Experience with the President's Science Advisory Committee, its Panels, and Other Modes of Advice

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Abstract

When Dwight Eisenhower became President in January 1953, the United States had just tested November 1, 1952 its 11-megaton prototype of a hydrogen bomb, and Eisenhower sought enduring peace and savings by basing the U.S. military strategy on nuclear weaponry and a downsizing of the military forces.

The detonation by the Soviet Union of a 400-kt fusion-containing device in August 1953 enhanced concern about U.S. vulnerability, and in early 1954 the unexpectedly large yield of the U.S. BRAVO test elevated fears for the actual survival of societies against the nuclear threat. Eisenhower initially sought a world moratorium on nuclear tests, but was unable to win over his Administration. On March 27, 1954, he met with an obscure Scientific Advisory Committee of the Office of Defense Mobilization (SAC-ODM) for a mutual exploration of what science and technology might bring to national security. The resulting 42-man (!) Technological Capabilities Panel (TCP) had a remarkable impact on the President himself and on the direction of the country's strategic missile and intelligence activities and structure, as well as a new emphasis on federal support of university research.

Rooted in MIT Summer Studies, the TCP reported on March 17, 1955 on the problems of surprise attack, the overall U.S. offensive capability, and, especially, on its Part V, *"Intelligence: Our First Defense Against Surprise."* That panel, chaired by Edwin Land, inventor of polarizing sheet and instant photography, originated the U-2 and OXCART (SR-71) strategic reconnaissance aircraft and the CORONA film-return imaging satellites.

The President's Science Advisory Committee (PSAC) was created in the White House in 1957 from the SAC-ODM and had major impact throughout the 1960s until its termination by President Richard Nixon in 1973. The presentation traces its story and that of some of its panels from personal experience of the author and his colleagues.

Here I try to strike a balance between reporting the early days of the President's scientific advisory apparatus and giving deserved attention to other mechanisms and other times.

As I indicated in the Abstract, the PSAC was an outgrowth of the Technological Capabilities Panel[1], in which the SAC to the Office of Defense Mobilization (ODM) had its first important contact with President Eisenhower.

James R. Killian, President of MIT, headed the TCP and his skill at organizing and presenting earned praise and esteem in this difficult role of explaining the existential hazard that would be posed by Soviet and U.S. possession of thermonuclear weapons.

Important impacts were on the military, to expand and accelerate the development and deployment of intercontinental ballistic missiles and submarine-launched strategic missiles, to explore defenses against missiles, and on the intelligence side, to very secretly develop and deploy the U-2 subsonic reconnaissance aircraft and the SR-71, Mach-3 titanium aircraft for overflight of denied territory, and the first film-return reconnaissance satellites.

[1] This introduction owes much to: Damms, R. V. (2000), James Killian, the Technological Capabilities Panel, and the Emergency of President Eisenhower' "Scientific-Technological Elite". Diplomatic History, 24: 57–78. doi: 10.1111/1467-7709.00198

The TCP and the ensuing PSAC provided President Eisenhower analysis, advice, and support for the President's commitment to arms control and diplomacy, although it did not achieve his heartfelt priority of a comprehensive ban on nuclear explosive tests—CTBT. In his farewell statement to the American people he characterized the failure to obtain a universal ban on nuclear weapon tests as the greatest failure of his or of any administration.

For the record I append a list of the members of PSAC and the SAC (ODM) of 1951 through 1973, when President Nixon abolished PSAC.

Post-WWII science in the United States and of the science advisory apparatus owe much to William T. Golden, who wrote for President Harry S. Truman organizing documents for the National Science Foundation and for making use of scientific advice to the presidency.

In 1980, Bill Golden published a special issue of Technology and Society devoted to *Science Advice to the President*, published also in book form as the first in a series that included *Science Advice to the Congress and the Judiciary*, and *Worldwide Science Advice*…

The second edition of *Science Advice to the President* was published in 1993, with additional chapters, including two pages from former President Gerald R. Ford, who wrote, in reference to President Nixon's abolition of PSAC and the Office of Science and Technology, *"On the more immediate topic of the structure of the White House scientific advisory apparatus, there was no doubt in my mind that it should be restored. The new Office of Science and Technology Policy took its place with the other strong units of Presidential staff—the Office of Management and Budget, the Domestic Council, the National Security Council and all the others—and played its role in helping me on the tasks which had any science and technology components."*

Back to the substance and impact of PSAC and White House Science.

