conceivable subject. Studies are available from any number of groups, some sponsored by corporations or advocacy groups, others by non-governmental organizations (NGOs) making a serious effort at earning a reputation for objectivity. The National Academy of Sciences (NAS) produces extensive and thoughtful reports at the rate of nearly one per day. A brief web search can turn out overwhelming volumes of information ranging from ideological "blogs" to scholarly articles. (Ironically, holders of scholarly articles typically demand payment making them harder to access and limiting their circulation.[6]) The difficulty, of course, is that nearly all of these organizations claim to represent "sound science."[7]

This surfeit of advice and information is one of the splendors of a free society. The diversity of sources is essential; the question at hand is whether it is sufficient. To be clear, the problem is not finding answers to specific, factual questions: the Congressional Research Service (CRS) provides Congress with excellent, timely reports. The problem arises in addressing questions that require more lengthy and complex analysis to support decisions – particularly when persistent uncertainties make firm technical conclusions impossible. Analysis is not likely to provide precise and unambiguous answers to questions such as the ones in Box A.

Concerns about gaps in the current apparatus of science and technology advice focus on analyses that:

- Can be delivered on a schedule tailored to the decision making process (this almost always means having a source of funding that will allow work to begin immediately upon receiving a request)
- Can be undertaken by highly talented people with extensive experience in conducting complex policy analysis and able to draw on expertise from specialists around the country
- Includes careful explanation of the uncertainties involved and how costs and benefits can be compared
- Reflects the best possible science and engineering information even when material from many different disciplines must be combined
- Explicitly weighs the interests and concerns of private organizations and interest groups with a stake in the outcome
- Develops practical policy alternatives based on relevant laws and regulations as well as presenting the political feasibility of different approaches
- Provides careful, unbiased evaluation of alternative strategies for achieving public goals such as strengthening national security or improving the environment, education, or health care

Provides results in a format that is relevant to the decision at hand and easily understandable by principals and staff who may lack technical expertise.

Box B Information Needs: Timeliness

Immediate information needs Government officials and their staffs often need information in a few hours to a few days to answer constituent questions, craft amendments, draft policy, or respond to currrent events. Experienced staff is effective in using a well-vetted list of names in their Rolodexes of contacts for quick answers. The Library of Congress and the Congressional Research Service have a long tradition of providing accurate and timely information for the Congress. CRS strives to provide information in as non-partisan a manner as possible, and all CRS reports are carefully reviewed to ensure accurate content. In recent years the Web has provided an extremely broad (but completely unfiltered) on-demand resource. As in all other areas, the utility of the Web depends entirely on the background (and nonsense filters) available to the user.

Short-term information needs (3-4 months) There are many instances when policymakers need information that goes beyond what is available in existing literature and may require several months to prepare. For example, congressional staff rarely have the luxury of staying abreast of the many diverse topics in annual appropriations bills. Congress needs a source of information that has been carefully vetted for accuracy and has appropriate policy review and recommendations. In many cases CRS can provide this information.

Long-term information needs (6-8 months) Most of the issues shown in Box A cannot be addressed without a significant investment of time and resources. Since OTA was closed, the primary source for such large, longer term studies has been the National Academies. Large, longer term studies are often needed in drafting new, major legislation, where the members of Congress need a comprehensive understanding of the issues.

Clearly, a number of organizations, most prominently the National Academy of Sciences, provide work that satisfies many of these requirements. A key concern is that the Academies are not designed to meet all of these criteria.

1.2 The Clients for Science and Technology Advice

A key requirement for any organization providing science and technology advice is whether it can effectively fit into the decision making process of the organization relying on its products. Congressional staffs, White House offices, and other key groups have unique requirements, unique schedules, and unique styles that often require considerable experience to understand. There are technical aspects to building effective relationships between analysts and their clients such as understanding schedules and the ebb and flow of events, the practical range of options that can be considered, and how best to communicate with key offices. Sometimes the most difficult part of the relationship, however, comes down to trust. Do the requestors feel that the analysts are a part of their team? Building trust of this kind is neither fast nor easy.

There is however, an inherent tension between the goal of building trust on the part of government clients and the commitment of most scientists and scientific organizations to engage in open and public dialogue by raising the pain threshold when those same government policymakers ignore sound science. If the organization is completely trusted as a confidential advisor and its leadership and staff are welcome even in the most politically sensitive discussions, then it may not be able to provide either the appearance—or the reality—of objectivity. On the other hand, complete, timely public release of analytical results is critical for earning the public's trust, but this can put the organization at odds with a policy-maker's political agenda.

The discussion that follows will explore three distinct clients for science and technology analysis:

1. Private advice for the President and White House staff
2. Analysis designed for members of Congress, congressional committees, and their staff
3. Publicly available studies

A separate section will review options for ensuring that the basic information needed for conducting independent reviews of policy issues is fully and freely available.

1.3 Methodology

We interviewed a variety of individuals with broad expertise in science policy. We are grateful for the insight and suggestions we received. To frame our discussions, we sent each individual a copy of our questionnaire (included as Appendix I) and then interviewed them. These interviews were not designed to answer the questions exactly, but rather to have a free-flowing discussion of the issues raised in the questionnaire and to determine what needs were most felt. It was clear from our interviews that many people have given this subject a great deal of thought.

1.4 Organization of the Report

Chapter 2 examines two specific decisions that demonstrate how our proposals would affect the process. Chapter 3 examines the current state of science advice by exploring what type of advice is needed and what organizations currently exist to provide it. Chapter 4 proposes changes to the presidential advisory process, Chapter 5 to the congressional advisory process, and Chapter 6 to scientific openness and access to information.

The authors gratefully acknowledge the time, effort, and insight of the individuals whose advice and review comments made this study possible.

SECTION 2

Case Studies

Before exploring options for strengthening federal science and technology advice it is worth taking a brief look at how the existing system works. The two cases discussed below were selected because they highlight a range of specific defects in the way complex scientific and technical decisions are managed that might be subject to remedy with a strengthened process. They also create a challenge for all proposals for reform: if a given proposal were in effect would it have prevented the difficulties encountered?

2.1 Methyl Tertiary Butyl Ether (MTBE)

The Clean Air Act Amendments of 1990 provided strong incentives for petroleum companies to use Methyl Tertiary Butyl Ether (MTBE) as a gasoline additive to reduce ozone in areas of the country that had failed to meet the original goals of the Clean Air Act [8]. The additive was already being used widely to provide the anti-knock octane enhancement once provided by lead. By the year 2000, MBTE was in more than a quarter of all gasoline sold in the United States. But in early 1999, doubts were being raised about the environmental benefits of the additive. [9] After learning that the chemical was a carcinogen and rapidly polluting ground water, the Governor of California directed that MTBE be banned as soon as possible with a phaseout completed December 31, 2003. At least 16 other states have taken similar steps. [10] Hundreds of millions of dollars in lawsuits are outstanding and at least one MTBE supplier has filed for bankruptcy. [11]

Even with the wisdom of hindsight, there is great controversy over exactly

what went wrong. If anything, the apparatus of science and technology advice was stronger during the period when key decisions about MTBE were being made than they are today. OTA and OSTP were both active. The White House and Congress were under the control of different parties during much of the period in question, allowing for tough and thorough public airing of differences. The National Academies were available if asked. It is appropriate to examine our proposals to determine if they would have improved this decision making process and reduced the risk of groundwater contamination by MTBE.

The National Science and Technology Council (NSTC) was asked to evaluate MTBE in 1997 in a report that should have raised warning signals. [12] The council concluded that EPA models had overestimated the air quality benefits by at least a factor of two and that the chemical had contaminated groundwater in nearly half of the states surveyed. A Blue Ribbon panel commissioned in part because of this report advised EPA in 1999 to "reduce the use of MTBE substantially (with some members supporting its complete phase out), and action by Congress to clarify federal and state authority to regulate and/or eliminate the use of gasoline additives that threaten drinking water supplies." [13] EPA prepared an advance notice of proposed rulemaking stating that the agency had concluded that continuation of existing regulations is "…likely to continue to result in the widespread release of MTBE into the environment; MTBE is difficult to contain and prevent from reaching sources of drinking water once it is released into the environment; and it has the potential to render drinking water unpotable at low levels and unsafe at higher levels." It asked for comments, suggesting that "the outcome of this rulemaking could be a total ban on the use of MTBE as a gasoline additive. Consistent with TSCA section 6, EPA will carefully consider regulatory alternatives to a ban." [14] A proposed rule drafted in response to comments was blocked by the Office of Management and Budget (OMB) early in the Bush administration never to see the light of day.

In his thoughtful article rehearsing the history of the MTBE debacle, University of Texas Law Professor Thomas McGarity points out that the problem resulted from the cumulative effect of five separate decisions made over a period of 30 years. [15] Each provided an opportunity for stronger science and technology advice.

1. The 1970 Clean Air Act provisions that led to a phaseout of lead in

gasoline without a clear set of criteria for the attributes of substitutes that could replace the anti-knock properties of lead. [16]

2. The 1977 Amendments to the Clean Air Act requiring gasoline additives that did not damage catalysts and created a waiver process that allowed EPA to approve MTBE in 1979.
3. Failure to adequately impose the requirements of the Toxic Substances Control Act during the mid 1980s in part because of industry pressure to limit what it considered unnecessary data gathering (ignoring EPA staff advice that both air and water quality impacts should be considered).
4. Lax regulation of underground storage tank systems that failed to consider the impact that MTBE would have on the rate at which contamination could spread to groundwater.
5. 1990 amendments to the Clean Air Act—driven in part by the combined interests of corn producers and petroleum companies wishing to head off major alternatives to gasoline–all but required MTBE and ethanol-based Ethyl Tertiary Butyl Ether (ETBE) to reduce ozone in heavily polluted areas but failed to set clear criteria for water quality or other potentially adverse impacts.

The MTBE debate has helped paralyze passage of new energy policy. Bills acceptable to the Senate would gradually phase out MTBE but legislation passed by the House would greatly delay the phase-out, override state efforts to ban MTBE at an early date, and hold MTBE manufacturers safe from claims filed by anyone claiming to be injured by the material. [17] The debate has been further inflamed by the fact that major MTBE producers are in the district of a key member of the House leadership.

What Could the Congress Have Done Better?

With the wisdom of hindsight, it is clear that in its efforts to resolve air quality problems, the Congress failed to recognize that it was inadvertently creating a recipe for a water quality disaster. There was a clear excuse for Congress' failure to provide for specific legislation about MTBE since little was known about the subject during most of the early decision making period. Indeed, its heath effects are still poorly characterized. But Congress could have done much

more to create a framework for collecting needed information and providing for a comprehensive assessment of expected and unexpected consequences. For example, Congress did not:

- Clearly establish performance objectives for all potential positive and negative impacts of fuel additives (including the risks to both air and water)
- Require the collection of the empirical data needed to undertake needed impact studies (instead of relying heavily on industry data)
- Support independent analysis of key tradeoffs (instead of relying on privately supported environmental groups, industry organizations, or administration analysis)

While the Congress clearly can not be expected to delve into the complex impacts of the thousands of new chemicals introduced into the economy, it undoubtedly should have paid closer attention to substances that were (a) required by legislation, and (b) entering the economy in vast quantities as a part of the more than 150-billion-gallon per year U.S. gasoline market. [18]

While OTA was not in place when the original decision was made to phase out lead in fuel, it was functioning throughout most of the history of the MTBE debacle. The two-volume OTA study on "Protecting the Nation's Groundwater from Contamination" published in 1984 [19] mentions gasoline leakage only in passing and says nothing whatsoever about MTBE. The OTA study on urban ozone and the Clean Air Act in 1988 also mentions MTBE only in passing and did not focus on the issues that would lead to the debacle a decade later. [20]

While these defects may result in part from a lack of imagination on the part of OTA analysts and their advisors, it is clear that a good part of the problem was that OTA was simply not asked the right questions at the right time. This resulted in part from the chronic congressional tendency to put off difficult decisions until forced to act, making it difficult to launch a major study far enough in advance to affect the decision. It may also have resulted from the failure of OTA to gain the trust needed for the key congressional leaders to assign it such a controversial and politically sensitive topic. It is possible that an OTA director with greater freedom to begin self-initiated projects would have had the foresight to launch such studies.

Having known for some time that it would likely enact a dramatic change in the nation's massive gasoline infrastructure, the Congress could have asked

OTA (or an equivalent organization in GAO) to explore the costs and benefits of different approaches. Instead of deferring all major decision-making to EPA and other federal agencies—all parts of the Executive Branch, the Congress could have commissioned a strategic study to explore fuels and engine designs that could achieve air quality goals at the lowest cost.

OTA analysts would not have had better data than was available to EPA – particularly when no good data existed – and might not have had better luck in forcing industry to volunteer information that might have been prejudicial to their economic interests. The health effects of MBTE – particularly the effects of ingesting the material – are still poorly understood. While industry began to realize the enormous risks presented by leaking underground gasoline storage tanks during the early 1980s, they were not particularly forthcoming about the evidence. A trusted and respected congressional organization able to reach out to industry, environmentalists, and other interested groups could, at a minimum, have helped Congress formulate a more comprehensive review process than the one actually undertaken by EPA. It would have provided the Congress a way to survey potential unintended consequences of new fuel types and ask the right questions. This congressional organization could have helped craft a set of directions to EPA about application of the "precautionary principle" – how best to assess the comparative dangers of known hazards such as lead – with the poorly understood hazards of materials such as MTBE. During the 30 years the issue was debated, the congressional group could have developed staff capabilities and links to university and corporate research groups that would also have proven useful in addressing many of the short-turn-around issues that inevitably accompany the actual construction of legislation. They could also have helped make congressional oversight more effective by providing a way to review whether the criteria established in legislation had in fact been met by EPA reviews.

The Congress has shown a remarkable lack of curiosity about MTBE legislation now under consideration in the energy bill. To our knowledge, no congressional agency has been tasked with reviewing costs and benefits and the hearing record is, at best, cursory.

Could the Administration Have Done Better?

The EPA review of MTBE has been criticized on a number of grounds that are obvious in retrospect. Its rules on underground storage tanks failed to reflect the fact that MTBE moves into ground water much faster than gasoline and lasts much longer. Its reviews of the health effects of MTBE focused narrowly on inhalation and possible absorption through the skin but failed to include an assessment of the impact of drinking contaminated water – in spite of recommendations by its own ad hoc MTBE toxicology group. The EPA relied much too heavily on industry data and did not require industry to perform enough tests acting under existing authority of the Toxic Substances Control Act. Finally, the EPA relied too heavily on privately funded environmental groups to provide feedback and critiques to industry analysis at a time when even the best funded groups were overwhelmed with changing environmental rules. [21]

There is, however, no evidence that EPA violated any law or exceeded any discretionary authority granted them by Congress. The Congress, in effect, deferred not just the decision making but, in many cases, the ground rules for deciding which questions were important to EPA bureaucrats. There is no doubt that these bureaucrats were influenced by changes in the political priorities of the President in office at the time; under the Reagan administration there was increased pressure on the agency to avoid regulations costly to industry. In the end, of course, the costs to everyone involved were much higher than they might have been. The administration needed:

- A strong science and technology advisor, with an ability to reach out to a large community of academic and industry scientists who could have sounded an early warning to the President that a costly debacle might be in the making.
- A strong interagency team under the NSTC that might have brought new insight from the Departments of Energy, Transportation, Agriculture, and OMB to bear on decisions being made exclusively by EPA.
- A strong analytical organization, with some independence, that could have self-initiated a study of options for reducing emissions from vehicles. The ability to contract with the National Academies would have further strengthened the process. At a minimum, such a review could have supplemented the independent reviews attempted by privately

funded environmental and other organizations to gain a fresh perspective on decisions being made by EPA. They could certainly have pointed to deficiencies in the data and urged EPA to supplement analysis in key areas.

The proposed EPA rule on MTBE has been stalled in OMB for several years without explanation. If both the President and the Congress agree, there is no good way to force the issue. An advisory organization, such as the National Science Board, with members whose terms spanned several administrations might have been able to provide greater continuity and made it more difficult to avoid public scrutiny of such decisions.

2.2 Stem Cells

When a difficult issue of science policy ends up in political attack ads during a presidential campaign and diatribes in political conventions, something has gone badly wrong. The stem cell decision-making process has failed thus far in part because one party to the debate has been able to all but demolish established review procedures. This created a situation where neither the Congress nor the administration was able to make effective use of objective advice or have the advantage of recommendations developed in neutral settings where difficult technical and ethical issues could be debated and resolved. In a letter to President Bush in 2002, former President Ford complained about the breakdown of the process. [22] He pointed out that equally difficult, and potentially equally explosive decisions involving emerging recombinant DNA technology had been made during his administration after a careful review and the implementation of regulatory procedures. The non-partisan institutions recommended in our report could not, and should not, have prevented the Congress or the President from taking actions they felt represented the will of their constituents. They could, however, greatly have increased the quality of the debate and prevented many of the technical errors that have vexed the stem cell debate.

As with the MTBE case, there is plenty of blame to go around. Advances in cell biology have been rapid and spectacular, raising legitimate fears that the pace of science will outstrip our ability to make sound judgments about how to define the limits of what should be attempted. Both proponents and opponents of stem cell research can be found using the argument of "sound science" to mask

what are, in the end, basic differences in values. Effective management of these issues doesn't require masking the difference in values, but it does require an effective mechanism for sorting fact from values.

A brief history

Research on stem cells in mice began in 1981, but the work broke into the headlines in 1996 [23] when researchers in Scotland produced Dolly, a cloned sheep. Dolly was created when the nuclear material of a single sheep egg was removed and replaced with the nucleus of an adult cell from a different sheep (Somatic Cell Nuclear Transfer or SCNT). The resulting embryo was implanted in a sheep's uterus and was born as a genetic duplicate of the animal supplying the adult DNA. This created a worldwide sensation. The Congress had already passed a rider to the Health and Human Services appropriations bill for FY96 (introduced during the fall of 1995) stating that:

> None of the funds made available in this Act may be used for
>
> (1) the creation of a human embryo or embryos for research purposes; or
>
> (2) research in which a human embryo or embryos are destroyed, discarded, or knowingly subjected to risk of injury or death greater than that allowed for research on fetuses in *utero* under 45 CFR 46.208(a)(2) and 42 U.S.C. 289g(b).
>
> For purposes of this section, the phrase 'human embryo or embryos' shall include any organism, not protected as a human subject under 45 CFR 46 as of the date of enactment of this Act, that is derived by fertilization, parthenogenesis, cloning, or any other means from one or more human gametes. [25]

This rider is commonly known as the "Dickey amendment" after former Congressman Jay Dickey (R-AK), the original author. No hearings were held on the amendment and there was virtually no debate. The rider provides no equivalent prohibition on use of tissues from human fetuses. [26]

The debate intensified in 1998 when a research team at the University of Wisconsin created a line of human stem cells from human embryos created by in vitro fertilization (i.e., joining sperm and egg outside of a human body), and a Johns Hopkins University team identified viable stem cells in 5- to 9-week-

old fetuses. In both cases the embryos were donated by individuals giving informed consent.

This startling success made the issue of human stem cell research an immediate, not just a theoretical, issue. The Clinton administration launched an elaborate process to review options. Following the model established under President Ford during the recombinant DNA debate, Clinton asked the recently convened National Bioethics Advisory Commission (NBAC) to review the issue and to report within 90 days on the ethical and legal issues that surrounded the potential cloning of human beings. [27] They produced a detailed set of recommendations that, among other things, recommended that federal agencies be prevented from using the method of transferring nuclear material from adult cells to embryos (SCNT) that had been used to produce Dolly. [28] This was a difficult decision since the SCNT method provided a tool that might be important for stem cell treatment. The risk of a patient rejecting stem cell tissue might be reduced significantly if the cells contained the patient's own DNA and were, in effect, healthy copies of the patient's own cells.