Here are a couple of pictures of the product of the Intelligence Panel of the TCP and the follow-on "Land Panel", chaired by Edwin H. Land, of which I was a member 1960-73.

The SR-71 OXCART Mach-3 Recon Aircraft

The HEXAGON photographic satellite vehicle. Length 60 ft; diameter 10 ft

Aerial Recovery By C-130

~~SECRET~~
Handle via
BYEMAN-TALENT-KEYHOLE

My chapter in the Bill Golden book is posted on my website[2], so I don't repeat that here. As part of a compilation of articles on PSAC and other aspects of science advice to presidents, it could concentrate on certain problems as well as accomplishments.

But I quote here from a December 2, 1969 letter for discussion in PSAC,

> (Page 179) *" While PSAC/OST has a record of important successes, its involvement has been in many cases almost accidental. For instance, the PSAC Vietnam Panel last month heard from Dr. Chester Cooper of the IDA and formerly on the staff of McGeorge Bundy, the President's Special Assistant for National Security Affairs. Dr. Cooper discussed with us decision-making in regard to Vietnam, making clear the secrecy, the ignorance, and the confusion attending our involvement in and conduct of this non-war with a non-organization at a time when the PSAC Naval Warfare Panel and the PSAC Military Aircraft Panel and the PSAC Vietnam Panel were all intensively involved in the war, Chet Cooper did not know of the existence of PSAC and thus had no idea of the informed support and resources available to him right in this building. In fact, he didn't learn of the existence or nature of PSAC until he went to work for the Institute of*

[2] http://www.fas.org/rlg/Presidential_Science_Advising_000080.PSA.doc

Defense Analyses where he is now Director of the International and Social Studies Division."

As a group of 18, PSAC met for two sequential days each month in the Old Executive Office Building (Eisenhower Executive Office Building) for a full agenda of discussion, presentations, and review of panel reports. At any time there were about a dozen PSAC panels, of 10-15 members, typically including one or two PSAC members. Access to classified material permitting, PSAC members were allowed to sit in on panel activities although that right was rarely exercised. All PSAC members had high-level security clearances, although some of the panels were involved with special clearances, especially those dealing with space and intelligence.

I was a member for the entire lifespan of PSAC (and before) of the Strategic Military Panel, dealing with the threat from Soviet nuclear weapons, and U.S. capabilities for defense against ballistic missile attack as well as for response. The air component of Soviet bombers and U.S. air defense and U.S. bombers was covered by the Military Aircraft Panel, which I recall that I chaired for this entire period.

The work of the standing and *ad hoc* panels informed PSAC and usually led to a written report or a series of annual reports nominally to the President, but which had impact throughout the government.

Of course, PSAC was more than physicists, and other scientists, including chemists and physicians, made major contributions. For instance, John Tukey (Mathematics, Princeton University and Bell Labs), in addition to being a member of the Intelligence Panel of TCP and of the Land Panel, headed an *ad hoc* panel on insecticides and pesticides, and on "Restoring the Quality of Our Environment." I had contributed to this initiative by photocopying and distributing at a PSAC session Rachel Carson's articles from the New Yorker about insecticides and pesticides.

One of our physicist colleagues from MIT, Jerrold Zacharias, took a rather sanguine view of insecticides and pesticides, as giving us the upper hand, "… until the bugs learn to spray back." Actually, the bugs learned first to be resistant to the chemicals that we used against them, and this resistance applied not only to insect pests in the agricultural world, but also to microbes that attacked humans.

A major contributor to PSAC was the late Paul Doty (Biochemistry, Harvard University) a PSAC member 1961-64, but also a member of the TCP. Doty

contributed mightily to PSAC competence in biochemistry, but especially in understanding the threat posed by chemical and biological warfare, at the beginning of the molecular biological revolution in biological weapons.

Ivan Bennett, physician, PSAC member and Vice Chair of PSAC, chaired a panel on chemical and biological warfare, of which Doty and I were members. This responded to a direct request by National Security Advisor Henry A. Kissinger for such a PSAC panel, and a report was duly provided to Kissinger and to President Nixon. In fact, the scientific and technical considerations taken into account by the PSAC panel were a small part of the activity going on at the time, as amply described in a 2009 case study of President Nixon's decision to renounce the U.S. offensive biological weapons program[3].

President Nixon, quite unexpectedly to the PSAC Panel, issued an Executive Order renouncing all U.S. offensive biological weapon research, and not only the stockpiling and deployment of BW agents that was a more conservative position. When queried explicitly by the Bennett Panel how toxins should be treated (organic poisons producing by living things, or their synthetic equivalents) Nixon expanded the unilateral renunciation to include toxins.

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[3] CASE STUDY SERIES 1, *President Nixon's Decision to Renounce the U.S. Offensive Biological Weapons Program, by* Jonathan B. Tucker and Erin R. Mahan, Center for the Study of Weapons of Mass Destruction, National Defense University, October 2009. http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA517679

The U.S. then began a diplomatic initiative to cast such renunciations into a universal treaty format, with formal success on the 1972 Biological and Toxin Weapons Convention[4]. It seems, however, that the Soviet Union did not accept the sincerity of the United States in its Executive Order and BW Convention, and continued an active BW program.

PSAC was, from the beginning, little involved in beating the drums for science support from the government. It was felt that its principal task was to support the presidency in the use of science and technology to aid the U.S. government, and that there would be both real and perceived conflict of interest if there were a substantial PSAC effort to encourage the U.S. government in its support of science and technology.

Those PSAC panels concerned with national security were much involved with technical matters. For instance, my Military Aircraft Panel included Luis W. Alvarez, inventor and developer of GCA (Ground-Controlled Approach) that had great impact on the ability of U.S. and British forces to fly (and land)

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[4] Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, http://www.opbw.org/

aircraft in all weather at British bases, without adding anything to the aircraft, and little to the training of the pilots.

We looked at current and potential roles and missions for aircraft and wrote many reports advocating a separation between reconnaissance and strike, including "bombing by navigation" against targets that had been identified and placed in a universal navigation grid. We did technical studies on "time difference of arrival" or navigation and positioning by multilateration, including specific recommendations to deploy what later became GPS. The MAP and other panels of the PSAC attempted to help with the conduct of the war in Vietnam, by helping to originate the use of LORAN-D for the emplacement of sensors at known positions in the landscape, and the delivery of munitions with respect to those sensors, all by navigation.

The MAP pioneered an expanded role for drone aircraft, for surveillance and reconnaissance, as well as weapon delivery.

As White House interest extended far beyond the military, so the role of the Military Aircraft Panel expanded to civil aircraft and eventually to studies of the northeast transportation corridor from Washington to Boston and to personal rapid transit.