In parallel with the National Bioethics Advisory Council, the director of NIH launched his own review beginning in 1999. Following extensive NIH reviews, proposed guidelines were published in the Federal Register in December of 1999. Over 50,000 comments were received from the public. The final review was published in February 2000. [29] Because of the Dickey amendment, the guidelines prohibited use of federal funds for creating embryos by any means for research, specifically including the SCNT method. It did allow federal researchers to use stem cells derived from embryos created by fertility clinics that were in excess of the needs of the patients and when the patients gave informed consent. The NIH also established the Human Pluirpotent Stem Cell Review Group to ensure that the regulations were properly followed by NIH and the groups it funds. The group never met.

The election of George W. Bush in 2000 changed the landscape fundamentally. The NIH was asked to review stem cell policy and published a comprehensive report reviewing the potential of the technology. It concluded that:

> During the next several years, it will be important to compare embryonic stem cells and adult stem cells in terms of their ability to proliferate, differentiate, survive and function after transplant, and avoid immune rejection.…

For researchers and patients, there are many practical questions about stem cells that cannot yet be answered. How long will it take to develop therapies for Parkinson's Disease and diabetes with and without human pluripotent stem cells? Can the full range of new therapeutic approaches be developed using only adult stem cells? How many different sources of stem cells will be needed to generate the best treatments in the shortest period of time?

Predicting the future of stem cell applications is impossible, particularly given the very early stage of the science of stem cell biology. To date, it is impossible to predict which stem cells—those derived from the embryo, the fetus, or the adult—or which methods for manipulating the cells, will best meet the needs of basic research and clinical applications. The answers clearly lie in conducting more research. [30]

The 2001 NIH document made no policy recommendations about how this complex research task should be achieved. This ambiguity was resolved in August 2001 when President Bush gave a national speech saying that the administration would permit research on stem cells but only on "…more than 60 genetically diverse stem cell lines that already exist. They were created from embryos that have already been destroyed ...where the life and death decision has already been made." He observed that, "Leading scientists tell me research on these 60 lines has great promise that could lead to breakthrough therapies and cures." [31]

The decision did not place any restrictions on human embryonic stem cell research conducted by corporations or private foundations. Nor did it place any restrictions on the fertility clinics that are the source of most embryos for stem cell derivation. Instead it limited federally funded research to that conducted using the existing lines. There are no federal regulations guiding the destruction of embryos in fertility clinics. The rule allows clinics to destroy unneeded embryos but does not allow them to be used to produce stem cells for federal research.

The public record provides few clues as to how this policy was created. There is no evidence that the review followed any of the precedents for considering bioethical decisions – a failure that disturbed former President Ford. There is no evidence that public comments were solicited. In fact, the regulations created after the lengthy review process under the Clinton administration were discarded without comment and the Human Pluripotent Stem Cell Re-

view Group never convened. The National Bioethics Advisory Council last met in May 2001, and according to the transcripts of that meeting, did not comment on stem cell policy and had not since 1999. [32] The next NBAC meeting was scheduled to occur in September 2001, but was cancelled due to the 9/11 terrorist attacks. The NBAC subsequently disbanded in October 2001 when its charter expired and was replaced with the entirely new President's Council on Bioethics announced in the President's August speech. [33] But of course the Council had not met before the decision was announced.

The price paid for the lack of a public process and open review was immediately apparent. The research community was understandably anxious to learn which cell lines were actually available for research. The list was challenged as soon as it was issued and considerable confusion remains. Upon careful examination, most of the 60 stem cell lines that "leading scientists" had told the President were available, in fact were not. The NIH once suggested that as many as 78 lines could be used but later discovered that only 21 lines are available. [34] Many were held by private companies or by research groups outside the United States. All of the permitted lines were developed using techniques that contaminated the human cells with mouse tissue, making them completely unsuitable for many critical experiments. There was also concern that existing stem cell lines could not be sustained indefinitely since mutations and other problems would inevitably create problems. The small number of lines, the inflexibility of the rule, and the small amount of funding available for embryonic stem cell research. [35] has led to a dramatic slowing of progress in this area of research. Researchers in Europe and Asia have moved rapidly to fill the void. The State of California will vote in November on a $3 billion state initiative to fund stem cell research.

The unexpected restrictions and the continuing confusion over which stem cell lines are useful has caused great consternation and disruption in U.S. stem cell research and led directly to the current scientific controversy. The impenetrable decision making process has not helped the ethical controversy.

What Could the Congress Have Done Better?

It could be expected that the inadequacies of the administration's review process could be countered by an independent assessment by the Congress. However, the Congress did not make a serious effort to acquire unbiased information about the stem cell controversy. Neither the House nor the Senate made a serious attempt to review either the substance of the administration's August decision on stem cells or the process leading to it. In fact, other than a few desultory hearings, there is no evidence that the Congress attempted to inform itself on the complex technical issues involved in stem cells.

The Dickey amendment has passed every year since 1996 without hearings and in the absence of a review by any congressional or external group. In the 108th Congress the House passed H.R. 534 that banned cloning for research for "therapeutic purposes," in effect banning SCNT research permanently. In an effort to garner support for members concerned by the indefinite duration of the ban, the bill calls for the Government Accountability Office (GAO) (formerly the General Accounting Office), in consultation with the National Academy of Sciences, to assess the bill's impacts and any need for modification of the permanent ban. In effect it called for a decision with the review to follow. No action was taken since the Senate failed to act on the bill.

No hearings were held on H.R. 534. [36] Numerous other bills on stem cell research have been introduced in the House and Senate during the past few years but few hearings have been held. These include a hearing by the Criminal Justice Subcommittee of the House Government Reform Committee on July 17, 2001. This hearing had seven witnesses of whom only three were medical researchers who clearly did not represent the spectrum of opinions in the medical research community. Two of these researchers were adamantly opposed to embryonic stem cell research.

The Senate has held five hearings on stem cells in the past five years. One, by the Science, Technology, and Space Subcommittee of the Commerce, Science and Transportation Committee in June 2003 had nine witnesses of which six were experts in the field. The Labor HHS (Health and Human Services) Subcommittee of the Senate Appropriations Committee held hearings on July 18, 2001, September 25, 2002, and May 22, 2003. A majority of the witnesses were experts in the field and panels were reasonably balanced and non-ideological.

It is important to realize the implications of these hearings. Instead of the logical places to hold these hearings, namely, in the Senate, the Health, Education, Labor & Pensions Committee or the Commerce, Science and Transportation Committee and, in the House, the Energy and Commerce Committee or the Science Committee, the bulk of the hearings were held in the Senate Appropriations Committee and the House Government Reform Committee. While some information is getting in to Congress, it is not reaching as many, or perhaps the correct, members as it should. Unfortunately, this seems to be indicative of a lack of a desire to know and a use of science to fit a policy.

In the end, however, neither the House nor the Senate asked the National Academies, the GAO or any other major analytical organization to undertake a technical review of the issue. The National Academies conducted a review of the President Bush's decision only after the Administration announced it. [37] The Academy's reviews did not comment on the specifics of the Administration's stem cell policies, but the authors were clearly dismayed at the result. Their report largely followed the conclusions of the Clinton administration's own NIH report in 2000, arguing strongly that progress in stem cell research required supporting diverse approaches and many different sources of stem cell cultures.

OTA was quite prescient in recognizing the potential of stem cell research. Early warning of the complex matrix of benefits and risks of new technologies was one of its founding missions. While the organization was abolished before cloning and stem cell issues hit the headlines, OTA assessed the potential use of stem cells to repair spinal cord and other injuries—and the ethical issues involved—in 1990. [38] Another report in 1988 examined the ethical issues involved with using excess embryos for research. [39]

OTA (or a new organization within GAO) could clearly have been commissioned to lay out the complex technical and ethical issues raised by rapid advances in stem cell research. This would have required flexible access to experts from many different backgrounds.

Could the Administration have done better?

President Ford and other administrations managed to create a process where all parties to a difficult bioethical decision felt that they were fairly heard even

if they did not agree with the details of the final decision. This was plainly not the case in the Bush administration's stem cell decision. The process was not transparent, it did not involve external advisors such as the National Academies, and it is not even clear what if any role was played by OSTP.

It is interesting to note that other nations have followed the path the U.S. helped pioneer in handling ethical issues in biomedical research and took great care to create respected review groups. In the United Kingdom, for example, the Human Fertilization and Embryology Authority (HFEA), established in 1991, has the authority to review policy on stem cell research and "to license and monitor clinics that carry out in vitro fertilization, donor insemination and human embryo research. The HFEA also regulates the storage of gametes (sperm and eggs) and embryos." [40] The HFE Act requires that the Chair, Deputy Chair and at least half of the HFEA members be "neither doctors nor scientists involved in human embryo research or providing infertility treatment." It further states that "HFEA Members bring to the HFEA a broad range of expertise, from medicine to law and religion to philosophy."

The fact that it was possible for the Bush administration to ignore precedent and base a major science policy decision on a secret review lacking any sort of external review or comment points to a clear defect in the public process. The complete turnover of advisory processes—with the key decision made during the hiatus between advisory groups—underscores the need for scientific and engineering staff and advisory groups with continuity between administrations. Analysis conducted by groups with the kind of independence enjoyed by the National Science Board could be relied on to produce objective work uninterrupted by changes of administration. An executive agency capable of sponsoring long-term studies with the National Academies or other groups could also ensure that changes in administration did not translate into a complete loss of institutional memory. Their work would certainly make it difficult for an administration of any ideological persuasion to avoid informed public and congressional scrutiny.

SECTION 3

The Current State of Science Advice

Historian Gregg Herken argues that, "The history of science advising from the discovery of atomic fission to the end of the Cold War suggests that the questions 'Who advises?' is hardly less important than that of 'Who governs?' [41] The critical contributions that radar, sonar, the proximity fuse, secure communications, and nuclear weapons played in the World War II made clear to everyone the importance of scientific and technological developments and, after the war, gave scientists public recognition and a public voice. Thus, at least since the post-World War II era, policy-makers have recognized the need for scientific advice. But designing effective institutions has proven to be extremely difficult. In spite of widespread recognition of the need, science and engineering advice outside of the Department of Defense (DoD) remains in a state of considerable disarray. A variety of experiments, described below, have been tried by the Congress and the President but none has been entirely successful. Any recommendations about how to remedy the current system should take into account this vexed history.

3.1 Advice to the President

The Executive Branch of the federal government receives science advice in many different ways. Many agencies have their own, in-house science shops, and the President receives advice from the OSTP and the President's Council on Science and Technology (CST).

President Dwight Eisenhower created the President's Science Advisory Committee (PSAC) in 1956 to provide advice on a wide range of scientific and

technical matters. Presidents Eisenhower, Kennedy, Johnson and Nixon utilized PSAC for a variety of tasks. In January 1973, President Richard Nixon fired his science advisor and disbanded the PSAC because of political disagreements. This led Congress in 1976 to create the current Office of Science and Technology Policy, in effect forcing the President to have some form of formalized science advice. The statute also authorized an advisory group, now known as the President's Council of Advisors on Science and Technology (PCAST).

The President's advisors are selected by him; the relationship between a President and his advisors is entirely up to the President. A potentially similar advisor, the National Security Advisor (NSA), has far greater influence because there has never been doubt that Presidents need advice on national security affairs. Science advisors are, however, much more easily ignored, marginalized, or forced to focus on a narrow range of issues. This being the case, we will explore the current mechanisms through which the President receives formal science advice and propose several changes to increase the likelihood that science is a consistent part of the decision making process.

3.1.1 Office of Science and Technology Policy

The Act that created the Office of Science and Technology Policy (Appendix II) is remarkable for its brevity. Essentially, the Executive Office of the President (EOP) is required to include a director of the OSTP and not more than four associate directors. All of these positions are confirmed by the Senate. The primary role of the director is

> to provide, within the Executive Office of the President, advice on the scientific, engineering, and technological aspects of issues that require attention at the highest levels of Government. [42]

The director is also tasked to

> advise the President of scientific and technological considerations involved in areas of national concern including, but not limited to, the economy, national security, health, foreign relations, the environment, and the technological recovery and use of resources; [43]

and to

> advise the President on scientific and technological consideration with regard to Federal budgets, assist the Office of Management and Budget with an annual review and analysis of funding proposed for research and development in budgets of all Federal agencies, and aid the Office of Management and Budget and the agencies throughout the budget development process. [44]

The remainder of the statute requires OSTP to study trends in science, initiate studies, and to report to Congress and the President on annual accomplishments. It has no specific budget authority and no ability to task other parts of the federal government, and the director has no statutory relationship with or access to the President. Its position is further weakened by the widespread misperception that the office is partly a lobby for research funding rather than being an integral part of a White House decision making team.

In practice, the organization has been used in various roles depending primarily on the personal relationship between the President and his OSTP director. For example, some accused President Reagan's OSTP director, George Keyworth, of subjugating his office to DoD and cheerleading for the administration's defense policies, especially the Strategic Defense Initiative (SDI). [45] This led, as well, to a poor relationship with some elements of the scientific community. [46]

The office fared much better under President George H. W. Bush. His director of OSTP, D. Allan Bromley, was Assistant to the President [47] and also a member of the President's Cabinet, the National Security Council (NSC), the Domestic Policy Council (DPC), and the National Economic Council (NEC). He was able to meet with the President on a regular basis and was heavily involved in a variety of decisions. The President invited the entire PCAST to spend a weekend with him at Camp David for their first meeting. [48]

Under President Clinton, John Gibbons (1992-1998) and Neal Lane (1998-2001) were both Assistants to the President for Science and Technology as well as Senate-confirmed directors of OSTP. Gibbons was identified along with proposed Cabinet members before Clinton's inauguration and was confirmed quickly, allowing him to begin work during the critical months of a new administration. The Clinton OSTP assigned the four Senate-confirmed associate director positions to Science, Technology, Environment, and National Security.

In the early years of the Clinton administration, neither Gibbons nor Lane had the direct access to the President enjoyed by Bromley. They instead benefited from the intense interest of Vice President Gore who was able to intervene effectively in budgetary and other policy areas. However, once John Podesta became White House Chief of Staff in 1998, direct access to the President increased for Lane. The Associate Director for National Security retained a joint appointment to the National Security Council. These relationships allowed OSTP and PCAST to be influential in areas ranging from control of nuclear material in the former Soviet Union to technologies for addressing global climate change. The organization lacked the formal access and influence of some other White House offices but was often influential because of informal relationships possible because of the access and collegiality afforded by their presence in the Old Executive Office building.

Under President George W. Bush, we see a dramatically changed relationship. While it is difficult to measure the influence of OSTP in any precise way, several recent developments certainly suggest it has declined under George W. Bush:

- The Office of Assistant to the President for Science and Technology was abolished.
- John Marburger was appointed as OSTP director June 25, 2001. His nomination was sent to the Senate on September 21, 2001, and he was confirmed October 23, 2001. The two associate directors were not confirmed by the Senate until August 1, 2002.
- The OSTP legislation authorizes four Senate-confirmed associate directors. All previous OSTP directors have kept these positions filled with "acting associate directors" holding the jobs during vacancies. Under the current administration, OSTP has elected to fill only two of these positions. [49]
- OSTP was removed from Old Executive Office Building (the Eisenhower Building), which houses the NSC, the DPC, the NEC, senior OMB officials, the Vice President's staff, and other key White House staff, and installed in rented quarters several blocks down Pennsylvania Avenue. The office has recently been moved to the New Executive Office building, which houses the less senior OMB staff.
- President Bush's decision to return U.S. astronauts to the Moon and send astronauts to Mars was reached by "high-level, tightly held discus-

sion[s] led by the National Security Council," [50] rather than the OSTP, even though there is an Assistant Director for Space Aeronautics within OSTP. In the current administration, this makes some sense: the NSC has a larger staff, the NSA has better access to the President, and the NSC staff has better access to the rest of the Executive Office of the President than does the OSTP.

- The 2003 awards for Science, Mathematics, and Engineering Mentoring were not delivered to the recipients until May of 2004. [51]

Under President George W. Bush, OSTP has devoted a large fraction of its time and energy to homeland security. As one indication, Dr. Marburger has spent a substantial amount time on terrorism and homeland security during 19 of the 23 times he has testified to Congress; eight of those hearings were specifically related to terrorism and homeland security. In addition, of the three reports released by OSTP during 2004, one dealt with agro-terrorism, one responded to the the Union of Concerned Scientists (UCS) report (see footnote 5), and in the third, *Bush Administration Science & Technology Accomplishments: Promoting Innovation for a Stronger, Safer America,* over 25 percent is related to homeland security. [52]

3.1.2 The National Science and Technology Council

In 1993, President Clinton created the National Science and Technology Council (NSTC) by Executive Order (Appendix V). The NSTC is a cabinet-level council that "is the principal means for the President to coordinate science and technology policies across the Federal Government. NSTC acts as a 'virtual' agency for science and technology to coordinate the diverse parts of the federal research and development (R&D) enterprise." [53] On paper it looks similar in structure to the NSC, the NEC, and the DPC, but its influence is tiny in comparison. For example, the NSTC, like the NSC, has the authority to develop Presidential Decision Memoranda, which could lead to issuing a Memorandum, thereby mimicking the powerful decision making tools of the NSC, but this authority is seldom if ever used. Also, while the President is the nominal chair of the NSTC, to our knowledge this President has never attended a meeting. The chairmanship goes to the Vice President when the President is absent and the President's science advisor when the Vice President is absent, again a structure similar to the NSC,[54] except the President does not now have a sci-

ence advisor. (Traditionally, of course, the director of OSTP has also served as the President's science advisor but he is not now so designated and the Executive Order specifies the advisor, not the director.)

At present the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA), which lack seats in the Cabinet rely most heavily on the President's science advisor and the NSTC process to represent their interests. The NSTC can also provide increased influence for science and technology programs that may be such small parts of large agencies that their interests seldom rise to the attention of the Cabinet-level managers. This is certainly true for departments and agencies like Transportation, Agriculture, or Commerce and can even be true for organizations like the Departments of Energy and Defense where research, while important to the department, is a small slice of the total budget.

There are several explanations for NSTC's weakness, the principal one being that most agencies and departments have far better ways of influencing the policy process than working through NSTC and its effective chair, the President's science advisor. Departments have influence directly through the Cabinet or through White House offices with far better access to the President. Again, the contrast with the NSC is stark. The Cabinet members on the NSC recognize that going through the NSA is a powerful way to influence the President. Indeed, nine times out of ten, when the term "National Security Council" is used in discussions in Washington, what is meant is not really the NSC but the NSA and her staff. The NSA and her staff have a long and respected tradition of delivering key questions to the interagency NSC, tasking the participating agencies with often complex analysis, developing a crisp set of carefully evaluated alternatives for a Presidential decision, and responding to these decisions. Nothing of the sort has developed for the science advisor and the NSTC. By virtue of being an Assistant to the President, the NSA has access to the President and to other senior members of the administration. The NSA also has the ability to appoint Special Assistants to the President for a variety of tasks. Further, the NSA is considered Cabinet Rank and is included in many meetings not accessible to other, lower-level advisors, while the science advisor has been included in Cabinet meetings in some administrations and not in others.