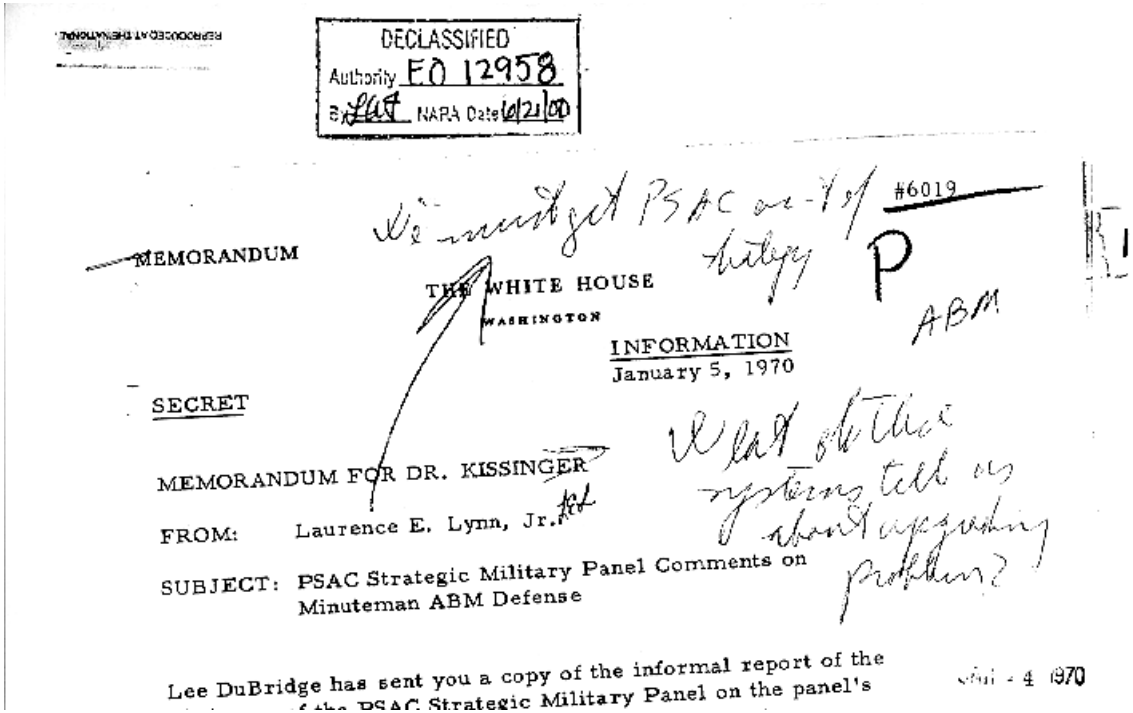
The Strategic Military Panel (like most other PSAC panels) met two days each month for many years, and was a major participant in U.S. studies of the effectiveness of missile defense and of ensuring the penetration of nuclear weapons against possible missile defenses, whether the interceptors were armed with nuclear warheads or not.

Each year, in preparation for the budget decisions, the SMP would provide the President an assessment of the current proposal of the U.S. army for ballistic missile defense of the country or, in some cases, of the strategic offensive retaliatory missile force. Carrying out its responsibility, the Army had a program every year ready for deployment. It had excellent contractors for the radar and interceptor in the AT&T Bell Telephone Laboratories, and for phenomenology of reentry physics, the MIT Lincoln Laboratory. The SMP assessed much work by Lincoln and Bell Labs on measurements of reentry phenomenology, both optical and radar, which might be used in discriminating real ballistic missile warheads from decoys.

Every year we would write the President in a Top Secret memo that the system would have this or that performance, but that it could be nullified with technical

countermeasures, with tactics, or it could be overwhelmed by numbers of incoming reentry vehicles. Or destroyed by a small fraction of the warheads.

The enthusiasm with which the President's National Security Advisor (Henry Kissinger for President Nixon) received these substantive highly classified reports is clear from Kissinger's annotation on a declassified memo[5] from his aide:



DECLASSIFIED
Authority EO 12958
By LLT NARA Date 6/21/00

We must get PSAC out of strategy

#6019

MEMORANDUM

THE WHITE HOUSE
WASHINGTON

INFORMATION
January 5, 1970

SECRET

MEMORANDUM FOR DR. KISSINGER

FROM: Laurence E. Lynn, Jr.

SUBJECT: PSAC Strategic Military Panel Comments on Minuteman ABM Defense

What's their system tell us about upgrading problem?

Lee DuBridge has sent you a copy of the informal report of the ... PSAC Strategic Military Panel on the panel's ... 4 1970

"We must get PSAC out of strategy."