The NSC also has an enormous advantage in having a large staff of experts,

most of whom are not replaced when the administration changes. The NSC staff grew from 10 people in the early 1960s to over 200 people under President Clinton, shrinking to over 100 in early 2004. The group includes over 70 staff dedicated solely to policy; the rest cover a variety of issues including managing the President's daily foreign policy activities.[55] The large staff allows substantial in-house experience on a broad array of topics and critical institutional memory. Just as the NSC is supported by the NSA's staff, the NSTC is supported by the staff of OSTP. Over the last few administrations it has developed that nearly all the OSTP professional staff turns over with a change of administrations. Only two OSTP professional staff members survived the transition from the Clinton administration to the Bush administration; both began their service under President George H.W. Bush. The reasons for this high turnover, compared to, say, the NSA's staff, are not entirely clear, but it comes with a huge cost in institutional expertise. [56]

Part of NSTC's apparent weakness comes from the nature of its "product." One could say the NSC's "product" is security. Science policy has two quite different sides: One is the government's policy toward science, for example, how to divvy up research funds, and the other is getting good science into government policies that include science but are not primarily scientific. Science makes up only a small part of any department's budget, so policy for science is typically not highly visible. And when getting science into public policy, the "product" often ends up not being a science policy product, but an agriculture product, or an energy product, and so forth, even if science helped shape the policy. Thus, the science policy staff becomes supporting to the final effort, rather than as central as the NSA's staff would be.

Nevertheless, there are situations where the NSTC's input could be critical. It proves monumentally difficult to develop a balanced R&D budget given existing OMB review processes. And it is difficult to craft any major initiative such as automobile or information technology research that requires collaboration by several agencies. NSTC is the forum for organizing such efforts. (Unfortunately, even when agencies are cooperative, fragmented congressional oversight creates enormous difficulties. Carefully laid plans to have the Departments of Transportation, Defense, and Energy collaborate on a safe, efficient new vehicle went awry when congressional appropriators failed to coordinate.)

The NSTC's attempts to develop collaborative projects has worked effec-

tively only when a group of agencies believe that they can achieve more from working together than working independently. Most agencies and Cabinet officials are justifiably skeptical of multi-agency projects if only because budget battles often seem to be zero-sum games. And they are keenly interested in getting credit for innovative programs. [57] As a result, effective collaborations are rare. The NSC avoids many of these problems because it clearly acts as the President's agent, because pressing security issues can sometimes force agencies to rise above bureaucratic bickering, and because much of the work is hidden from public view. Neither the science advisor nor the OSTP have this kind of bureaucratic power.

3.1.3 President's Council of Advisors on Science and Technology

The OSTP statute also calls for a senior group of non-governmental advisors, the President's Council of Advisors on Science and Technology (PCAST). [58] Like the OSTP, their role and access to the President depend heavily on his preferences. Under President George H. W. Bush, almost half of the PCAST meetings included discussions with the President. "PCAST responded directly to Presidential requests for information, it reviewed [Federal Coordinating Council for Science, Engineering, and Technology] reports … and it also kept a watching brief so that it could identify issues in science and technology to the President before they became problems." [59] PCAST also produced reports on bioscience; high-performance computing; and the interplay between science, technology, national security and the American standard of living. While President Clinton's PCAST met only occasionally with the President, because of Vice President Gore's interest in science policy the PCAST played a critical role in several key areas. [60] But the organization was criticized for failing to regain its historic mission as a direct and timely advisor to the President, supported by adequate funding and staff. [61]

Under President George W. Bush, the focus of PCAST shifted away from basic research to focus instead on nanotechnology (a project started under the Clinton administration) and homeland security. PCAST did not meet for the first 18 months of President Bush's term. Unlike previous administrations, this PCAST reports to OSTP Director John Marburger, not the President.

3.1.4 The Critical Technologies Institute

The Critical Technologies Institute is a Federally Funded Research and De-

velopment Center (FFRDC) chartered by the Congress in 1992 and renamed the Science and Technology Policy Institute (STPI) in 1998. [62] The program is funded through appropriations to NSF, but acts under the guidance of OSTP. [63]

Through this institute, Congress had hoped to develop publicly available analyses of key issues in science and technology policy. It was also designed to maintain a core permanent staff that would provide institutional memory to compensate for the staff turnover in OSTP resulting from changes in the administration.

The institute never fully achieved this mission: unhappiness with the institute led the Bush administration to transfer management of the institute from the RAND Corporation to the Institute for Defense Analyses (IDA) on December 1, 2003.

While IDA management may well improve operation of the organization, the institution suffers from a number of structural problems. Management is awkward since the organization has many masters. It's funding is directed to NSF but the operation is directed by OSTP. The Congressional sponsors anticipated public reports that would help the public and the Congress make informed choices but OSTP frequently was more interested in public than in private advice. The organization will, for example, not even release the topics of its ongoing research projects.

3.1.5 The National Science Board

The National Science Board (NSB) was established in 1950 along with NSF to provide oversight of the NSF research portfolio. However, its mandate is open-ended, potentially including almost any aspect of the U.S. R&D effort. [64] Nevertheless, the NSB has focused on acting as a board of directors for NSF and has not aggressively intervened in inter-departmental science and technology issues. Few of those interviewed for this study mentioned the NSB and all who did agreed that, seen from the outside, it is considered a part of the NSF and not a principal resource for the President nor as having a coordinating role across the government science and technology effort. Indeed, some suggested that because of its close ties to the NSF, any attempt to comment on other agencies' budget priorities would be viewed as an effort to boost NSF at others' expense.

The NSB does publish biennial reports on the state of science and engineering in the country. It recently published a report on the coordination of federal R&D. One of its main conclusions is that coordination is poor and few mechanisms exist for enforcing coordination. [65]

The NSB would seem a natural candidate to coordinate the national R&D effort. Most observes believe, however, that given its long history of advising only NSF it would be extremely difficult to expand the organization's mission to make it an effective advisor to the President and OMB on administration-wide science and policy issues.

3.1.6 Other Advisory Systems: Securities and Exchange Commission's Office of Economic Analysis

There are advisory boards for many different parts of the Executive Branch, including EPA's Science Advisory Committee, the Department of Transportation's Transportation Research Board and DoD's Defense Science Board. We present the example of an advisory panel that is designed to provide public information.

While the NSC may represent a powerful example of how private analysis and advice can be delivered efficiently to the President, the Securities and Exchange Commission (SEC) illustrates how an agency can receive and effectively act on good analysis. The Office of Economic Analysis (OEA) is an in-house think tank at the SEC. It "analyzes impacts and benefits of proposed regulations, conducts studies on specific rules, and engages in long-term research and policy planning" [66] for the SEC. Some staff members are civil service, while some have short-term positions on sabbatical. The OEA staff currently includes seven people with advanced degrees in economics and five with degrees in finance. The current chief economist is on leave from the Marshall School of Business at the University of Southern California; other staff members have held or currently hold positions at the University of Georgia, Iowa State University, and the Commodity Futures Trading Commission. OEA's mission statement notes that: "Since our work often addresses novel issues, OEA economists publish frequently in top academic and practitioner journals. We strongly encourage speaking and publishing to disseminate our analyses and to develop the professional skills of our staff." [67] Articles written by staff members have appeared in prestigious academic and professional journals. Thus, not only does the staff advise the

SEC on the potential effects of regulations, but it also is expected to expose these ideas to a wide audience of interested parties. The SEC is not part of the Executive Office of the President and does not directly advise the President. This gives the OEA staff more leeway in their work: while members do not speak with the voice of the President, they do carry the weight of the administration in their analyses and publications.

3.2 Advice to Congress

In the Executive Branch, all decision making flows up to the President. In the Congress, by contrast, there are 535 individual clients who all have slightly different perspectives, and a large number of different committees and subcommittees. Each has unique needs in drafting of legislation, Executive Branch oversight, and analytical support. This means the type of organization that will successfully advise the President will not work for Congress. Further, each Senator and Representative has a staff that interprets and refines scientific information into the format they desire. The Executive Branch employs thousands of scientists. Congress's entire staff, including its few support agencies and member and committee staff, number only in the few tens of thousands with fewer than one hundred scientists. Many congressional staff with technical backgrounds are current or former recipients of privately funded fellowships offered by organizations such as the American Association for the Advancement of Science (AAAS).

In Congress, as in the Executive Branch, the management of science and technology issues is scattered across many different organizations. This certainly makes sense in that a good agriculture, transportation, health, or energy program needs to balance research investments with other government responsibilities. An obvious difficulty is that it is difficult for any committee staff to maintain the wide range of in-house technical skills required to address increasingly complex scientific and engineering issues. One solution is to create congressional organizations that provide what is in effect a shared staff. Congress has three organizations that support this mission. These are CRS, the GAO, and the Congressional Budget Office. The question is whether the current system is adequate.

The fragmentation of responsibilities in Congress makes it extremely difficult to develop anything approaching a coherent treatment of research priori-

ties. [68] It is difficult enough for the administration to craft a coherent interagency research program but nearly impossible to describe it coherently to the Congress. The 1996 plan for the Oceanographic Partnership Act, for example, had to be briefed to 43 separate committees. [69] There are strong arguments for maintaining the diverse, often competitive research programs funded by many different federal agencies; it is also possible to have too much of a good thing. [70] No one with any experience in Congress would imagine that committees would be willing to give up jealously guarded jurisdictions. There is a painful absence of any formal or routine mechanism for reviewing the overall balance of federal R&D, initiatives that require coordination of several different federal agencies or departments, or the relative success of different strategies for research management.

3.2.1 Office of Technology Assessment

The Office of Technology Assessment [71] was created in 1972 because the Legislative Branch felt it was not getting appropriate advice regarding complex technical matters. In particular, the Congress felt it was at a disadvantage when it came into conflict with the Executive Branch. The primary focus of the organization was to provide Congress with detailed studies on a broad range of science and technology related topics. The OTA had a small [72] permanent staff of about 200, of whom 88% had advanced degrees, including 54% with Ph.D.s in relevant fields. [73] The staff was supplemented with outside panels of experts as needed. Studies typically took from 18 to 24 months to complete, cost roughly $500,000 each, and were generally well received. The OTA also provided Congress with immediate expert advice and assisted Congress in identifying or providing appropriate witnesses for hearing testimony.

OTA was painstakingly designed to be bipartisan. Its board consisted of 12 members of Congress and always had six Republicans and six Democrats regardless of the party composition of the Congress. The board had to approve all study requests and approve the release of all studies after their completion. Virtually all studies were requested by members of both parties – typically the Chair and Ranking Minority member of a full committee. This somewhat ponderous process made it difficult to produce partisan requests but also added considerable overhead – and often delays – to the process. [74]

In spite of the elaborate procedures, many Republicans believed that the organization had a Democratic bias. Democrats were clearly an early powerful force, led by Representative Emilio Daddario (D-CT), then Chairman of the House Subcommittee on Science, Research and Development and by Senator Edward Kennedy (D-MA). It was also inevitable, however, that careful and unbiased studies would reach conclusions at odds with some member's political belief. While OTA went to great lengths to avoid either the reality or the perception of bias, this did not shield it from harsh attack when the political consequences were significant. One important example was OTA's unflattering assessment of President Reagan's Strategic Defense Initiative.

There was a long learning curve as OTA began to understand how best to serve the Congress and members got a clearer understanding of the kinds of work OTA could and could not do. In the beginning, OTA undoubtedly invested too heavily in lengthy, detailed reports that were informative but not timely. It was also accused of producing voluminous material that was difficult for members and staff to use and reports that were not well focused on the practical alternatives facing the Congress. To its credit, OTA recognized these failings and made considerable progress in focusing its work on products that delivered useful information at the right time and in a useful format. Once well established, OTA completed roughly 30 studies each year.

The progress made was not persuasive to the new Congress elected in 1994, which eliminated OTA as part of Speaker Newt Gingrich's Contract with America in spite of a spirited defense by several Republican board members. The public rationale for closing the office was congressional cost saving.[75] One often cited reason for the vote is that OTA was seen as overly linked to committee chairs and ranking members and less responsive to newly-elected members. When new members came into power they had little experience with the organization and little interest in its survival.

3.2.2 Congressional Research Service

The Congressional Research Service (CRS) began life as the Congressional Reference Service in 1914. It provides all congressional offices with nonpar-

tisan information and research, giving immediate answers to questions and short-term studies on a wide array of issues. [76] While CRS does prepare some self-initiated reports on frequently requested topics, most of its work is done in response to short turn around requests for factual information. CRS has an excellent reputation for impartiality on all issues, makes no policy recommendations, and does not produce detailed analysis requiring extensive input from external experts. All requests to CRS for information are confidential. [77] Requested information ranges from constituent inquiries sent to CRS for a response to requests for background information for legislation and synopses of world events. If repeated requests are made for the same information, CRS will generate a report available to congressional staff through the CRS website. Further, if CRS determines that a given topic will remain of interest for some time, it will continuously update reports as events warrant.

There is an ongoing debate as to whether these CRS reports should be made readily available to the public. There is concern that allowing such access would encourage lobbying of CRS for favorable representation in reports. At present, the public can request a CRS report from their member of Congress. Many also find their way on to the Web through a variety of channels.

The CRS is divided into six divisions: American Law; Domestic Social Policy; Foreign Affairs, Defense and Trade; Government and Finance; Information Research; and Resources, Science and Industry, the last created in 1970 as part of a CRS reorganization. This division has roughly 80 staffers (one quarter with science or engineering Ph.D.s), divided among six sections covering Agriculture and Food Supply; Energy and Minerals; Environmental Policy; Natural Resources and Earth Science; Science and Technology Policy; and Transportation and Industry Analysis. This division does perform some internally initiated, forward-looking studies, but, like the rest of CRS, it is mainly driven by congressional requests.

3.2.3 Government Accountability Office (formerly General Accounting Office)

Founded in 1921, as the General Accounting Office, the Government Accountability Office (GAO) serves primarily as an instrument of oversight through the evaluation of ongoing programs. [78] GAO has offices across the country and is continually monitoring a variety of projects. GAO can be tasked

by any member of Congress. Prior to release, GAO studies are reviewed by both the requesting office and the project that was evaluated. Once complete, the study, unless classified, is released on the GAO website, although studies can be embargoed for up to 30 days at the request of the originating office.

GAO is also involved in an ongoing experiment to perform technology evaluations. In 2001, realizing a need for the type of technology assessment previously performed by OTA, Senators Richard Durbin (D-IL) and Robert Bennett (R-UT), then the Chairman and Ranking Member of the Subcommittee on Legislative Branch of the Committee on Appropriations, convinced Congress to begin an experiment with technology assessment at GAO. The first technology assessment, examining biometric technologies for support of border control, was requested on October 30, 2001, with the result due by June 15, 2002. GAO asked the National Academies to help assemble panels to advise the work. The report was actually delivered to Congress on November 15, 2002. [79] The delay came about in large part because this was the first study of this type that GAO had attempted. An independent review team concluded that while the GAO process could be improved it was generally sound. [80] Congress elected to continue the GAO experiment and a report on cybersecurity was released in mid-2004. [81] Additional studies on cargo container security and wildfire fighting are underway.

At its current staffing level, GAO can only complete one to three technology assessment studies per year. GAO was assisted by the National Academies for the first studies. This led some to question the need for involving GAO at all; others feel that GAO's product can be more carefully tailored to Congress's needs, so it is useful to have assessments performed there. Finally, the present method for selecting and funding assessment topics has been criticized for being somewhat haphazard: the topic of the first study was specified by Senators Durbin and Bennett in report language; the second study was requested by Senators Susan Collins, Joseph Lieberman, Ernest Hollings and Representative Adam Putnam. Most observers agree that a more systematic method of choosing topics must be put in place if the GAO experiment proves successful and the group begins to undertake a larger number of projects.

3.2.4 Congressional Budget Office

The Congressional Budget Office (CBO) was created in 1974, "to provide

the Congress with the objective, timely, nonpartisan analyses needed for economic and budget decisions and with the information and estimates required for the Congressional budget process." [82] The primary science-related function of CBO is to evaluate the science-related budget requests for the Department of Energy (DoE), NIH, NSF, and so forth. While there are no direct science policy-setting activities involved, this work allows the Congress to determine the effects of budgetary decisions on basic science research in the United States. In addition, CBO provides one of the few reports—and the only from within the government—that offers a clear view of the entire science budget.

3.3 The National Academies

Founded in 1863 by President Abraham Lincoln, the National Academy of Sciences (NAS) serves "whenever called upon by any department of the Government" to "investigate, examine, experiment, and report upon any subject of science or art." [83] In their own words "The National Research Council (NRC) was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of further knowledge and advising the federal government" and has become "the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public and the scientific and engineering communities." [84] The NAS created the National Academy of Engineering (NAE) in 1964 and the Institute of Medicine (IOM) in 1970. None of these bodies receives an annual appropriation from Congress. Instead, all studies are funded by the requesting agency or, in the case of congressionally-mandated studies, the affected agency. [85] This allows the Academies to refuse to perform studies. However, it also means the Academies generally lack the ability to initiate studies of their own choosing. While the Academy has recently built an endowment of $300 million, this money is used for a variety of purposes including the construction of a new buildings, lecture series, and distribution of NAS reports.

The NRC, on behalf of the National Academies, produces roughly 600 reports, workshops and roundtables per year. [85] Some of these are mandated by Congress, some are requested by various parts of the administration, and a handful are started by the NRC itself. The NRC will appoint prominent scientists—often, but not always, members of the National Academies—to a panel that collects and reviews information for a given study. The panel is supported by staff

from the NRC—many of whom have Ph.D.s in related subjects—and receives briefings from additional experts. Once the material is collected and assimilated, the panel writes a report that is peer reviewed. The resulting report is released by the NRC on its website and for sale through the National Academies Press. These reports are usually exhaustive and take over a year to complete after funding is procured, which can itself be a time consuming process. This approach results in reports with enormous credibility, but they are not always as focused on government decisions as they could be and are not always timed to meet government decision making schedules. Further, these studies are often quite expensive, costing upwards of $1 million for a relatively basic effort.[86]

The NRC has apparently moved to fill some of the gap left when OTA was de-funded. Congressionally-mandated studies increased from an average of about 30 per year in the early 1990s to about 50 per year. [87] A significant number of OTA employees now work for the Academies, several in senior positions. [88]

Criticisms of the National Academies have focused on three areas:

Timeliness: Full academy studies can take years to complete and there are examples of studies that were completed too late to inform a critical vote or decision. A full study and associated peer review typically takes 12 to 18 months to complete after firm funding has been received. Congressional studies can take much longer. Many months can be required to get a study requested via legislation, the only mechanism that Congress has for directing an agency to fund an Academy study. Agencies may then take 6 to 9 months to complete the paperwork needed to transfer funds, a process that can be particularly protracted if the agency is hostile to the idea of a public review of one of its programs. [89] Congressionally-mandated studies can take so long that members occasionally use a request for an Academy study as a way of delaying a decision.

The Academies have recognized timeliness as a problem and have moved to address it. Clearly there is a tradeoff between the complexity and completeness of a study and the time required to complete it. One problem is that the Academies use extremely senior people, making scheduling a challenge. In addition, panelists are not compensated, which can make schedules difficult to enforce. An agency unhappy to be ordered to fund a study will sometimes either fail to fully cooperate or try to interfere in ways that drag out the schedule. The

Academies have nevertheless explored methods for delivering reports quickly – but typically only when there is a high level of interest and sense of urgency. They were, for example, able to produce a study of the risks of arsenic in drinking water in 3 months. [90] The report *Climate Change Science: An Analysis of Some Key Questions*, was requested by the Bush White House on May 11, 2001 and released on July 1, 2001. However, this work is less than 30 pages long, mainly a review of existing literature, and did not go through the normal review process. Further, funding for this study was available concurrent with the request. They are also able to produce short "letter" reports on comparatively short notice and they occasionally release pre-publication and interim reports.