[5] "Missile Defense Thirty Years Ago: Déjà Vu All Over Again?" Edited by William Burr, December 18, 2000. http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB36/index.html

Conflict between supporters of the BMD systems and the objective analysis of PSAC probably contributed to Nixon's eliminating PSAC in early 1973, at the end of my second four-year term. PSAC members, including Jerry Wiesner, then a consultant-at-large, had carefully asked the PSAC chair, President's Science Advisor Lee Dubridge, whether they should resign from PSAC in order to provide their own personal testimony to Congressional hearings on the antiballistic missile (ABM or BMD) system. Having asked the President, Dr. Dubridge reported that PSAC members should not resign—that it was important for the Congress to have the personal views of the members. But other White House staff were undoubtedly unhappy with such testimony, and with my own on the commercial Supersonic Transport (SST) program that I had long studied both in and out of government.

Informal interactions among PSAC and panel members led to good things, too, as with my noticing that my neighbor at the PSAC conference table, John Tukey, was writing Fourier sums during some presentation or discussion that had nothing to do with Fourier series. He told me of the suggestion by British mathematician I.J. Good that would allow doubling the number of points in a Fourier transform without quadrupling the number of multiplications.

This was just what the doctor ordered not only for my own computer experiments on hexagonal close packed solid He-3, but also for many applications of Fourier transform in science and engineering and national security. I immediately requested support from Herman Goldstine, Director of Mathematical Sciences in the IBM Research Division, who persuaded one James W. Cooley to work with John Tukey. In short order, they produced the Cooley-Tukey paper, algorithm, and FORTRAN code that would do a Fourier transform of n points in $n \cdot \ln(n)$ multiplications rather than n^2—no great difference for a 10-point transform, but an enormous advance in the 20,000 point transform I was attempting at the time, and of incomparable value if one wanted the equivalent of the Fourier transform of an image of 10^7 pixels.

Even at that time, there were government think tanks (Federally Funded Research and Development Centers—FFRDCs) that did many studies for the government, and one of the priorities of PSAC, at its beginning in 1957, was to institutionalize S&T leadership within each of the government departments and agencies. Paradoxically, the existence of a Chief Scientist or of an Under Secretary for R&D or S&T in the agencies did not reduce the need for PSAC or for technical competence on the part of the Office of Science and Technology (OST) which in addition to its day-to-day role in working with the Office of Management and Budget (OMB) and in providing technically literate communication among

agencies, provided support for PSAC in the form of panel staff (typically an Executive Secretary).

When I was first involved with such matters in Washington, I urged PSAC and OST staff to help create an audio teleconferencing capability that would allow discussion of Secret materials via the open telephone, with a combination of strong encryption and the necessary compression of the digitized voice. This was available among government locations (on special high bandwidth lines) and eventually over the public switched telephone system (PSTS) using devices such as the STU-3[6].

Now that encryption is ubiquitous over the web, and speech compression is the basis of all VOIP or cell-phone voice communication, and that Virtual Private Networks (VPN) provide a similar capability, it would be highly desirable to extend this to advisory committees and especially to smaller panels so that travel and scheduling problems would be much eased for work on classified topics. Even more important would be the reduction of delay and the benefits of timely communication.

[6] Secure Telephone Unit.

But there are serious problems with such a technological and sociological fix, because others are willing to expend significant resources to obtain the information that is under discussion. There are opportunities to compromise the smartphone or other instrument that is being used, if it is not permanently in a controlled space, and to observe or listen to the decrypted voice or display.

Still, it would be very valuable to obtain such a capability, even though it involved a dedicated terminal or smartphone.

Departmental S&T Advisory Boards or Committees

The military services each had at least one and probably several advisory committees, as did the National Security Agency. In addition, the Secretary of Defense (or at least the Director of Defense Research and Engineering or the Under Secretary to which that role evolved) had the Defense Science Board (DSB) which at the time I was a member in the 1960s was composed largely of executives and high-level staff from large defense contractors.

I chaired for Secretary of Defense Melvin Laird and Deputy Secretary David Packard (co-founder of Hewlett-Packard) a DSB Task Force on Advanced

Tactical Fighter Aircraft, the report of which has been routinely declassified and is available on my website at: http://tinyurl.com/6p93p77

In recent years, and with the evolution of IT, the DSB has become much more open in its operation and its product. The current chairman of the DSB, Paul Kaminski, commended to me the report of a 2010 summer study on *Enhancing the Adaptability of U.S. Military Forces*[7], as exemplary of DSB's current role. A September 2011 DSB report[8] on *Science and Technology Issues of Early Intercept Ballistic Missile Defense Feasibility* provides a clearly independent and substantive analysis that shows the ineffectiveness of the present U.S. missile-defense program against anticipated threats from Iran.