Balance and Bias: The Academies have a superb reputation for ensuring balance and an elaborate system of peer review to guarantee accuracy. Anonymous reviewers provide detailed comments on drafts and an independent ombudsman ensures that comments are addressed. Nevertheless, the panels of the Nation's most senior scientists have been criticized for overemphasizing the views of an entrenched scientific establishment. The Academies clearly recognize that "without careful oversight by the committee chair and sometimes NRC management, committee members with the most at stake in a study or perhaps with the most free time available could have a disproportionate influence over a study's deliberations and outcomes." [91]

Flexibility: The Academies' lack of financial independence limits their ability to initiate studies independently. By far the bulk of their studies are undertaken at the request of federal agencies. Academy management realizes that this can create at least the appearance of a conflict when Academy programs – and program staff – depend on continued good relationships with the funding agencies. They have been proactive in taking steps to minimize the problem.

In recent years the academies have been much more successful in attracting independent sources of funding with studies funded by private foundations and from a growing endowment. Their ability to produce the report *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism* [92] quickly in response to the 9-11 attacks was possible only because funding was available through this route.

SECTION 4

Options for the Executive Branch

Science advice, or any advice, is hardest to ignore when it is made public, but sometimes advice to the President is more effective when it is given in confidence and the advisor can work closely with, and with the personal trust of, the President. The two main options below address both issues. The first is designed to strengthen the role of the Science and Technology Advisor in providing private advice to the President, similar to the National Security Advisor. The second gives OSTP a more public role, along the lines of the SEC's Office of Economic Analysis. Those who believe the problem is simply getting good advice to the ear of the President will emphasize the first option. Those who believe a President is able to get, but then is inclined to ignore, good science advice will emphasize the second option.

These two options are not mutually exclusive; indeed we believe they will be most effective if pursued together. What is probably not possible is to continue to combine in one person the two functions of Science Advisor and director of OSTP if the options as they are laid out here are followed.

4.1 Strengthen the Private Advice Provided to the President

The example of the National Security Advisor suggests that it should be possible to design a much stronger apparatus for providing the President with

scientific and technical inputs. The actions suggested below could be accomplished by amending the OSTP statute or through executive order.

4.1.1 Create a Permanent National Science and Technology Council

The NSC statute formally names the agency heads required to participate in the NSC and requires that, "The Council shall have a staff to be headed by a civilian executive secretary who shall be appointed by the President." This precedent could be followed in a revised OSTP statute to establish a permanent National Science and Technology Council. The NSTC would be managed by a science advisor who works directly for the President inside the Executive Office of the President.

In this formulation, the director would not be Senate confirmed (and thus clearly covered by Executive Privilege [93]) and would have a small staff, similar to other White House offices such as the NEC [94] and the DPC [95]. There are, of course, risks involved in creating a powerful position not subject to congressional oversight and any new legislation should make it clear that while some communications with the President may be privileged, the Congress expects to be kept fully apprised about the substance of key national decisions.

4.1.2 Provide for a Permanent Staff

As at the NSC, shorter-term, politically appointed staff could supervise longer-term, more permanent professional staff of at least 20 experts (the NSC has approximately 80) who would not be replaced when administrations changes. Just as the NSC borrows much of its staff from agencies such as intelligence or the military, the OSTP needs long-term staff who understand the workings of government. Staff could be supplemented by fellows and visitors who are active scientists working at the forefront of their fields. A smaller staff has the simple logistical advantage of more easily fitting into the Executive Office Building, nearer to the President and the rest of his closest advisors. Both the NEC and the DPC are headed by Assistants to the President with staffs in the Executive Office Building. [96]

4.1.3 Make the Science Advisor's Office a Formal Part of the National Security Council and Other White House Offices

In many administrations, it has been the custom to have one of the OSTP associate directors hold a position on the NSC staff and participate in all meetings. It would be preferable if this were made formal and permanent policy and if other members of the OSTP staff were also given joint appointments to other White House agencies including the DPC and the NEC. [97]

4.1.4 Strengthen PCAST

PCAST could take on a much greater and more independent role if it were given a greater budget and had a significant support staff. [98] (OSTP provides only one staff person at present.) One possible model is the JASONs [99] that provide detailed, timely, highly respected analysis for DoD. A similar institution could be formed to provide national science advice. The JASONs hold focused 4- to 6-week meetings once a year, followed by several long weekend meetings. At these meetings, senior advisors address one or more timely problems important to the Office of the Secretary of Defense. JASON studies are selected from a combination of topics suggested by JASON members and by sponsors; a similar mechanism could be used for PCAST. However, JASON is exempt from the openness requirements of the Federal Advisory Committee Act (FACA) due to national security needs. This will be much harder to justify for a scientific advisory group.

4.1.5 Create a Formal Pocess for Crafting and Reviewing a Government-Wide Science and Technology Budget

The published version of the science and technology budget is largely a summary of budget decisions made for each agency. OMB and OSTP annually send out a notice to agency heads outlining the administration's R&D priorities to guide the budget preparation. But the process for ensuring that these priorities are honored are ineffective or nonexistent.

The R&D budget summary published with the federal budget appears in a section of the "analytical perspectives" under a category called "Cross cutting programs." [100] Other activities discussed on an equal footing in this section are "strengthening federal statistics," and "integrating services with information

technology." While these are all worthy activities, the science and technology budgets deserve more attention. The existing structure makes it extremely difficult for the President or the budget directors to correct any perceived lack of balance in the research portfolio or to take a broad view across disciplines. For example, the recent progress in the biological sciences has been dramatically aided by diagnostic tools invented in the physical sciences. With the current budget process, this kind of cross-discipline support is hard to even see, much less foster.

An effective process would need to involve close collaboration between OMB and the Science and Technology Advisor directed by the President.

4.2 Strengthen the Public Role of OSTP

If the role of White House policy advising is covered adequately, the OSTP could be one step removed from the White House and, while still part of the Executive Branch, given more freedom to publicly debate the role of, and policies for, science in the United States. To distinguish this office from the current model, we name it the Science and Technology Policy Agency (STPA). To strengthen the STPA:

4.2.1 Define the Role of the Four Senate Confirmed Positions for Associate Directors

The statute establishing the NSC specifically describes major operations such as the Committee on Transnational Threats. The role of OSTP associate directors could also be defined and might include (i) Basic Research including Health Care, (ii) Technology, (iii) National Security and Homeland Security, and (iv) Energy and the Environment. Filling the four associate director positions would be required rather than allowed.

4.2.2 Ensure a Strong Professional Staff and Budget

The studies could be conducted either inhouse or contracted out, for example, to the National Academy. [101] STPA would need a reasonably reliable level of funding to support these studies regardless of where they were conducted. The highest levels of the staff would be politically appointed but supported by a

non-political expert staff that could expect to keep their jobs with a change in administration.

4.2.3 Redefine the President's Council of Advisors for Science and Technology to Give It Greater Independent Authority

Members could be appointed to terms that would overlap from one administration to the next and for terms of, say, seven years to intentionally put them out of sync with presidential and congressional election cycles. [102] The authority, currently not utilized, now given to NSF's National Science Board could be transferred to an organization reporting directly to the President. The group could have far greater credibility and independence if the members were given the same terms of appointment now enjoyed by the National Science Board. They would also need reasonable levels of staff and budget support.

4.2.4 Create a Regular, Independent, External Review of Federal R&D Activities

Research budgets are shaped by a complex set of forces at least some of which result from a fair assessment of the most promising directions of future research. But the realities of history, political forces, bureaucratic inertia, for example, are always factors. No administration would look forward to having these difficult decisions second-guessed by an external review group. But the process would clearly be improved if there were an opportunity for an independent audit of the total R&D package proposed. An effective audit would review:

- Overall research priorities
- Balance between disciplines and between basic and applied work
- New areas needing attention (e.g., education technology and housing) and areas where programs and facilities should be phased out
- Effective strategies for research management (including interagency management)

The proposal for STPA studies raises a number of issues. The organization would need a reasonably reliable level of funding to support these studies regardless of where they were conducted. STPA studies will raise two challenges: first, choosing the subjects of the studies and, second, assuring their scientific rigor. Many will see the power to determine study topics as the key to controlling the political agenda of the STPA, so this power must be both carefully guarded and shared. A possible approach would start with funding levels set to allow, say, six major studies a year. Two could be suggested by the President's science advisor—who, in this option, is a political ally of the President—and

two could be suggested by Congress and two by the advisory board of the STPA.

Suggestions coming from Congress have two complications. The first, obviously, is what internal mechanism Congress would use to pick topics; that is something for Congress to decide. The second is how the choices would be transmitted to the STPA. Because of the separation of powers, Congress can direct an Executive Branch agency to do something only through legislation, which is a slow process. Perhaps a working arrangement could evolve from good will on both sides so that congressional "suggestions" for study topics, made known through some agreed procedure, would not have the force of law but would, by custom, be taken up by STPA. Whatever the mechanism, one important aspect of the arrangement would be to have funding in place and the organization ready to go when the topics were decided. The alternative, to legislatively designate topics and appropriate specific funds, would be too slow for most topics of interest.

The checkered history of the Critical Technologies Institute provides some important lessons. An organization capable of providing the kinds of independent work envisioned by the Congress would have to be given much greater independence and the protection of a prestigious board of directors.

SECTION 5

Options for the Legislative Branch

Congress needs an independent source of scientific and technical advice to play an effective independent role in modern government. Extensive information is available from administration experts, volunteer advice from specialists outside of government, studies by interest groups, and by the NAS. But a June 14, 2001 workshop in Washington, D.C. on Congressional science advice (attended by four Congressmen and over 100 Congressional staffers and other interested parties) pointed repeatedly to the major gaps that remain. [103]

Congress presents unique problems for any apparatus of science and technology advice. Its many committees and subcommittees have specialized interests – interests that often change with leadership. While many issues, such as the reauthorization of major government functions in transportation or agriculture, come at predictable five-year intervals, in reality, most schedules are very difficult to predict. Few members of Congress have technical backgrounds – something that presents a major challenge to scientists unfamiliar with communicating complex technical arguments in plain English.

The following discussion will review options for strengthening congressional science advice.

5.1 Restart OTA

During its 20-year existence, OTA produced "nearly 750 full assessments,

background papers, technical memoranda, case studies, and workshop proceedings." [104] OTA was never officially closed; it was simply given a zero appropriation. OTA could, therefore, be restored through an appropriation of funds. This was attempted by Rep. Rush Holt (D-NJ) during the 107th Congress with some bipartisan support. The bill, HR 2148, changed the name of OTA's creating legislation, the Technology Assessment Act of 1972 (2 U.S.C. 471), to the Office of Technology Assessment Reestablishment Act of 2001 and provided for a budget of $20 million per year for fiscal years 2002 through 2007. The bill was referred to the House Committee on Science but no action was ever taken.

Most of those interviewed for this study, even strong supporters of OTA, agreed that the practical political difficulties of bringing OTA back will be daunting. The already difficult task of proposing remedies is made more difficult by the damaging debate that led to the closing of OTA. Strong positions were taken during this debate that can not be gracefully reversed. Many members who voted to close OTA are still in Congress, creating a certain amount of resistance to changing that decision. Second, while legislatively simple, in theory, none of the OTA structure exists and would have to be reconstituted. The original OTA had a long growth period before it was well meshed with congressional culture. Previous experience could help, but some breaking-in period should be expected. Third, many of OTA's functions have been taken over by CRS, the National Academies, and the NGO community, reducing the need and incentive for a renewed OTA.

If OTA were reconstituted, however, it could address many of the currently perceived problems of government science advice. By being outside the Executive Branch, it provides a separate and independent voice. There is just one President, who belongs to one party or the other. The Congress can be extremely partisan. But congressional agencies have been remarkably good at producing reports with a bipartisan imprimatur. The CRS and GAO receive wide bipartisan support, and there is no reason, in principle, that OTA could not also.

Holt's proposal was rejected by the House in a recorded vote in July 2004. Jack Kingston (R-GA), chair of the Legislative Branch Appropriations Subcommittee, spoke in opposition to the bill arguing that there was bipartisan agreement to eliminate OTA in 1995 in the belief that "... there were other committees that we could turn to to get technology studies and technology as-

sessment. Some of these, for example, are the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council. All of them have hundreds of people who are technically educated. And then in addition to that, there are 3,273 people at the General Accounting Office and 729 at the Congressional Research Service. We have not suffered because of the loss of technology assessment. It is perhaps true that we could rearrange some of the food on the plate and make sure that it does not get shuffled to the back burner; but if my colleagues think about it, Mr. Chairman, we actually have thousands of people out there doing studies, and we just need to make sure that this does not fall through the cracks. As a result of eliminating the Office of Technology Assessment, we have saved $274 million, which is serious money in tight budget times, and that is money that we can put into many other worthy causes; and, of course, that is what the debate is all about." [105] Presumably he was referring to ten years of savings since OTA's last annual budget was $22 million.

5.2 Create a New Science and Technology Analysis Function within GAO

Congress could increase GAO's annual appropriation to support projects targeted on OTA-like science and technology assessments. Major OTA studies cost about $500,000 and appropriations would have to reflect this. Some have suggested that about four studies a year, requiring an additional $2 million in GAO's budget, would be a good starting point. Our interviews suggest that GAO is a more appropriate congressional agency than CRS. The culture at CRS is targeted more on short-term reports while GAO does more long-term, in-depth studies. Further, GAO's management is more receptive to the new role than CRS's seems to be.

Representative Rush Holt (D-NJ), with 15 bipartisan cosponsors, introduced HR 4670 on June 23, 2004. This bill is designed to "establish a Center for Scientific and Technical Assessment" [106] within GAO, which is in many ways an OTA within GAO. It would have a director, dedicated staff, and be overseen by a congressionally-controlled Technical Assessment Board (TAB). This TAB would consist of 12 members of Congress, the Comptroller General and the directors of CRS and the Center and would consider requests from any mem-

ber of Congress. Assessments would be carried out using NAS-like advisory panels not subject to the FACA. All reports would be peer reviewed prior to release. Rep. Holt's legislation authorizes $30 million for each of the next three fiscal years to carry out these studies. [107]

Similar bills have been introduced in the Senate. Senators Jeff Bingaman (D-NM) and Joseph Lieberman (D-CT) introduced S. 2556 on June 22, 2004 designed to:

> (A) direct the establishment of a technology assessment capability in the General Accounting Office; (B) ensure the quality of such technology assessments in order to enhance the ability of Congress to address complex technical issues in a more timely and effective manner; and (C) condition the development of a technology assessment capability in the General Accounting Office on the provision of adequate additional resources and administrative flexibility. [108]

Unlike the legislation that created OTA, this bill "does not create a Technology Assessment Board consisting of members of Congress to help select topics." [109] It instead relies on a group of five prominent scientists, nominated by the National Academies, to select topics. The bill authorizes $2 million for each of the next three fiscal years to carry out these studies. The GAO Comptroller has great leeway in determining how to carry out the studies; all studies are to be peer reviewed before submission. In addition, "the Comptroller General shall be properly apprised of Federal and non-Federal entities providing information to Congress to (1) enable effective coverage of critical issues; and (2) avoid duplication of effort."

The Senate bill is much more general and allows for a great deal of flexibility in selecting topics. The House bill is much more ambitious in scope—the amount authorized for studies is substantially larger—and requires Congress to determine study subjects. No action has yet been taken on either of these bills in the 108th Congress. However, these bills will likely be introduced again in the next Congress.

Creating a technology assessment section within GAO has some of the advantages of recreating OTA while avoiding some of the problems. GAO has broad bipartisan support and its reports are widely respected inside and outside

Congress. GAO already works closely with Congress and understands congressional needs and uses of reports and information. Finally, GAO already has an administrative structure set up and running.

5.3 Encourage Privately Supported Analytical Groups Focused on Congressional Decisions

A pilot project that might serve as a model is being funded by the John D. and Catherine T. MacArthur Foundation. The project supports research at a variety of think tanks and university groups across the country already funded by MacArthur as centers for scholarship on peace and security issues. A new group within the American Association for the Advancement of Science, the Center for Science, Technology and Security Policy, will coordinate the work. Dr. Norman Neureiter, most recently science advisor to Secretary of State Colin Powell, heads this Center. The purpose of the Center is not to produce reports on its own, but rather to assist university and NGO researchers in determining appropriate topics and funding appropriate audiences for them within Congress. The Center will also serve as a point of contact for Congress to request witnesses, reports and briefings on science, technology and security policy, providing Congress access to the research groups and vice versa.

There are two main problems with private funding of a study center to support Congress. First, the amounts of money can be large and ongoing. OTA's budget was tens of millions per year, a significant fraction of even a large foundation's budget. Moreover, foundations, as a rule, try to avoid open-ended long-term financial commitments. They are eager to get a new project going but prefer that it become self-supporting eventually, which is difficult to envision in this case. Second, foundations almost always have some explicit mission and point of view. Each was set up by a philanthropist who had a vision and wanted that vision carried on. What is seen as a vision by some will be seen as an agenda by others. Thus, foundations may slant analyses they support. Perhaps more importantly, even if they are perfectly able to provide the rigorously bipartisan balance that science advice to the Congress demands, they will not be perceived as bipartisan. Nevertheless, the MacArthur experiment or some similar structure could be supported by direct congressional appropriation.

5.4 Strengthen Protection for Whistleblowers

There have been many cases in recent years where Federal employees or contractors often have access to technical information critical for helping the Congress and independent organizations make informed judgments about policy but have been prevented from releasing this information. The Whistleblowers Protection Act (WPA) of 1989 provides some protection for federal employees who disclose information on waste, fraud, or abuse being withheld from the public. A series of administrative and judicial rulings have greatly reduced the practical scope of the protections offered and created a chilling effect on whistleblowers. [110] For example:

An employee is not protected by the WPA if he or she directs criticism to the wrong-doer instead of to a higher authority.

An employee is not protected by the WPA if the information disclosed was done so in the course of his or her duties.

An employee is not protected by the WPA if the information disclosed is already known.

The Federal Employee Protection of Disclosures Act, introduced with bipartisan support on June 26, 2003 (S. 1358), would remove these and other restrictions and make permanent the "anti-gag" rule that has been passed by the Congress on an annual basis for 13 years. This protects whistleblowers disclosing national security information, even in instances where the whistleblower is accused of releasing potentially "classifiable" information.

5.5 Strengthen the Congressional Process

The previous proposals would result in publicly visible changes to the structure of Congress's support organizations. The members and their staffs could also increase their use of science advice in the normal business of Congress. None of the following suggestions would be adequate alone but each would help to get good science into the public policy process.

5.5.1 Include Science and Technology in Congress' Early Organizational Meetings

Newly elected members of Congress receive training on the duties and responsibilities of being a member of Congress prior to being sworn in. Further, all members and members-elect meet in November and December of even numbered years to discuss the coming legislative session. Various institutions, including Harvard University, the Brookings Institution, and the Heritage Foundation, provide this training on a variety of topics. [111] These sessions could include science, science policy, and review of the science resources available to members. There are a variety of organizations that could and would do this, including CRS, the AAAS, and a coalition of scientific professional societies. The goal would not be to provide Representatives and Senators with specific advice on specific questions, which could not be anticipated in any case, but to remind them of the importance of sound science in the deliberative process and offer sources of information.

5.5.2 Make Review of the Science and Technology Budget as a Whole an Integral Part of the Appropriations Process

It is difficult for OMB or any executive agency to see the national science and technology budget as anything other than a paper exercise if the compilation is not reviewed independently by any meaningful congressional process. At present, research budgets are scattered across many appropriations categories and subcommittees of appropriations and authorizing committees. Many national research tasks require contributions from several different agencies: research focused on homeland security, biomedicine, education technology and many other areas require combining expertise from many different science and engineering specialties and could benefit from the diverse research communities and management styles of different government organizations. But even if the administration is able to design an effective research program involving several agencies, there is no appropriate venue in Congress to argue for the merits of the program as a whole. At a minimum, the Appropriations Committee could establish a standing task force to review the S&T budget as a whole and ask for administration witnesses to justify the size, balance, and direction of the effort. This would not force committees to coordinate but at least a coherent case could be presented.