The National Academies of Science

The U.S. National Academy of Sciences was chartered by President Lincoln in 1963 by the U.S. Congress in response to a request by President Lincoln. Its current operating name is The National Academies of Science, under which one finds the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council, which last is the organization that provides independent, expert studies on many topics. Some of

[7] See http://www.acq.osd.mil/dsb/reports2000s.htm
[8] http://www.acq.osd.mil/dsb/reports/ADA552472.pdf

them are self-funded and initiated, but most are supported by the U.S. government—often by congressional direction. The NRC has great convening power, and many of its studies provide substantial contributions to understanding and to policy options. The NAS/NRC has a mechanism for public comment on proposed composition of study panels, and a strong review mechanism, overseen by a Report Review Committee. A book-length study is published almost every working day, and with few exceptions these are now available to anyone without charge for download in PDF format from www.nap.edu-- the National Academies Press. Most participants in each study are not members of The National Academies.

In addition to the National Academies' publicly available studies, there are classified studies for the administration and Congress, most of which have an unclassified version or Executive Summary. An example of such, on which I served, is *"Effects of Nuclear Earth Penetrator and Other Weapons" (2005)*.[9]

A concern with NRC studies is the increasingly long time required for security review; this applies also to reports of the Defense Science Board.

[9] http://www.nap.edu/catalog.php?record_id=11282

Evidently, I cannot do justice here to an exposition or analysis of the DSB or NAS/NRC report process, but it is better to mention than to ignore them completely.

The Late Lamented Office of Technology Assessment 1972-1995

After much discussion over the years, the U.S. Congress in 1972 passed legislation to establish the OTA. This Office supplemented its small staff with outside talent on the individual studies, and also had an advisory panel of additional outsiders for each of the studies. The advisory panel membership included advocates of extreme positions on the study topic; OTA leadership and the study panel needed to take all these views seriously but were not required to compromise among them. Studies for which I served on the advisory panel included "*MX Missile Basing (September 1981)*," "*Directed Energy Missile Defense in Space (April 1984)*," and, perhaps, "*Ballistic Missile Defense Technologies (September 1985)*," which I felt were substantive and influential. The text of all OTA studies has been archived[10] at Princeton, including these three.

Most OTA studies were not related to national security. Together they constituted a body of competent, relevant, and timely assessments on matters of great interest to the Congress and the nation. Unfortunately, in 1995, the new Congress reflected the view that official competent analysis interfered with the political process more congenial to many in that body, and disestablished OTA.

[10] "The OTA Legacy," http://www.princeton.edu/~ota/

The Congressional Research Service of the Library of Congress works exclusively for the U.S. Congress, providing policy and legal analysis to committees and Members of both the House and Senate for almost 100 years. It does not make its reports available to the public or to the administration, but national-security related reports have been archived by Steve Aftergood at the Federation of American Scientists.[11] Some of these reports are very valuable, but they generally don't have the depth that was provided by the OTA process.

American Physical Society Studies

The APS has published several important studies[12], including the 1975 "*Report to the American Physical Society by the study group on light-water reactor safety,*[13]" that of the 1987 "*Study Group on Science and Technology of Directed Energy Weapons*,[14]" and the 2003 study group on "*Boost Phase Intercept Systems for National Missile Defense*,[15] which I judge to have been very influential.

PCAST in the Modern Era

[11] http://www.fas.org/sgp/crs/secrecy/index.html
[12] http://www.aps.org/policy/reports/studies/
[13] H.W. Lewis, Chair. http://rmp.aps.org/abstract/RMP/v47/iS1/pS1_1
[14] N. Bloembergen and C. K. N. Patel, Co-chairs. http://rmp.aps.org/abstract/RMP/v59/i3/pS1_1
[15] D. Kleppner and F. Lamb, Co-chairs. http://www.aps.org/policy/reports/studies/upload/boostphase-intercept.PDF

Although PSAC was disestablished by President Nixon in 1973, along with the Office of Science and Technology, President Gerald R. Ford was persuaded of the need for science and technology support in the White House and established the OSTP (Office of Science and Technology Policy) by legislative action, but not PSAC itself. I have already quoted President Ford's words on this subject. A White House Science Council of outside advisors was established by President Reagan

The Obama Administration has been particularly vigorous in its staffing and use of the President's Council of Advisors on Science and Technology--PCAST, which now meets six times a year for a two-day session. The members are as shown,[16] notably with co-chairs John Holdren and Eric Lander—respectively Assistant to President Obama for Science and Technology and Director of the Broad Institute of MIT and Harvard:

John P. Holdren (co-chair) is Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy (OSTP) in the Executive Office of the President.

Eric S. Lander (co-chair) is the Director of the Broad Institute of MIT and Harvard and co-chair of PCAST

[16] http://www.whitehouse.gov/administration/eop/ostp/pcast/about/members

William Press (vice-chair) is Professor of Computer Science and Integrative Biology at the University of Texas at Austin and has wide-ranging expertise in computer science, theoretical physics, astrophysics, computational biology, and international security.

Maxine Savitz (vice-chair) is retired general manager of Technology Partnerships at Honeywell, Inc and has more than 30 years of experience managing research, development and implementation programs for the public and private sectors, including in the aerospace, transportation, and industrial sectors.

Rosina Bierbaum is Dean of the School of Natural Resources and Environment at the University of Michigan. She has worked at the intersection of science and policy for more than 20 years, including serving as Associate Director for Environment in OSTP in the Clinton Administration and Acting Director of OSTP in 2000-2001.

Christine Cassel is President and CEO of the American Board of Internal Medicine and previously served as Dean of the School of Medicine and Vice President for Medical Affairs at Oregon Health & Science University.

Christopher Chyba is Professor of Astrophysical Sciences and International Affairs at Princeton University and a member of the Committee on International Security and Arms Control of the National Academy of Sciences.

S. James Gates Jr. is the John S. Toll Professor of Physics and Director of the Center for String and Particle Theory at the University of Maryland, College Park.

Mark Gorenberg is a Managing Director of Hummer Winblad Venture Partners, which he joined in 1990 when the firm began investing its first fund.

Shirley Ann Jackson is the President of Rensselaer Polytechnic Institute (since 1999) and former Chair of the US Nuclear Regulatory Commission (1995-1999).

Richard C. Levin has served as President of Yale University since 1993 and is a distinguished economist with interests in industrial organization, the patent system, and the competitiveness of American manufacturing industries, including industrial research and development, intellectual property, and productivity.

Chad Mirkin is George B. Rathmann Professor of Chemistry, Professor of Medicine, Professor of Chemical and Biological Engineering, Professor of Biomedical Engineering, and Professor of Materials Science and Engineering at Northwestern University.

Mario J. Molina is a Professor of Chemistry and Biochemistry at the University of California, San Diego and the Center for Atmospheric Sciences at the Scripps Institution of Oceanography, as well as Director of the Mario Molina Center for Energy and Environment in Mexico City.

Ernest J. Moniz is the Cecil and Ida Green Professor of Physics and Engineering Systems, Director of the Energy Initiative, and Director of the Laboratory for Energy and the Environment at MIT

Craig Mundie is Chief Research and Strategy Officer at Microsoft Corp.

Ed Penhoet is a Director of Alta Partners. He serves on the boards of directors of ChemoCentryx, Immune Design, Metabolex, Scynexis, and ZymoGenetics.

Barbara Schaal is the Mary-Dell Chilton Distinguished Professor, Washington University.

Eric Schmidt is Executive Chairman and a former CEO of Google Inc.

Daniel Schrag is the Sturgis Hooper Professor of Geology in the Department of Earth and Planetary Sciences at Harvard University and Professor of Environmental Science and Engineering in the School of Engineering and Applied Sciences.