5.5.3 Other Process Improvements

5.5.3.1 Create or Expand CRS Fellowships

The CRS staff has good contact with outside experts that are tapped for information as needed. However, there often are times when it would be useful and appropriate to have such expertise in-house. There are many instances in which the topic of interest is quite important for many months but then wanes, to be replaced by a new topic. A fellowship could be created to bring researchers with particular expertise into CRS to deal with a science-related issue that can be predicted to be of interest to Congress in the coming session. For example, the Science and Technology Policy Fellowships run by the AAAS could place one or two fellows directly in CRS. This would allow CRS to have an ongoing method to bring in specialized expertise as needed. These fellowships would also provide a clear path for CRS to identify potential new staff and for scientists to transition from pure academic research to the world of policy.

5.5.3.2 Provide Quarterly Staff Training Seminar Series

To some degree, the issues that will be of interest to Congress are known before the session starts. This provides an opportunity for early member and staff education through a series of quarterly one-day seminars on upcoming science-related topics. The seminars could include several sessions on a variety of topics, designed to provide staff with an introduction to the subject material and a familiarity of terms. Ideally, material would be presented from several different sources [112] to staff from both bodies and of both parties simultaneously and would allow substantial time for interaction with the expert presenters. These seminars could be run for Congress by CRS, by an outside source such as the AAAS, by a coalition of professional societies or universities, or a coalition of think tanks. [113] The challenge for any proposal of this type is to convince members and staff that it is a valuable use of their time, which requires that subjects be picked carefully and the presentation crafted to emphasize a congressional perspective.

A model for these seminars can be found in the Council on Competitiveness's Forum on Technology and Innovation. Founded in 1999 in partnership with Senators Jay Rockefeller (D-WV) and Bill Frist (R-TN) and supported by

grants from the Alfred P. Sloan Foundation and the John D. and Catherine T. MacArthur Foundation, the forum is a briefing series for congressional staff on technology policy issues. The original senate sponsors have moved on to other duties and the forum is now headed by Senators John Ensign (R-NV) and Ron Wyden (D-OR). The forum holds briefings four to six times per year on a variety of high-technology topics [114] and "advocates no particular position or policy prescription." [115] Both a transcript and a video record of each briefing are available on the forum's website, [116] in addition to links to relevant legislation and news articles.

5.5.3.3 Increase Participation in Policy Debates by Scientific Societies

Perhaps the single most common complaint heard during the interviews we conducted on Capitol Hill was lack of outreach from the various professional societies. This has been noted by outside observers, too: "The professional societies of science should advance beyond clichés and act on the recognition that participation in the nation's political life is a virtuous activity, good for the nation and good for science—and well worth the support of scientists." [117] With so much funding coming from the federal government, scientific societies are accustomed to lobbying for support. But they could also work harder to get science into the policy debate. For example, the American Physical Society released a report [118] on President Bush's Hydrogen Initiative written by a group with experience in bench science and industrial technology management and included experts on hydrogen storage, hydrogen production, and fuel cells. Careful management of this paper led to hearings in the House Committee on Science [119] that led Chairman Sherwood Boehlert (R-NY) to call for changes in the hydrogen program. [120]

Of course, there will always be the perception that scientists, because they are active participants, are not able to give truly disinterested advice in their own fields; that policy advocacy and lobbying roles are inevitably entwined. For example, the American Society of Cell Biologists worked with several other groups representing universities, scientific societies, medical doctors, and patients to found the Coalition for the Advancement of Medical Research (CAMR) in 2001. CAMR now has 85 member societies working together to educate Congress on stem cells, resulting in regulations allowing stem cell re-

search and continued federal funding for stem cell research. Cell biologists are the best source of scientific information about stem cells but a cynic might point out that, as researchers using stem cells, they will naturally want to reduce restrictions. Nevertheless, if scientists do not step forward to advocate good science, no one else can be expected to and, overall, the policy debate is helped by greater involvement of the scientific societies. Professional societies should become more involved in assuring that the science in the public debate is credible.

5.5.3.4 Increase Participation of Individual Scientists

While bringing scientists to Washington to meet with legislators is an effective way to raise awareness for a specific issue, it is also useful to have ongoing relationships between scientists and their representatives. Scientists, perhaps with the help of their universities, can actively pursue meetings with their representatives in their district offices and arrange visits to campus research facilities. Congressmen have much more time flexibility in their districts and respond well to constituents. Legislators could develop long-term relationships with recognized experts who could later be called on to provide advice on a variety of science-related topics.

Universities can make it easier for scientists to take leaves of absence and work in government. Sabbatical leaves would be particularly attractive since this arrangement could reduce the cost to the congressional office or agency. This has been highly successful for physicists and others with a tradition of working in DoE laboratories and DoD advisory groups like the JASONs. It has not been a tradition in most other specialties. Indeed for many promotion and tenure committees work outside the preferred specialty can be seen as a liability and not an asset.

SECTION 6

Options to Increase Scientific Openness and Access to Information

The importance of openness in science is axiomatic. Open communication of scientific research permits the confirmation of experimental results, fosters the cross-fertilization of ideas, and enables the propagation of scientific knowledge throughout the scientific community and the wider public. All of the options considered in this report require access to information and many require that information gets out into the public domain to insure that good scientific and technical advice is incorporated into the public policy making process.

At the same time, there are well-established justifications for secrecy in certain aspects of scientific research. National security classification may be imposed on "scientific, technological matters relating to the national security." Other, more controversial restrictions may be imposed on a potentially open-ended set of "sensitive but unclassified" types of information.

The appropriate degree of control, if any, on scientific research will naturally fluctuate over time depending on the maturity of the particular research in question, the degree of its diffusion in the larger community, and the international security climate. But such controls have too often been imposed and then left in place indefinitely. Information security policies have not been routinely subjected to critical examination. Secrecy has grown by accretion and without any effective check.

In this chapter we propose specific actionable steps that could be taken to enhance scientific openness, with due regard to security and other related concerns, and with respect to both classified information and unclassified information. [121]

6.1 Fundamental Classification Policy Review

The President should direct each agency that conducts or sponsors classified scientific research to perform a comprehensive review of its classification policies to ensure that classification is employed only where properly justified and currently necessary.

A model and precedent for such a review is the Fundamental Classification Policy Review that was performed by the Department of Energy in 1995-1997 "to determine which information must continue to be protected and which no longer requires protection". [122]

That initiative -- which proceeded on the proposition that "classification must be based on explainable judgments of identifiable risk to national security and no other reason" -- was carried out by panels of experts in the relevant technologies. The views of affected agencies other than DoE and of the interested public were solicited. In the end, the review identified numerous categories of scientific and technical information that no longer warranted protection (and some others that were deemed to require increased protection). The result was a significantly streamlined classification policy that was newly calibrated to the current threat environment and simultaneously more responsive to scientific and public interests in disclosure of information. A similar effort could and should be replicated by all agencies that deal in classified scientific and technical information, including DoD and the Central Intelligence Agency.

Both science and national security policy stand to benefit by reducing the scope of secrecy because decisions could be made using more complete information and the limited resources available for security could be employed only where they are truly needed.

6.2 Proposal: Limit Controls on Unclassified Scientific Information

The President should extend the longstanding policy embodied in National Security Decision Directive (NSDD) 189 that minimizes restrictions on unclassified scientific information.

Classification is the proper tool for controlling scientific information that

must be controlled. Unclassified scientific information should have unrestricted access. This is the position that was enunciated by President Reagan in NSDD 189:

"It is the policy of this Administration that, to the maximum extent possible, the products of fundamental research remain unrestricted. It is also the policy of this Administration that, where the national security requires control, the mechanism for control of information generated during federally-funded fundamental research in science, technology and engineering at colleges, universities and laboratories is classification". [123]

This policy has been subsequently endorsed by National Security Adviser Condoleezza Rice in a November 2001 letter and by several independent panels and experts. [124] For purposes of clarity, and in the interests of sound security policy, this approach should be ratified and sustained.

6.3 Create New Internal Checks on Secrecy

The President should establish new mechanisms within the Executive Branch to review and, where necessary, overrule controls on classified and unclassified scientific information. Such mechanisms could include new oversight bodies or enhanced versions of existing organizations.

The logic behind such a proposal is that while there are significant incentives for restricting information, both legitimate and illegitimate, there are no comparable incentives for removing such restrictions.

A new set of procedures is required to restore equilibrium to information security policy, and to ensure that information that no longer requires protection is promptly released from control. [125] There is a well-defined, though not entirely effective, mechanism for overseeing the national security classification system. Thus, the Information Security Oversight Office (ISOO) conducts periodic inspections and reviews classification and declassification plans. It also responds to questions and challenges from members of the public. The Interagency Security Classification Appeals Panel (ISCAP), established by Executive Order 12958, has made a significant contribution toward eliminating unwar-

ranted classification actions by its member agencies. Not even such limited internal oversight exists with respect to the increasingly diverse controls on so-called sensitive but unclassified information.

The President could direct the ISOO to expand its portfolio to encompass such sensitive but unclassified information, though to be effective this would require an infusion of new personnel and resources to an organization that is stretched thin. Similarly, the President could task ISCAP to receive and evaluate challenges to controls that have been imposed on unclassified information, in addition to its current oversight of classified information. To avoid diluting or diverting the efforts of these existing entities, it may be preferable to devise a new organization or interagency panel that can tackle controls on unclassified information, while bolstering the work already being performed on oversight of classified information.

6.4 Adopt an Affirmative Disclosure Policy

An administration and a Congress that recognize the value of transparency in science (and other areas of governance) should not simply dismantle unnecessary obstacles to public access, but should also positively affirm disclosure as the norm.

With respect to science in particular, two steps could usefully be adopted, one regarding external scientific advisory boards and one regarding internal agency deliberations.

6.4.1 Mandate Routine Publication of Advisory Committee Reports.

Agencies frequently turn to external advisory boards for expertise and independent review. In many cases such boards are subject to the FACA, and their records must ordinarily be disclosed upon request. In other cases, such as the JASON defense advisory group, advisory committee reports are not routinely disclosed and are hard to come by.

We propose that in every case where they are not otherwise exempt (e.g.,

due to national security classification), publication of all advisory committee reports should be required, either on the web site of the committee, if one exists, or on the web site of the sponsoring agency.

This norm of "pre-emptive disclosure" could be accomplished either through amendment of the FACA (which currently requires only that subject records "shall be available for public inspection and copying" under the Freedom of Information Act (FOIA)) or through executive order, or both.

6.4.2 Direct agencies to proactively disclose deliberative records when possible

To promote increased transparency, the President should issue an executive order to direct agencies whenever possible to publish internal policy assessments, advisory studies, and other briefing papers of public interest or lasting significance.

In certain sensitive areas of government policy, agencies require a zone of confidentiality to properly consider their options and to weigh alternatives. But all too often, such "confidentiality" has become the rule, not the exception.

An executive order directing disclosure of key deliberative documents would not preclude the possibility of confidential internal deliberations, which in fact are protected by the fifth exemption of the FOIA. But it would signal that openness is a positive value, not a weakness or a concession.

Appendices

Appendix I: The Questionnaire

The following text is the document sent to our various experts. As mentioned in the introduction, the intent was not for each respondent to answer all the questions, but rather to use them to stimulate a discussion. We found this tactic to be quite successful.

Our questions come in three areas:

I. Congress

(a) It's been nearly a decade since the Office of Technology Assessment (OTA) was de-funded. How well is the current system for providing timely, unbiased science and technology advice working? If there's a problem, how serious is it? Can you provide examples of a Congressional decision making process during the past few years that would clearly have been helped by better independent science or technology analysis?

(b) If you had $20-30 million a year to improve science and technology advice to Congress, how you spend it? How would you set priorities for the work?

(c) What are your views about the following options for strengthening Congressional S&T advice:

1. add new functions to CRS or GAO (how well is the current GAO experiment working?)
2. refund OTA with its original charter
3. start a new congressional organization with freshly defined mission and

authority

4. giving the National Academies a regular annual budget for studies in support of critical policy needs (how should the topics be selected? What fraction of the funds should be available to the Academies for topics of their own choosing?)

5. encourage the formation of a new, privately funded organization?

(d) If a new or strengthened organization is established, what control would Congress need over such an entity? Would a large, permanent staff, answerable to Congress alone, be required? Or could a small staff assemble ad hoc groups of scientists to address problems as needed?

(e) How well does the existing hearing process generate effective information on critical science and technology issues? How well does the record examine legitimate disagreements and uncertainties? If there's a problem, how can it best be remedied?

• Should there be a formal change in rules to ensure that critical issues are effectively covered for the public record or a new set of guidelines from the leadership?

• Recognizing that committee rules take precedence, and that the majority party will always control hearings, would it be possible to have some non- or bipartisan group recommend at least some of the witnesses? SHOULD there be a mechanism to select witnesses through an impartial group, to provide more balance?

II. The Administration

(a) What role should the Office of Science and Technology Policy play? Should it be an independent entity within the Executive Branch, or should it act as an overseer and coordinator of science offices within the various Departments? How effective are the science offices within the various Departments?

(b) How effective is OSTP? Should its role be strengthened? If so, how?

(c) The National Security Council (NSC) has specific authority that the OSTP does not:

a. The NSC statute calls for a National Security Committee, chaired by the president. Other members include the National Security Advisor, who is specifically mentioned as a special assistant to the president

b. The NSC statue calls for a national security council, which is headed by the NSA. The NSC is involved in all security-related decisions.

c. The OSTP statute says there's a head of the OSTP, with some staff

d. The OSTP statute calls for OSTP to do other Departments' bidding by responding to requests from them; major lack of autonomy

Should OSTP be given similar authority?

(d) Should OSTP be given a formal role in establishing R&D budget priorities?

(e) The OSTP statute requires reports, but these are either not produced or are perfunctory. Is there a way to make these reports more useful? Or is this symptomatic of a more serious problem? Does anyone care about these reports, or are they viewed as a product of a useless office?

(f) Are other models for providing public science and technology advice, analysis, and public discussion of issues appropriate for strengthening national science and technology advice? For example:

- The SEC has an Office of Economic Analysis that, in addition to performing analyses for the SEC, is encouraged to publish in peer-reviewed journals and present results to interested parties across the country.
- The Surgeon General has a similar bully pulpit for health related activities.
- Federally Funded Research and Development Centers, such as the RAND Science and Technology Policy Institute, that provide analytic support for OSTP.

(g) Some of our members are concerned that federal advisory boards do not fairly reflect the opinions of science and technology experts, that they are not given adequate information, that their reports are not made available in a timely or complete way. If there is a problem, are there statutory remedies?

III. Openness and Access to Information

1. Are expanding controls on official information interfering with the deliberative process? Are these controls degrading the quality of information available to the public? What level of information is needed by the public?

- Is the proliferation of new mechanisms for restricting unclassified infor-

mation -- such as Sensitive Homeland Security Information (SHSI), Sensitive Security Information (SSI), and Sensitive But Unclassified (SBU) -- having an adverse impact? To what extent can we even know?

• Is the scope of national security classification properly defined and applied? Are mechanisms in place to ensure timely declassification and correction of inappropriate classification decisions? How will we know when bad decisions have been made?

• To what extent can active measures to increase transparency, disclosure and dissemination contribute to a revitalized deliberative process?

• How would you assess the health and utility of the Freedom of Information Act? What changes to the Act are needed?

• How would you assess the state of the Federal Advisory Committee Act and other "open meeting" provisions? What changes, if any, would you propose?

Appendix II: Legislation Creating the Office of Science & Technology Policy

The Office of Science and Technology Policy was created as part of Public Law 94-282 (signed by the President May 6, 1976).

Title 42, Chapter 79, Subchapter II of the United States Code:

Sec. 6611. - Establishment of Office

There is established in the Executive Office of the President an Office of Science and Technology Policy (hereinafter referred to in this subchapter as the ''Office'')

Sec. 6612. - Director; Associate Directors

There shall be at the head of the Office a Director who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall be compensated at the rate provided for level II of the Executive Schedule in section 5313 of title 5. The President is authorized to appoint not more than four Associate Directors, by and with the advice and consent of the Senate, who shall be compensated at a rate not to exceed that provided for level III of the

Executive Schedule in section 5314 of such title. Associate Directors shall perform such functions as the Director may prescribe

Sec. 6613. - Functions of the Director

(a) The primary function of the Director is to provide, within the Executive Office of the President, advice on the scientific, engineering, and technological aspects of issues that require attention at the highest levels of Government.

(b) In addition to such other functions and activities as the President may assign, the Director shall -

(1) advise the President of scientific and technological considerations involved in areas of national concern including, but not limited to, the economy, national security, health, foreign relations, the environment, and the technological recovery and use of resources;

(2) evaluate the scale, quality, and effectiveness of the Federal effort in science and technology and advise on appropriate actions;

(3) advise the President on scientific and technological considerations with regard to Federal budgets, assist the Office of Management and Budget with an annual review and analysis of funding proposed for research and development in budgets of all Federal agencies, and aid the Office of Management and Budget and the agencies throughout the budget development process; and

(4) assist the President in providing general leadership and coordination of the R&D programs of the Federal Government

Sec. 6614. - Policy planning; analysis; advice; establishment of advisory panel

(a) The Office shall serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. In carrying out the provisions of this section, the Director shall -

(1) seek to define coherent approaches for applying science and technology to critical and emerging national and international problems and for promoting coordination of the scientific and technological responsibilities and programs of the Federal departments and agencies in the resolution of such problems;

(2) assist and advise the President in the preparation of the Science and Technology Report, in accordance with section 6618 of this title;

(3) gather timely and authoritative information concerning significant developments and trends in science, technology, and in national priorities, both current and prospective, to analyze and interpret such information for the pur-

pose of determining whether such developments and trends are likely to affect achievement of the priority goals of the Nation as set forth in section 6601(b) of this title;

(4) encourage the development and maintenance of an adequate data base for human resources in science, engineering, and technology, including the development of appropriate models to forecast future manpower requirements, and assess the impact of major governmental and public programs on human resources and their utilization;

(5) initiate studies and analyses, including systems analyses and technology assessments, of alternatives available for the resolution of critical and emerging national and international problems amendable to the contributions of science and technology and, insofar as possible, determine and compare probable costs, benefits, and impacts of such alternatives;

(6) advise the President on the extent to which the various scientific and technological programs, policies, and activities of the Federal Government are likely to affect the achievement of the priority goals of the Nation as set forth in section 6601(b) of this title;

(7) provide the President with periodic reviews of Federal statutes and administrative regulations of the various departments and agencies which affect research and development activities, both internally and in relation to the private sector, or which may interfere with desirable technological innovation, together with recommendations for their elimination, reform, or updating as appropriate;

(8) develop, review, revise, and recommend criteria for determining scientific and technological activities warranting Federal support, and recommend Federal policies designed to advance

(A) the development and maintenance of broadly based scientific and technological capabilities, including human resources, at all levels of government, academia, and industry, and

(B) the effective application of such capabilities to national needs;

(9) assess and advise on policies for international cooperation in science and technology which will advance the national and international objectives of the United States;

(10) identify and assess emerging and future areas in which science and technology can be used effectively in addressing national and international problems;

(11) report at least once each year to the President and the Congress on

the overall activities and accomplishments of the Office, pursuant to section 6615 of this title;

(12) periodically survey the nature and needs of national science and technology policy and make recommendations to the President, for review and transmission to the Congress, for the timely and appropriate revision of such policy in accordance with section 6602(a)(6) of this title; and

(13) perform such other duties and functions and make and furnish such studies and reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

(b) (1) The Director shall establish an Intergovernmental Science, Engineering, and Technology Advisory Panel (hereinafter referred to as the ''Panel''), whose purpose shall be to

(A) identify and define civilian problems at State, regional, and local levels which science, engineering, and technology may assist in resolving or ameliorating;

(B) recommend priorities for addressing such problems; and

(C) advise and assist the Director in identifying and fostering policies to facilitate the transfer and utilization of R&D results so as to maximize their application to civilian needs.

(2) The Panel shall be composed of

(A) the Director of the Office, or his representative;

(B) at least ten members representing the interests of the States, appointed by the Director of the Office after consultation with State officials; and

(C) the Director of the National Science Foundation, or his representative.

(3) (A) The Director of the Office, or his representative, shall serve as Chairman of the Panel.

(B) The Panel shall perform such functions as the Chairman may prescribe, and shall meet at the call of the Chairman.

(4) Each member of the Panel shall, while serving on business of the Panel, be entitled to receive compensation at a rate not to exceed the daily rate prescribed for GS-18 of the General Schedule under section 5332 of title 5, including travel time, and, while so serving away from his home or regular place of business, he may be allowed travel expenses, including per diem in lieu of subsistence in the same manner as the expenses authorized by section 5703(b) of title 5 for persons in government service employed intermittently.

Sec. 6615. - Science and technology report and outlook

(a) Contents of report

Notwithstanding the provisions of Reorganization Plan Number 1 of 1977, the Director shall render to the President for submission to the Congress no later than January 15 of each odd numbered year, a science and technology report and outlook (hereinafter referred to as the ''report'') which shall be prepared under the guidance of the Office and with the cooperation of the Director of the National Science Foundation, with appropriate assistance from other Federal departments and agencies as the Office or the Director of the National Science Foundation deems necessary. The report shall include -

(1) a statement of the President's current policy for the maintenance of the Nation's leadership in science and technology;

(2) a review of developments of national significance in science and technology;

(3) a description of major Federal decisions and actions related to science and technology that have occurred since the previous such report;

(4) a discussion of currently important national issues in which scientific or technical considerations are of major significance;

(5) a forecast of emerging issues of national significance resulting from, or identified through, scientific research or in which scientific or technical considerations are of major importance; and

(6) a discussion of opportunities for, and constraints on, the use of new and existing scientific and technological information, capabilities, and resources, including manpower resources, to make significant contributions to the achievement of Federal program objectives and national goals.

(b) Printing; availability to public

The Office shall insure that the report, in the form approved by the President, is printed and made available as a public document

Sec. 6616. - Additional functions of Director

(a) Service as Chairman of Federal Coordinating Council for Science, Engineering, and Technology and as member of Domestic Council

The Director shall, in addition to the other duties and functions set forth in this subchapter -

(1) serve as Chairman of the Federal Coordinating Council for Science, Engineering, and Technology established under subchapter IV of this chapter; and

(2) serve as a member of the Domestic Council.

(b) Advice to National Security Council

For the purpose of assuring the optimum contribution of science and technology to the national security, the Director, at the request of the National Security Council, shall advise the National Security Council in such matters concerning science and technology as relate to national security.

(c) Officers and employees; services; contracts; payments

In carrying out his functions under this chapter, the Director is authorized to -

(1) appoint such officers and employees as he may deem necessary to perform the functions now or hereafter vested in him and to prescribe their duties;

(2) obtain services as authorized by section 3109 of title 5 at rates not to exceed the rate prescribed for grade GS-18 of the General Schedule by section 5332 of title 5; and

(3) enter into contracts and other arrangements for studies, analyses, and other services with public agencies and with private persons, organizations, or institutions, and make such payments as he deems necessary to carry out the provisions of this chapter without legal consideration, without performance bonds, and without regard to section 5 of title 41

Sec. 6617. - Coordination with other organizations

(a) Consultation and cooperation with Federal departments and agencies; utilization of consultants; establishment of advisory panels; consultation with State and local agencies, professional groups, and representatives of industry, etc.; hearings; utilization of services, personnel, equipment, etc., of public and private agencies and organizations, and individuals

In exercising his functions under this chapter, the Director shall -

(1) work in close consultation and cooperation with the Domestic Council, the National Security Council, the Council on Environmental Quality, the Council of Economic Advisers, the Office of Management and Budget, the National Science Board, and the Federal departments and agencies;

(2) utilize the services of consultants, establish such advisory panels, and, to the extent practicable, consult with State and local governmental agencies, with appropriate professional groups, and with such representatives of industry, the universities, agriculture, labor, consumers, conservation organizations, and such other public interest groups, organizations, and individuals as he deems advisable;

(3) hold such hearings in various parts of the Nation as he deems necessary, to determine the views of the agencies, groups, and organizations referred to in paragraph (2) of this subsection and of the general public, concerning national

needs and trends in science and technology; and

(4) utilize with their consent to the fullest extent possible the services, personnel, equipment, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order to avoid duplication of effort and expense, and may transfer funds made available pursuant to this chapter to other Federal agencies as reimbursement for the utilization of such personnel, services, facilities, equipment, and information.

(b) Information from Executive departments, agencies, and instrumentalities

Each department, agency, and instrumentality of the Executive Branch of the Government, including any independent agency, is authorized to furnish the Director such information as the Director deems necessary to carry out his functions under this chapter.

(c) Assistance from Administrator of National Aeronautics and Space Administration

Upon request, the Administrator of the National Aeronautics and Space Administration is authorized to assist the Director with respect to carrying out his activities conducted under paragraph (5) of section 6614(a) of this title

Sec. 6618. - Major science and technology proposals

The Director shall identify and provide an annual report to Congress on each major multinational science and technology project, in which the United States is not a participant, which has a total estimated cost greater than $1,000,000,000

Appendix III: Legislation Creating the National Security Council

The National Security Council was established by the National Security Act of 1957 (Public Law 235-61 Stat. 496).

TITLE 50 > CHAPTER 15 > Sec. 402

Sec. 402. - National Security Council

(a) Establishment; presiding officer; functions; composition

There is established a council to be known as the National Security Council (hereinafter in this section referred to as the ''Council'').

The President of the United States shall preside over meetings of the Coun-

cil: Provided, That in his absence he may designate a member of the Council to preside in his place.

The function of the Council shall be to advise the President with respect to the integration of domestic, foreign, and military policies relating to the national security so as to enable the military services and the other departments and agencies of the Government to cooperate more effectively in matters involving the national security.

The Council shall be composed of -

(1) the President;

(2) the Vice President;

(3) the Secretary of State;

(4) the Secretary of Defense;

(5) the Director for Mutual Security;

(6) the Chairman of the National Security Resources Board; and

(7) the Secretaries and Under Secretaries of other executive departments and of the military departments, the Chairman of the Munitions Board, and the Chairman of the Research and Development Board, when appointed by the President by and with the advice and consent of the Senate, to serve at his pleasure.

(b) Additional functions

In addition to performing such other functions as the President may direct, for the purpose of more effectively coordinating the policies and functions of the departments and agencies of the Government relating to the national security, it shall, subject to the direction of the President, be the duty of the Council -

(1) to assess and appraise the objectives, commitments, and risks of the United States in relation to our actual and potential military power, in the interest of national security, for the purpose of making recommendations to the President in connection therewith; and

(2) to consider policies on matters of common interest to the departments and agencies of the Government concerned with the national security, and to make recommendations to the President in connection therewith.

(c) Executive secretary; appointment; staff employees

The Council shall have a staff to be headed by a civilian executive secretary who shall be appointed by the President. The executive secretary, subject to the direction of the Council, is authorized, subject to the civil-service laws and chapter 51 and subchapter III of chapter 53 of title 5, to appoint and fix the

compensation of such personnel as may be necessary to perform such duties as may be prescribed by the Council in connection with the performance of its functions.

(d) Recommendations and reports

The Council shall, from time to time, make such recommendations, and such other reports to the President as it deems appropriate or as the President may require.

(e) Participation of Chairman or Vice Chairman of Joint Chiefs of Staff

The Chairman (or in his absence the Vice Chairman) of the Joint Chiefs of Staff may, in his role as principal military adviser to the National Security Council and subject to the direction of the President, attend and participate in meetings of the National Security Council.

(f) Participation by Director of National Drug Control Policy

The Director of National Drug Control Policy may, in the role of the Director as principal adviser to the National Security Council on national drug control policy, and subject to the direction of the President, attend and participate in meetings of the National Security Council.

(g) Board for Low Intensity Conflict

The President shall establish within the National Security Council a board to be known as the ''Board for Low Intensity Conflict''. The principal function of the board shall be to coordinate the policies of the United States for low intensity conflict.

(h) Committee on Foreign Intelligence

(1) There is established within the National Security Council a committee to be known as the Committee on Foreign Intelligence (in this subsection referred to as the ''Committee'').

(2) The Committee shall be composed of the following:

(A) The Director of Central Intelligence.

(B)The Secretary of State.

(C) The Secretary of Defense.

(D) The Assistant to the President for National Security Affairs, who shall serve as the chairperson of the Committee.

(E) Such other members as the President may designate.

(3) The function of the Committee shall be to assist the Council in its activities by -

(A) identifying the intelligence required to address the national security interests of the United States as specified by the President;

(B) establishing priorities (including funding priorities) among the programs, projects, and activities that address such interests and requirements; and

(C) establishing policies relating to the conduct of intelligence activities of the United States, including appropriate roles and missions for the elements of the intelligence community and appropriate targets of intelligence collection activities.

(4) In carrying out its function, the Committee shall -

(A) conduct an annual review of the national security interests of the United States;

(B) identify on an annual basis, and at such other times as the Council may require, the intelligence required to meet such interests and establish an order of priority for the collection and analysis of such intelligence; and

(C) conduct an annual review of the elements of the intelligence community in order to determine the success of such elements in collecting, analyzing, and disseminating the intelligence identified under subparagraph (B).

(5) The Committee shall submit each year to the Council and to the Director of Central Intelligence a comprehensive report on its activities during the preceding year, including its activities under paragraphs (3) and (4).

(i) Committee on Transnational Threats

(1) There is established within the National Security Council a committee to be known as the Committee on Transnational Threats (in this subsection referred to as the ''Committee'').

(2) The Committee shall include the following members:

(A) The Director of Central Intelligence.

(B) The Secretary of State.

(C) The Secretary of Defense.

(D) The Attorney General.

(E) The Assistant to the President for National Security Affairs, who shall serve as the chairperson of the Committee.

(F) Such other members as the President may designate.

(3) The function of the Committee shall be to coordinate and direct the activities of the United States Government relating to combatting transnational threats.

(4) In carrying out its function, the Committee shall -

(A) identify transnational threats;

(B) develop strategies to enable the United States Government to respond to transnational threats identified under subparagraph (A);

(C) monitor implementation of such strategies;

(D) make recommendations as to appropriate responses to specific transnational threats;

(E) assist in the resolution of operational and policy differences among Federal departments and agencies in their responses to transnational threats;

(F) develop policies and procedures to ensure the effective sharing of information about transnational threats among Federal departments and agencies, including law enforcement agencies and the elements of the intelligence community; and

(G) develop guidelines to enhance and improve the coordination of activities of Federal law enforcement agencies and elements of the intelligence community outside the United States with respect to transnational threats.

(5) For purposes of this subsection, the term ''transnational threat'' means the following:

(A) Any transnational activity (including international terrorism, narcotics trafficking, the proliferation of weapons of mass destruction and the delivery systems for such weapons, and organized crime) that threatens the national security of the United States.

(B) Any individual or group that engages in an activity referred to in subparagraph (A).

(j) Participation of Director of Central Intelligence

The Director of Central Intelligence (or, in the Director's absence, the Deputy Director of Central Intelligence) may, in the performance of the Director's duties under this Act and subject to the direction of the President, attend and participate in meetings of the National Security Council.

(i)[128] Special Adviser to the President on International Religious Freedom

It is the sense of the Congress that there should be within the staff of the National Security Council a Special Adviser to the President on International Religious Freedom, whose position should be comparable to that of a director within the Executive Office of the President. The Special Adviser should serve as a resource for executive branch officials, compiling and maintaining information on the facts and circumstances of violations of religious freedom (as defined in section 6402 of title 22), and making policy recommendations. The Special Adviser should serve as liaison with the Ambassador at Large for International Religious Freedom, the United States Commission on International Religious Freedom, Congress and, as advisable, religious nongovernmental or-

ganizations

Sec. 402a. - Coordination of counterintelligence activities

(a) Establishment of Counterintelligence Policy Board

There is established within the executive branch of Government a National Counterintelligence Policy Board (in this section referred to as the ''Board''). The Board shall report to the President through the National Security Council.

(b) Function of Board

The Board shall serve as the principal mechanism for -

(1) developing policies and procedures for the approval of the President to govern the conduct of counterintelligence activities; and

(2) resolving conflicts, as directed by the President, which may arise between elements of the Government which carry out such activities.

(c) Coordination of counterintelligence matters with Federal Bureau of Investigation

(1) Except as provided in paragraph (5), the head of each department or agency within the executive branch shall ensure that -

(A) the Federal Bureau of Investigation is advised immediately of any information, regardless of its origin, which indicates that classified information is being, or may have been, disclosed in an unauthorized manner to a foreign power or an agent of a foreign power;

(B) following a report made pursuant to subparagraph (A), the Federal Bureau of Investigation is consulted with respect to all subsequent actions which may be undertaken by the department or agency concerned to determine the source of such loss or compromise; and

(C) where, after appropriate consultation with the department or agency concerned, the Federal Bureau of Investigation undertakes investigative activities to determine the source of the loss or compromise, the Federal Bureau of Investigation is given complete and timely access to the employees and records of the department or agency concerned for purposes of such investigative activities.

(2) Except as provided in paragraph (5), the Director of the Federal Bureau of Investigation shall ensure that espionage information obtained by the Federal Bureau of Investigation pertaining to the personnel, operations, or information of departments or agencies of the executive branch, is provided through appropriate channels in a timely manner to the department or agency concerned, and that such departments or agencies are consulted in a timely manner with respect to espionage investigations undertaken by the Federal Bureau of Investigation

which involve the personnel, operations, or information of such department or agency.

(3) (A) The Director of the Federal Bureau of Investigation shall submit to the head of the department or agency concerned a written assessment of the potential impact of the actions of the department or agency on a counterintelligence investigation.

(B) The head of the department or agency concerned shall -

(i) use an assessment under subparagraph (A) as an aid in determining whether, and under what circumstances, the subject of an investigation under paragraph (1) should be left in place for investigative purposes; and

(ii) notify in writing the Director of the Federal Bureau of Investigation of such determination.

(C) The Director of the Federal Bureau of Investigation and the head of the department or agency concerned shall continue to consult, as appropriate, to review the status of an investigation covered by this paragraph, and to reassess, as appropriate, a determination of the head of the department or agency concerned to leave a subject in place for investigative purposes.

(4) (A) The Federal Bureau of Investigation shall notify appropriate officials within the executive branch, including the head of the department or agency concerned, of the commencement of a full field espionage investigation with respect to an employee within the executive branch.

(B) A department or agency may not conduct a polygraph examination, interrogate, or otherwise take any action that is likely to alert an employee covered by a notice under subparagraph (A) of an investigation described in that subparagraph without prior coordination and consultation with the Federal Bureau of Investigation.

(5) Where essential to meet extraordinary circumstances affecting vital national security interests of the United States, the President may on a case-by-case basis waive the requirements of paragraph (1), (2), or (3), as they apply to the head of a particular department or agency, or the Director of the Federal Bureau of Investigation. Such waiver shall be in writing and shall fully state the justification for such waiver. Within thirty days, the President shall notify the Select Committee on Intelligence of the Senate and the Permanent Select Committee on Intelligence of the House of Representatives that such waiver has been issued, and at that time or as soon as national security considerations permit, provide these committees with a complete explanation of the circumstances which necessitated such waiver.

(6) The Director of the Federal Bureau of Investigation shall, in consultation with the Director of Central Intelligence and the Secretary of Defense, report annually, beginning on February 1, 1995, and continuing each year thereafter, to the Select Committee on Intelligence of the Senate and to the Permanent Select Committee on Intelligence of the House of Representatives and, in accordance with applicable security procedures, the Committees on the Judiciary of the House of Representatives and the Senate with respect to compliance with paragraphs (1) and (2) during the previous calendar year.

(7) Nothing in this section may be construed to alter the existing jurisdictional arrangements between the Federal Bureau of Investigation and the Department of Defense with respect to investigations of persons subject to the Uniform Code of Military Justice, nor to impose additional reporting requirements upon the Department of Defense with respect to such investigations beyond those required by existing law and executive branch policy.

(8) As used in this section, the terms ''foreign power'' and ''agent of a foreign power'' have the same meanings as set forth in sections[129]1801(a) and (b), respectively, of this title.

Appendix IV: Executive Order Establishing the Domestic Policy Council

The Domestic Policy Council was established by President Bill Clinton in Executive Order 12859 on August 17, 1993

By the authority vested in me as President by the Constitution and the laws of the United States of America, including sections 105, 107, and 301 of title 3, United States Code, it is hereby ordered as follows:

Section 1. Establishment. There is established the Domestic Policy Council ("the Council").

Sec. 2. Membership. The Council shall comprise the:

(a) President, who shall serve as a Chairman of the Council;

(b) Vice President;

(c) Secretary of Health and Human Services;

(d) Attorney General;

(e) Secretary of Labor;

(f) Secretary of Veterans Affairs;

(g) Secretary of the Interior;

(h) Secretary of Education;

(i) Secretary of Housing and Urban Development;

(j) Secretary of Agriculture;

(k) Secretary of Transportation;

(l) Secretary of Commerce;

(m) Secretary of Energy;

(n) Secretary of the Treasury;

(o) Administrator of the Environmental Protection Agency;

(p) Chair of the Council of Economic Advisers;

(q) Director of the Office of Management and Budget;

(r) Assistant to the President for Economic Policy;

(s) Assistant to the President for Domestic Policy;

(t) Assistant to the President and Director of the Office of National Service;

(u) Senior Advisor to the President for Policy Development;

(v) Director, Office of National Drug Control Policy;

(w) AIDS Policy Coordinator; and

(x) Such other officials of Executive departments and agencies as the President may, from time to time, designate.

Sec. 3. Meeting of the Council. The President, or upon his direction, the Assistant to the President for Domestic Policy ("the Assistant"), may convene meetings of the Council. The President shall preside over the meetings of the Council, provided that in his absence the Vice President, and in his absence the Assistant, will preside.

Sec. 4. Functions.

(a) The principal functions of the Council are:

(1) to coordinate the domestic policy-making process;

(2) to coordinate domestic policy advice to the President;

(3) to ensure that domestic policy decisions and programs are consistent with the President's stated goals, and to ensure that those goals are being effectively pursued; and (4) to monitor implementation of the President's domestic policy agenda. The Assistant may take such actions, including drafting a Charter, as may be necessary or appropriate to implement such functions.

(b) All executive departments and agencies, whether or not represented on the Council, shall coordinate domestic policy through the Council.

(c) In performing the foregoing functions, the Assistant will, when appropriate, work with the Assistant to the President for National Security Affairs and the Assistant to the President for Economic Policy.

Sec. 5. Administration.

(a) The Council may function through established or ad hoc committees, task forces or interagency groups.

(b) The Council shall have a staff to be headed by the Assistant to the President for Domestic Policy. The Council shall have such staff and other assistance as may be necessary to carry out the provisions of this order.

(c) All executive departments and agencies shall cooperate with the Council and provide such assistance, information, and advice to the Council as the Council may request, to the extent permitted by law.

President George W. Bush added homeland security functions to the Domestic Policy Council on January 23, 2003 via Executive Order 13284, excerpted below:

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Homeland Security Act of 2002 (Public Law 107-296), and the National Security Act of 1947, as amended (50 U.S.C. 401 et seq.), and in order to reflect responsibilities vested in the Secretary of Homeland Security and take other actions in connection with the establishment of the Department of Homeland Security, it is hereby ordered as follows:

Sec. 10. Executive Order 12859 of August 16, 1993 ("Establishment of the Domestic Policy Council"), is amended by:

(a) inserting "(o) Secretary of Homeland Security;" after "(n) Secretary of the Treasury;" in section 2; and

(b) relettering all subsequent subsections in section 2 appropriately.

Appendix V: Executive Order Establishing the National Science and Technology Council

President Bill Clinton established the National Science and Technology Council on November 23, 1993, via Executive Order 12881.

By the authority vested in me as President by the Constitution and the law of the United Stated of America, including section 301 of title 3, United States Code, it is hereby ordered as follows:

Section 1. Establishment. There is established the National Science and Technology Council ("the Council").

Section 2. Membership. The Council shall comprise the:

(a) President, who shall serve as Chairman of the Council;

(b) Vice President;

(c) Secretary of Commerce;

(d) Secretary of Defense;

(e) Secretary of Energy;

(f) Secretary of Health and Human Services;

(g) Secretary of State;

(h) Secretary of the Interior;

(i) Administrator, National Aeronautics and Space Administration;

(j) Director, National Science Foundation;

(k) Director of the Office of Management and Budget;

(l) Administrator, Environmental Protection Agency;

(m) Assistant to the President for Science and Technology;

(n) National Security Adviser;

(o) Assistant to the President for Economic Policy;

(p) Assistant to the President for Domestic Policy; and

(q) Such other officials of executive departments and agencies as the President may, from time to time, designate.

Section 3. Meetings of the Council. The President or, upon his direction, the Assistant to the President for Science and Technology ('the Assistant"), may convene meetings of the Council. The President shall preside over the meetings of the Council, provided that in his absence the Vice President, and in his absence the Assistant, will preside.

Section 4. Functions.

(a) The principal functions of the Council are, to the extent permitted by law:

1. to coordinate the science and technology policy-making process;

2. to ensure science and technology policy decisions and programs are consistent with the President's stated goals;

3. to help integrate the President's science and technology policy agenda across the Federal Government;

4. to ensure science and technology are considered in development and implementation of Federal policies and programs; and

5. to further international cooperation in science and technology.

The Assistant may take such actions, including drafting a Charter, as may be necessary or appropriate to implement such functions.

(b) All executive department and agencies, whether or not represented on the Council, shall coordinate science and technology policy through the council and shall share information on research and development budget requests with the council.

(c) The Council shall develop for submission to the Director of the Office of Management and Budget recommendations on R&D budgets that reflect national goals. In addition, the Council shall provide advice to the Director of the Office of Management and Budget concerning the agencies' R&D budget submissions.

(d) The Assistant will, when appropriate, work in conjunction with the Assistant to the President for Economic Policy, the Assistant to the President for Domestic Policy, the Director of the Office of Management and Budget, and the National Security Adviser.

Section 5. Administration.

(a) The Council will oversee the duties of the Federal Coordinating Council for Science, Engineering, and Technology, the National Space Council, and the National Critical Materials Council.

(b) The Council may function through established or ad hoc committees, task forces, or interagency groups.

(c) To the extent practicable and permitted by law, executive departments and agencies shall make resources, including, but not limited to, personnel, office support, and printing, available to the Council as requested by the Assistant.

(d) All executive departments and agencies shall cooperate with the Council and provide such assistance, information, and advice to the Council as the Council may request, to the extent permitted by law.

Executive Order 12384 was issued by President George Bush to include homeland security functions in the NTSC.

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Homeland Security Act of 2002 (Public Law 107-296), and the National Security Act of 1947, as amended (50 U.S.C. 401 et seq.), and in order to reflect responsibilities vested in the Secretary of Homeland Security and take other actions in connection with the establishment of the Department of Homeland Security, it is hereby ordered as fol-

lows:

Sec. 9. Executive Order 12881 of November 23, 1993 ("Establishment of the National Science and Technology Council"), is amended by:

(a) inserting "(i) Secretary of Homeland Security;" after "(h) Secretary of the Interior;" in section 2; and

(b) relettering all subsequent subsections in section 2 appropriately.

Appendix VI: Executive Order Establishing the President's Council of Advisors on Science and Technology

President Bill Clinton created the President's Council of Advisors on Science and Technology on November 23, 1993 with Executive Order 12882.

President's Committee of Advisors on Science and Technology

By the authority vested in me as President by the Constitution and the laws of the United States of America, including section 301 of title 3, United States Code, and in order to establish an advisory committee on science and technology, it is hereby ordered as follows:

Section 1. Establishment. There is established the President's Committee of Advisors on Science and Technology ("PCAST"). PCAST shall be composed of not more than 16 members, one of whom shall be the Assistant to the President for Science and Technology ("Assistant"), and 15 of whom shall be distinguished individuals from the nonfederal sector appointed by the President. The nonfederal sector members shall be representative of the diverse perspectives and expertise in this Nation's investments in science and technology. The Assistant to the President for Science and Technology shall co-chair PCAST with a nonfederal sector member selected by the President.

Sec. 2. Functions. (a) The PCAST shall advise the President, through the Assistant, on matters involving science and technology. (b) In the performance of its advisory duties, PCAST shall assist the National Science and Technology Council ("Council") in securing private sector involvement in its activities.

Sec. 3. Administration. (a) The heads of executive departments and agencies shall, to the extent permitted by law, provide PCAST such information with respect to scientific and technological matters as required for the purpose of carrying out its functions.

(b) In consultation with the Assistant to the President for Science and

Technology, PCAST is authorized to convene ad hoc working groups to assist the Council.

(c) Members of PCAST shall serve without any compensation for their work on PCAST. However, members may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by law for persons serving intermittently in the government service (5 U.S.C. 5701–5707).

(d) Any expenses of PCAST shall be paid from the funds available for the expenses of the Office of Science and Technology Policy.

(e) The Office of Science and Technology Policy shall provide such administrative services as may be required.

Sec. 4. General. (a) I have determined that the Committee shall be established in compliance with the Federal Advisory Committee Act, as amended (5 U.S.C. App.). Notwithstanding any other Executive order, the functions of the President under the Federal Advisory Committee Act, as amended, except that of reporting to the Congress, which are applicable to PCAST shall be performed by the Office of Science and Technology Policy in accordance with the guidelines and procedures established by the Administrator of General Services.

(b) PCAST shall terminate 2 years from the date of this order unless extended prior to that date.

ofrpc12

(c) Executive Orders Nos. 12700, 12768, and Section 2 of Executive Order No. 12869 are hereby revoked.

ofrpc12

This executive order was extended several times, most recently by President Bush with Executive Order 13226 on September 30, 2001.

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Federal Advisory Committee Act, as amended (5 U.S.C. App.), and in order to establish an advisory committee on science and technology, it is hereby ordered as follows:

Section 1. Establishment. There is established the President's Council of Advisors on Science and Technology (PCAST). The PCAST shall be composed of not more than 25 members, one of whom shall be a Federal Government official designated by the President (the "Official"), and 24 of whom shall be nonfederal members appointed by the President and have diverse perspectives and expertise in science, technology, and the impact of science and technology on the Nation. The Official shall co-chair PCAST with a nonfederal member designated by the President.

Sec. 2. Functions. (a) The PCAST shall advise the President, through the Official, on matters involving science and technology policy.

(b) In performance of its advisory duties, the PCAST shall assist the National Science and Technology Council (NSTC) in securing private sector involvement in its activities.

Sec. 3. Administration. (a) The heads of the executive departments and agencies shall, to the extent permitted by law, provide the PCAST with information concerning scientific and technological matters when requested by the PCAST co-chairs.

(b) In consultation with the Official, the PCAST is authorized to convene ad hoc working groups to provide preliminary nonbinding information and advice directly to the PCAST.

(c) Members shall serve without compensation for their work on the PCAST. However, members may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by law for persons serving intermittently in the government service (5 U.S.C. 5701-5707).

(d) Any expenses of the PCAST shall be paid from the funds available for the expenses of the Office of Science and Technology Policy.

(e) The Office of Science and Technology Policy shall provide such administrative services as the PCAST may require, with the approval of the Official.

Sec. 4. General. (a) Notwithstanding any other Executive Order, the functions of the President with respect to the PCAST under the Federal Advisory Committee Act, as amended, except that of reporting to the Congress, shall be performed by the Office of Science and Technology Policy in accordance with the guidelines and procedures established by the Administrator of General Services.

(b) The PCAST shall terminate 2 years from the date of this order unless extended by the President prior to that date.

(c) Executive Order 12882 of November 23, 1993; Executive Order 12907 of April 14, 1994; and section 1(h) of Executive Order 13138 of September 30, 1999, are hereby revoked.

Appendix VII: Senate Legislation to Make Permanent GAO's Technology Assessment Function

Introduced by Senators Jeff Bingaman (D-NM) and Joseph Lieberman (D-CT) on June 22, 2004.

S. 2556

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. GENERAL ACCOUNTING OFFICE TECHNOLOGY ASSESSMENTS.

(a) Findings and Purposes.--

(1) Findings.--Congress finds that--

(A) it is important for Congress to be better informed regarding the impact of technology on matters of public concern, including implications for economic, national security, social, scientific, and other national policies and programs;

(B) on a pilot basis, the General Accounting Office has demonstrated a capacity to perform independent and objective technology assessments for Congress; and

(C) the development of a cost-effective and efficient capacity for timely and deliberate technology assessments by the General Accounting Office requires the commitment of additional resources and administrative flexibility given the current resource constraints of the General Accounting Office.

(2) Purposes.--The purposes of this Act are to--

(A) direct the establishment of a technology assessment capability in the General Accounting Office;

(B) ensure the quality of such technology assessments in order to enhance the ability of Congress to address complex technical issues in a more timely and effective manner; and

(C) condition the development of a technology assessment capability in the General Accounting Office on the provision of adequate additional resources and administrative flexibility.

(b) Technology Assessments.--Chapter 7 of title 31, United States Code, is amended by inserting after section 720 the following:

``Sec. 721. Technology assessments

``(a) The General Accounting Office shall establish a technology assessment capability to coordinate and prepare information for Congress relating to the policy implications of applications of technology.

``(b) The Comptroller General may establish standards and procedures to govern technology assessments performed under this section as the Comptroller General determines necessary.

``(c) Technology assessments performed under this section shall--

``(1) provide Congress with timely and objective information to contribute to legislative consideration of technology applications and their policy implications, including thorough reports, in-depth studies, and short-term consultations;

``(2) be undertaken by the Comptroller General with special attention to the technical expertise and policy analysis skills needed to perform a prospective assessment of technology applications and policy implications;

``(3) be designed, to the extent practicable, to review an application of technology to an issue of public interest, including consideration of benefits, cost, and risks from such technology; and

``(4) include peer review by persons and organizations of appropriate expertise.

``(d) In performing technology assessments, the Comptroller General shall be properly apprised of Federal and non-Federal entities providing information to Congress to--

``(1) enable effective coverage of critical issues; and

``(2) avoid duplication of effort.

``(e) Technology assessments performed under this section may be initiated as provided under section 717(b).

``(f)(1) In consultation with the National Academy of Sciences, the Comptroller General shall establish a technology assessment advisory panel to provide advice on technology assessments performed under this section, methodologies, possible subjects of study, and the means of improving the quality and timeliness of technology assessment services provided to Congress.

``(2) The advisory panel shall consist of 5 members, who by reason of professional background and experience, are specially qualified to advise on technology assessments.

``(3) Terms on the advisory panel shall--

``(A) be for a period of 2 years; and

``(B) begin on January 1, on each year in which a new Congress is convened.

``(4) Notwithstanding section 1342, for the purposes of establishing a technology assessment advisory panel, the Comptroller General may accept and use voluntary and uncompensated services (except for reimbursement of travel expenses). Individuals providing such voluntary and uncompensated services shall not be considered Federal employees, except for purposes of chapter 81 of title 5 and chapter 171 of title 28.

``(g)(1) In order to gain access to technical knowledge, skills, and expertise necessary for a technology assessment performed under this section, the Comptroller General may utilize individuals and enter into contracts or other arrangements to acquire needed expertise with any agency or instrumentality of the United States, with any State, territory, or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution.

``(2) Contracts and other arrangements under this subsection may be entered into--

``(A) with or without reimbursement; and

``(B) without regard to section 3709 of the Revised Statutes (41 U.S.C. 5) or section 3324 of this title.

``(h) The Comptroller General shall submit to Congress an annual report

on technology assessment activities of the General Accounting Office.

``(i)(1) There are authorized to be appropriated to the General Accounting Office to carry out the activities described in this section, $2,000,000 for each of fiscal years 2004, 2005, and 2006.

``(2) Technology assessments under this section may not be performed during fiscal years 2004, 2005, and 2006, unless a sufficient annual appropriation is provided for such fiscal years.''.

(c) Technical and Conforming Amendment.--The table of sections for chapter 7 of title 31, United States Code, is amended by inserting after the item relating to section 720 the following:

``721. Technology assessments.''.

Appendix VIII: House Legislation to Make Permanent GAO's Technology Assessment Function

108th CONGRESS

2d Session

H. R. 4670

To provide for the establishment of a Center for Scientific and Technical Assessment.

IN THE HOUSE OF REPRESENTATIVES

June 23, 2004

Mr. HOLT (for himself, Mr. HOUGHTON, Mr. BOEHLERT, Mr. MORAN of Virginia, Mr. HONDA, Mr. GORDON, Mr. MCDERMOTT, Mr. WAXMAN, Mr. OLVER, Mr. GREENWOOD, Mr. CASTLE, Mr. VAN HOLLEN, Mr. FROST, Mr. BERMAN, Mr. RUPPERSBERGER, and Mr. EHLERS) introduced the following bill; which was referred to the Committee on Science

A BILL

To provide for the establishment of a Center for Scientific and Technical Assessment.

Be it enacted by the Senate and House of Representatives of the United

States of America in Congress assembled,

SECTION 1. CENTER FOR SCIENTIFIC AND TECHNICAL ASSESSMENT.

(a) Establishment- There shall be established a Center for Scientific and Technical Assessment (in this section referred to as the `Center') to provide timely advice to the Congress on scientific and technical aspects of public policy issues. The Center shall be administered by a Director.

(b) Technical Assessment Board-

(1) Establishment and purpose- There shall be established a Technical Assessment Board whose purpose shall be to provide guidance to the Director of the Center to ensure that the Center provides timely and useful responses to congressional requests.

(2) Membership- The Technical Assessment Board established under paragraph (1) shall consist of--

(A) 6 members of the Senate appointed by the President Pro Tempore of the Senate, including 3 from the majority party and 3 from the minority party;

(B) 6 members of the House of Representatives appointed by the Speaker of the House of Representatives, including 3 from the majority party and 3 from the minority party;

(C) the Comptroller General; and

(D) the Director of the Congressional Research Service and the Director of the Center, who shall be nonvoting members.

Service as a member on the Technical Assessment Board shall not be construed under the rules of the House of Representatives or the Senate as service as a member of a House of Representatives or Senate Committee.

(3) Vacancies- Vacancies in the membership of the Technical Assessment Board shall not affect the authority of the remaining members to act, and such vacancies shall be filled in the same manner as in the case of the original appointment.

(4) Chairman and vice chairman- There shall be selected at the beginning of each Congress a chairman and a vice chairman, one of whom shall be a member of the Senate selected by the members of the Technical Assessment Board who are members of the Senate from among their number, and one of whom shall be a member of the House of Representatives selected by the members of the Technical Assessment Board who are members of the House of Representatives from among their number. The chairmanship and vice chairmanship shall alternate between the Senate and the House of Representatives with each year. The chairman during each odd-numbered year shall be a member of the House of Representatives. The vice chairman shall act in the place of the chairman in the absence of the chairman.

(5) Authority to act- The Technical Assessment Board established under this subsection may sit and act at such places and times as it chooses, including during the sessions, recesses, and adjourned periods of Congress.

(c) Director and Deputy Director-

(1) Director- The Director of the Center shall be appointed by the Comptroller General with the approval of the Technical Assessment Board and shall serve for a term of 6 years unless sooner removed by the Technical Assessment Board. The Director shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

(2) Powers and duties- In addition to the powers and duties vested by this section, the Director shall exercise such powers and duties as may be delegated by the Technical Assessment Board. The Director, with the permission of the Comptroller General, shall have the authority to hire, remove, or promote permanent staff and enter into contracts for consultants, expert analysis, and peer reviewers described in subsection (f). In consultation with the Technical Assessment Board and with the approval of the Comptroller General, the Director shall prepare the annual budget for the Center for submission to Congress.

(3) Deputy director- The Director may appoint, with the approval of the Comptroller General, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Direc-

tor. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

(4) Conflicts of interest- Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Comptroller General, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Center makes any contract or other arrangement under this section.

(d) Congressional Requests-

(1) In general- Any member of Congress may make requests to the Technical Assessment Board that the Center conduct an investigation and report to the requester, within a specified time period, on any matter relating to scientific and technical assessment.

(2) Formal calls for requests- The chairman of the Technical Assessment Board established under subsection (b) shall submit to all members of Congress formal calls for requests under this subsection.

(3) Prioritization- Requests under paragraph (1) shall be addressed by the Center in accordance with the following priority order:

(A) Requests with bipartisan and bicameral support.

(B) Requests with bipartisan support.

(C) Requests from other members.

The Director, with the approval of the Technical Assessment Board, may determine the final priority for consideration of and fulfilling requests among and within each category described in subparagraphs (A) through (C).

(e) Advisory Panels- The Director may establish an advisory panel as necessary to support each technical assessment report provided by the Center. Such panels shall not be subject to the Federal Advisory Committee Act (5 U.S.C. App.).

(f) Peer Review- Each report requested under this subsection shall be subject to peer review before delivery to the committee or member of Congress requesting the report. Such peer review shall consist of rigorous vetting, checking, criticism, and recommendations for improvement by independent, qualified ex-

perts in the various aspects of the subject of the request under study. Independent experts shall assess each Center report by considering the scientific method, factual accuracy, results, and conclusions put forward by the authors. The peer reviewers' comments shall be given to the report authors to allow for change, improvement, and modification of the report before delivery to the Director. After final review by the Director, and the approval of the Technical Assessment Board, the report shall be delivered to the committee or member of Congress requesting the report.

(g) Public Release- Except for classified reports, the Center, with the permission of the Technical Assessment Board, shall promptly release a report requested under subsection (d) to the public, except that such release shall be delayed by not more than 2 weeks at the request of the Technical Assessment Board or a member of Congress.

(h) Authorization of Appropriations- There are authorized to be appropriated to the Comptroller General for carrying out this section $30,000,000 for each of the fiscal years 2005 through 2007, to remain available until expended.

Endnotes

[1] Michael Gough, ed., Politicizing Science: The Alchemy of Policymaking (Stanford: Hoover Institution Press, 2003). When discussing how science ought to be applied to public policy, the editor writes on page two, "Those ideals do not exist, have never existed, and probably never will."

[2] M. Granger Morgan and Jon Peha, eds., Science and Technology Advice for Congress (Washington, D.C.: Resources for the Future, 2003).

[3] " 'Just pick up a list of committee hearings and run through the subjects they are dealing with,' Representative Rush Holt (D-NJ) said recently. 'Telecommunications, encryption, health care decline, national missile defense, purity of prescription medicine, fuel efficiency. I don't think that anybody would say there wouldn't be enough work for such an agency.' " Jim Dawson, "Legislation to Revive OTA Focuses on Science Advice to Congress," Physics Today 54, no. 10 (2001): 24.

[4] Representative Henry A. Waxman (D-CA), the Ranking Member of the House Committee on Government Reform, has compiled a website (http://www.house.gov/reform/min/politicsandscience/) with details of many allegations.

[5] The Union of Concerned Scientists has a substantial website, http://www.ucsusa.org/global_environment/rsi/index.cfm, which includes the report, Scientific Integrity in Policymaking, detailing several dozen allegations of science misuse, and a statement signed by 62 National Medal of Science winners, 48 Nobel Laureates, 8 Crafoord Prize winners and 133 members of the National Academy of Sciences voicing their concern over the misuse of science by the current Bush administration.

[6] See, for example, "Access all areas," The Economist, 7 August 2004, 64-65.

[7] In an effort to undermine research showing that smoking is harmful the "…tobacco [industry] quietly formed a coalition of industries that would challenge every aspect of government science, from its studies of global warming to auto safety. They called their group, formed in 1993, the Advancement of Sound Science Coalition."

Franklin Foer, "Closing of the Presidential Mind," The New Republic, 5 July 2004 and 12 July 2004, 17-21.

[8] Section 211(k) of the Clean Air Act.

[9] National Research Council, Ozone-Forming Potential of Reformulated Gasoline (Washington, D.C.: National Academies Press, May 1999), p. 4.

[10] Much of the information in this section is taken from the Congressional Research Service, "MTBE in Gasoline: Clean Air and Drinking Water Issues," Report 98-290 ENR, 11 August 2003.

[11] Nelson Antosh, "Declining MTBE Sales Claim Two Local Victims," Houston Chronicle, 22 July 2003, at B1. Another major MTBE plant in the Houston area closed down in early September 2003. See "Company to End Plant's MTBE Production," Houston Chronicle, 6 September 2003, at C2.

[12] http://www.epa.gov/otaq/regs/fuels/ostpexec.pdf.

[13] http://www.epa.gov/OMS/consumer/fuels/oxypanel/blueribb.htm.

[14] http://www.epa.gov/fedrgstr/EPA-TOX/2000/March/Day-24/t7323.htm.

[15] Thomas O. McGarity, "MTBE: A Precautionary Tale," Harvard Environmental Law Review 28 no. 281 (2004).

[16] U.S.C. Title 42, §7545(c)(2)(C).

[17] Congressional Research Service, "The Safe-Harbor Provision for Methyl Tertiary Butyl Ether (MTBE)," RS21676, updated 4 June 2004.

[18] The Toxic Substances Control Act of 1976 provides an elaborate process for determining when data should be gathered for new chemicals.

[19] U.S. Congress, Office of Technology Assessment, Protecting the Nation's Groundwater From Contamination, OTA-O-233 (Washington, D.C.: October 1984).

[20] U.S. Congress, Office of Technology Assessment, Urban Ozone and the Clean Air Act: Problems and Proposals for Change (Washington, D.C.: April 1988).

[21] For a detailed discussion see McGarity (2004).

[22] Letter quoted in Washington Fax, 2 May 2002.

[23] I. Wilmut et al., "Viable offspring derived from fetal and adult mammalian cells," Nature 385, 27 February 1997, 810-813.

[25] Section 128 of Public Law 104-99 (signed January 26, 1996). Note that this was an omnibus appropriations bill but explicitly included the ban on embryo creation for research.

[26] Congressional Research Service (CRS), "Stem Cell Research," RL31015, August 2004.

[27] The cloning report was requested subsequently, in February 1997 and completed in

June 1997. A separate review of stem cells was requested in November 1998 and completed in September 1999.

[28] Bioethics.georgetown.edu/nbac/.

[29] Judith Johnson, "Stem Cell Research," CRS RL31015, 22 July 2004.

[30] http://stemcells.nih.gov/info/scireport/execSum.asp.

[31] www.whitehouse.gov/news/releases/2001/08/20010809-2.html.

[32] http://www.georgetown.edu/research/nrcbl/nbac/transcripts/may01/5-15-01.pdf.

[33] www.bioethics.gov/reports/executive.html.

[34] See CRS RL31015 for a detailed analysis of the counting controversy.

[35] In FY 2004, only $25 million was requested by the Bush administration for embryonic stem cell research. In contrast, over $190 million was requested for adult stem cell research.

Ruth R. Faden and John D. Gearhart, "Facts on Stem Cells," The Washington Post, 23 August 2004.

[36] The committee report that accompanies H.R. 534 makes this point quite clearly. H.R. 534 was introduced and referred to the Judiciary Committee on February 5, 2003 and was reported out of committee a week later, on February 12, 2003. During the committee markup on February 12, Rep. Nadler (D-NY) questioned Chairman Sensenbrenner (R-WI) on the lack of hearings. Mr. Sensenbrenner's reply indicated that the House leadership wanted to proceed regardless of the Judiciary Committee's actions.

[37] National Research Council, Institute of Medicine, Stem Cells and the Future of Regenerative Medicine (Washington, D.C.: National Academies Press, 2002). Available at http://www.nap.edu/books/0309076307/html/. This study was not requested by Congress or an Executive Branch agency but instead was initiated by the National Research Council and funded by the National Academies and the Ellison Foundation.

[38] U.S. Congress, Office of Technology Assessment, Neural Grafting: Repairing the Brain and Spinal Cord, OTA-BA-462 (Washington, D.C.: 1990).

[39] U.S. Congress, Office of Technology Assessment, Excess Embryos. Infertility: Medical and Social Choices, OTA-BA-358 (Washington, D.C.: May 1988).

[40] http://www.hfea.gov.uk/AboutHFEA/About%20the%20HFEA.pdf.

[41] Gregg Herken, Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI (Stanford: Stanford University Press, 2000), p. 221.

[42] U.S.C. Title 42, Chapter 79, Subchapter II, Section 6613.

[43] Ibid.

[44] Ibid.

[45] "Keyworth soon made it plain that his interpretation of the roles of science adviser differed dramatically from that of his predecessors-telling the OSTP staff, for example, that they should consider themselves 'the president's slaves.' During his first weeks in office, Keyworth further demonstrated his loyalty to the administration by supporting the massive military buildup announced by Reagan's secretary of defense, Caspar Weinberger. The new science adviser also publicly defended the administration's decision to dramatically reduce federal funds for basic scientific research and to cut the National Science Foundation's budget by one fourth." Herken, p. 201.

[46] "Keyworth's identification with the Densepack fiasco bore an unexpected cost for the science adviser, in terms both of his political influence within the administration and his credibility with his peers in the scientific community." Herken, p. 207.

[47] Prior to Bromley, Presidential science advisors were Special Assistants to the President, several ranks below Assistant. During G. H. W. Bush's administration, there was a move in Congress-with strong bipartisan support-to elevate the science advisor to official Cabinet rank, rather than the unofficial position held by Bromley. This was strongly opposed by OMB Director Richard Darman and was eventually defeated.

[48] D. Allan Bromley, The President's Scientists: Reminiscences of a White House Science Advisor (New Haven: Yale University Press, 1994).

[49] David Malakoff, "White House Denies Playing Politics With Science," Science 303 (5 March 2004): 1446-1447.

[50] Andrew Lawler, "How Much Space for Science," Science 303 (January 2004): 610-612.

[51] http://www.ostp.gov/html/PAESMEM5-6-04.pdf.

[52] http://www.ostp.gov/html/_reportfacts.html.

[53] National Science and Technology Council (NSTC), "Methylmercury in the Gulf of Mexico: State of Knowledge and Research Needs," June 2004.

[54] U.S.C. Title 50, Chapter 15, Section 402.

[55] A detailed historical study and critique of the NSC can be found at http://www.brook.edu/dybdocroot/comm/policybriefs/pb068/pb68.htm: Ivo Daalder and I.M. Destler, "A New NSC for a New Administration," Brookings Institution Policy Brief #68, November 2000.

[56] During the 1950s and 1960s staff routinely stayed through several administrations. As an example, David Z. Beckler worked for PSAC for every President from Eisenhower through Nixon.

[57] At one point during the Clinton administration an interagency project joining the Department of Housing and Urban Development (HUD) and the Department of Energy (DoE) was nearly thrown off the rails when the Secretary of HUD told the Secretary of DoE at the last minute that he was not welcome at the announcement. The science advisor had to rush to the rescue.

[58] The PCAST was first used by President George H. W. Bush in 1990. President Clinton formally established PCAST in 1993 with Executive Order 12882; the membership was increased from 16 to 19 in 1994.

[59] D. Allan Bromley, The President's Scientists: Reminiscences of a White House Science Advisor.

[60] http://ostp.gov/Energy/index.html, http://ostp.gov/pcast/youngletter.html.

[61] Carnegie Commission on Science, Technology and Government, Science and Technology and the President: A Report to the Next Administration (New York: Carnegie Corporation, January 1997).

[62] http://www.rand.org/scitech/stpi/AuthAct.pdf.

[63] http://www.rand.org/scitech/stpi/about.html.

[64] U.S.C. Title 42, Chapter 16, Sec 1863 (j)(2): "The Board shall render to the President for submission to the Congress reports on specific, individual policy matters related to science and engineering and education in science and engineering, as the Board, the President, or the Congress determines the need for such reports."

[65] National Science Board, Federal Research Resources: A Process for Setting Priorities (Washington, D.C.: National Science Foundation, 11 October 2001).

[66] From the SEC website, http://www.sec.gov/about/economic.shtml.

[67] From the SEC website, http://www.sec.gov/about/economic/ea-employment.htm.

[68] Carnegie Commission on Science, Technology and Government, Science, Technology, and Congress: Organizational and Procedural Reforms (New York: Carnegie Corporation, February 1994). The report called for a specific budget allocation for education, science, and technology. Were this sub-allocation set for each subcommittee, "it would be possible for Congress to develop an overall priority for 'education, science, and technology' and see it carried through all stages of the budget process."

[69] Center for the Study of the Presidency, Advancing Innovation: Improving the S&T Advisory Structure and Policy Process, Report to the President-Elect 2000. (Winter, 2000).

[70] National Academy of Engineering, Mastering a New Role: Shaping Technology Policy for National Economic Performance (Washington, D.C.: National Academies Press, 1993).

[71] The history of OTA can be traced at http://www.wws.princeton.edu/~ota/.

[72] Note that the GAO has more than 3,300 staff: http://www.gao.gov/sp/d04534sp.pdf.

[73] Taken from http://www.wws.princeton.edu/~ota/ns20/proces_f.html.

[74] This led to relationship problems between Congress and OTA: many members felt OTA was not responsive to their needs, and others were simply unaware of its existence.

[76] Carnegie Commission on Science, Technology and Government, Science, Technology, and Congress: Analysis and Advice from the Congressional Support Agencies (New York: Carnegie Corporation, October 1991).

[77] If so directed, CRS will not indicate to staff in the same office the nature of other requests.

[78] Christopher T. Hill, "An Expanded Analytical Capability in the Congressional Research Service, the General Accounting Office, or the Congressional Budget Office," pp. 106-117, in Science and Technology Advice for Congress, M.Granger Morgan and Jon M. Peha, editors, Resources for the Future, Washington DC, 2003.

[79] The report, GAO-03-174, is available at http://www.gao.org/cgi-bin/getrpt?GAO-03-174. The study was requested by Chairman Sherwood Boehlert and Ranking Minority Member Ralph Hall of the House Committee on Science; Senators Jeff Bingaman, Pete Domenici, Joseph Lieberman and Pat Roberts; and Representatives Vernon Ehlers, Rush Holt, Amo Houghton, and James Moran.

[80] The reviewers were Robert W. Fri, M. Granger Morgan and William A. (Skip) Stiles, Jr. Robert Fri has served as deputy administrator of the EPA and the Energy Research and Development Administration; M. Granger Morgan is head of the Department of Engineering and Public Policy at Carnegie Mellon University; and William Stiles served as a staff member in the House of Representatives, including Legislative Director of the House Science Committee and staff liaison to the Office of Technology Assessment.

[81] General Accounting Office, Technology Assessment: Cybersecurity for Critical Infrastructure Protection, GAO-04-321 (Washington, D.C.: May 2004). Funding for this study was officially approved on July 10, 2002 and the topic was selected on April 28, 2003.

[82] From the CBO website: http://www.cbo.gov/Mission.cfm.

[83] Act of Incorporation of the National Academy of Sciences, March 3, 1863. Available at http://www7.nationalacademies.org/archives/nasincorporation.html.

[84] As an example, the recent NAS study on potassium iodide distribution (Distribution and Administration of Potassium Iodide in the Event of a Nuclear Incident) was requested by Congressman Edward J. Markey (D-MA) in P.L. 107-188, Public Health Security and Bioterrorism Preparedness Response Act of 2002, and funded by the Centers for Disease Control and Prevention.

[85] See www.nas.edu. Also Ahearne, John F and Peter D Blair, "Expanded Use of the National Academies," in Morgan and Peha op. cit at [78] p. 172.

[86] Ahearne and Blair in Morgan and Peha p.119-121.

[87] Ibid. p. 119.

[88] An informal survey by Peter Blair indicates that there are over 50 former OTA employees at the Academy, including Blair himself.

[89] Ahearne and Blair, op. cit.

[90] National Research Council, Arsenic in Drinking Water: 2001 Update (Washington, D.C.: National Academies Press, 2001).

[91] Ahearne and Blair, op. cit., p. 122

[92] National Research Council, Making the Nation Safer: The Role of Science and Technology in Countering Terrorism, National Academies Press, Washington, D.C., 2002.

[93] "Executive Privilege" is the notion "that the constitutional principle of separation of powers implies that the Executive Branch has a privilege to resist certain encroachments by Congress and the judiciary, including some requests for information" (http://writ.news.findlaw.com/dorf/20020206.html). In practice, this means that some advisors to the president can not be compelled to testify before Congress.

[94] The National Economic Council was created in 1993 by President Bill Clinton in Executive Order 12835 (available at http://www.archives.gov/federal_register/executive_orders/1993_clinton.html). The principal functions are to coordinate policy making for domestic and international economic issues, coordinate economic policy advice for the President, ensure that policy decisions and programs are consistent with the President's economic goals, and monitor implementation of the President's economic policy agenda.

[95] The Domestic Policy Council was created in 1993 by President Bill Clinton in Executive Order 12859 (available at http://www.archives.gov/federal_register/executive_orders/pdf/12859.pdf) and amended by President George W. Bush in 2003 in Executive Order 13284 (available at http://frwebgate1.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=411925503012+7+0+0&WAISaction=retrieve). The Council includes the President, Vice President, many Cabinet Secretaries and the Assistants to the President for Economic Policy and Domestic Policy. The Assistant to the President for Domestic Policy has the ability to convene and preside over the Council. Further details are available online at http://www.whitehouse.gov/dpc/.

[96] Center for the Study of the Presidency, op. cit.

[97] Carnegie Commission, Science and Technology and the President: A Report to the Next Administration, January 1997.

[98] Ibid.

[99] The JASONs is an independent group of distinguished scientists and technical researchers that provides analysis of critical national security issues. JASON membership is carefully balanced to provide a wide spectrum of scientific expertise and technical analysis in theoretical and experimental physics, materials, information sciences, and other allied disciplines. The JASON process ensures senior government leaders have the full range of U.S. academic expertise available on issues critical to national security involving classified and unclassified information. See http://www.dtic.mil/descriptivesum/Y2000/DARPA/PE0602301E-

R-1%2312.pdf.

[100] OMB Budget Documents (http://www.whitehouse.gov/omb/budget/fy2005/pdf/spec.pdf).

[101] Carnegie Commission on Science, Technology and Government, Science, Technology, and Congress: Expert Advice and the Decision-Making Process (New York: Carnegie Corporation, February 1991). The panel recommended that the Congress "devise a way to make direct requests for certain studies to the National Academy of Sciences complex."

[102] If properly constructed, this would remove some of the burden from the National Science Board, and allow it to concentrate on NSF.

[103] M. Granger Morgan and Jon M. Peha, eds., Science and Technology Advice for Congress.

[104] U.S. House of Representatives, Hon. Amo Houghton (R-NY), Congressional Record, Extension of Remarks (28 September 28 1995), pp. E1868-1870.

[105] U.S. House of Representatives, Legislative Branch Appropriations Act, 2005 (12 July 2004), H5494 (at frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname=2004_record&page=H5494&position=all).

[106] H.R. 4670. See Appendix VIII for the complete bill.

[107] Rep. Holt introduced a version of this bill as an amendment to the H.R. 4755, the Legislative Branch Appropriations Act for FY 05. The amendment was defeated 115-252, probably because funding the GAO project required a decrease in funding for the Architect of the Capitol and the Government Printing Office.

[108] S. 2556. See Appendix VII for the complete bill.

[109] Sen. Jeff Bingaman, in the Senate Congressional Record, June 22, 2004, pp. 7178-7193.

[110] U.S. Senate, statement by Senators Akaka and Chafee, Congressional Record (5 May 2004), S4901.

[111] Judy Schneider, "Congress' Early Organizational Meetings," Congressional Research Service Report 96-675 GOV. Available at http://www.house.gov/rules/96-657.htm.

[112] As an example, a session on coal mining would include experts from the coal industry, the timber industry, and environmentalists.

[113] An example is the Brookings Institution/American Enterprise Institute training sessions for new Members of Congress.

[114] http://www.tech-forum.org/upcoming/archive.htm.

[115] http://www.tech-forum.org/about.htm.

[116] http://www.tech-forum.org/.

[117] Daniel S. Greenberg, Science, Money, and Politics (Chicago: The University of Chicago Press, 2001), p. 473.

[118] Available at http://www.aps.org/public_affairs/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=49633.

[119] Opening statements from the March 3, 2004 hearing are available at http://www.house.gov/science/hearings/full04/index.htm.

[120] Press release available at http://www.house.gov/science/press/108/108-198.htm.

[121] For background on the arguments in favor of scientific openness and the almost equally well-known critique of current security policies see, for example:

"Report of the Defense Science Board Task Force on Secrecy," July 1970, available at

http://www.fas.org/sgp/othergov/dsbrep.html; Congressional Research Service, "Sensitive But Unclassified and Other Federal Security Controls on Scientific and Technical Information: History and Current Controversy," updated 2 July 2003, available at http://www.fas.org/sgp/crs/RL31845.pdf; Harold C. Relyea, Silencing Science: National Security Controls and Scientific Communication (Ablex Publishing, 1994); Herbert N. Foerstel, Secret Science: Federal Control of American Science and Technology (Praeger Publishers, 1993).

[122] See Department of Energy, "Report of the Fundamental Classification Policy Review Group," chaired by Dr. Albert Narath, January 1997. At http://www.fas.org/sgp/library/repfcprg.html.

[123] The White House, National Security Decision Directive (NSDD) 189, "National Policy on the Transfer of Scientific, Technical and Engineering Information," 21 September 1985. At http://www.fas.org/irp/offdocs/nsdd/nsdd 189.htm.

[124] Letter from Condoleeza Rice to Harold Brown, 1 November 2001, available at http://www.fas.org/sgp/bush/cr110101.html. A 2002 panel led by John Hamre of the Center for Strategic and International Studies (CSIS) stressed the importance of this policy: http://www.csis.org/css/ExecSummary.pdf.

[125] See Steven Aftergood, "Making Sense of Government Information Restrictions," Issues in Science and Technology (Summer 2002); available at http://www.issues.org/issues/18.4/stalk.htm.

[128] So in original. Probably should be "(k)."

[129] So in original. Probably should be "section."

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