David E. Shaw serves as chief scientist of D. E. Shaw Research, where he leads an interdisciplinary research group in the field of computational biochemistry, and is a Senior Research Fellow at Columbia University.

Ahmed Zewail is the Linus Pauling Professor of Chemistry and Physics, and Director of the Physical Biology Center at Caltech.

Information technology (IT) has revolutionized society as demonstrated, for instance, by the mechanism I'm using to communicate with you. Thus, PCAST has its own website[17], and, of course, PCAST activities are much aided by virtual meetings, teleconference with accompanying graphics, and the like.[18] Much good current and historical material is provided by a recent CRS report on "*The President's Office of Science and Technology Policy (OSTP): Issues for Congress*"[19] and PCAST reports are now listed and available[20] on the web, documenting a shift away from the earlier focus on military/space/aerospace toward aspects of civil society.

[17] http://www.whitehouse.gov/administration/eop/ostp/pcast
[18] Full disclosure, I am an unpaid consultant with OSTP.
[19] http://www.fas.org/sgp/crs/misc/RL34736.pdf
[20] http://www.whitehouse.gov/administration/eop/ostp/pcast/docsreports

Conclusion

Physicists still play an important role in advising on national security matters, but other voices are also heard. Furthermore, the government has many other concerns in education, energy, environment, information technology, health and biotechnology, which deserve attention and in which physics is far from the only expertise required.

Governance is made far more difficult and our future more problematic by the conflicts in the congress, and by the turmoil and economic collapse from the meltdown of the financial sector in 2008. The bottom line of this physicist's advice, beyond doing what we can where we are obviously needed, is to move seriously into simulation and modeling for public policy—page 19 of my 2009 presentation to the AAAS Science and Technology Policy Forum.[21] This is a recommendation I made in 1965 to the Lyndon B. Johnson administration, at the time of formation of the Department of Housing and Urban Development—HUD. As outlined in my 2009 talk, simulation and modeling for regulation or deregulation could have prevented or countered the rapacious behavior of ENRON in the electrical energy market and could have supplemented ignorance or blindness in the repeal of the Glass-Steagall act, which repeal I and many believe was responsible for the 2008 disaster in the banking business.[22]

[21] http://www.fas.org/rlg/042209%20R&D_Opportunites_and_Needs2.pdf
[22] March 16, 2012 Bill Moyers and Company telecast with John Reed and Byron Dorgan. (www.billmoyers.com Search for "john Reed" and for "Byron Dorgan".

Members of President's Science Advisory Committee and of Science Advisory Committee of the Office of Defense Mobilization from 1951 to 1973

Name	Affiliation[a]	Years	Field
Alvarez, Luis W.	Lawrence-Berkeley Laboratory University of California at Berkeley	1973	Physics
Bacher, Robert F.	California Institute of Technology	1953-56, 1957-59	Physics
Baker, William O.	Bell Telephone Laboratories	1957-59	Physical chemistry
Baldeschwieler, John D.	Stanford University	1969-73	Chemistry
Bardeen, John	University of Illinois	1959-62	Physics
Beadle, George W.	California Institute of Technology	1960	Biology
Bennett, Ivan L., Jr.	Johns Hopkins University	1966-70	Pathology
Berkner, Lloyd W.	Associated Universities, Inc.	1957-58	Physics
Bethe, Hans A.	Cornell University	1956-59	Theoretical physics
Bradbury, Norris E.	Los Alamos Scientific Laboratory	1955-57	Physics
Branscomb, Lewis M.	Joint Inst. for Lab. Astrophysics	1965-67	Physics
Bronk, Detlev W.	The Rockefeller Institute	1951-62	Physiology, biophysics
Brooks, Harvey	Harvard University	1960-64	Physics
Buckley, Oliver E.[b]	Bell Telephone Laboratories	1951-55	Electrical engineering
Buchsbaum, Solomon J.	Sandia Laboratories (1971) Bell Telephone Lab. (1972-73)	1971-73	Physics
Cairns, Theodore L.	E.I. DuPont de Nemours & Co.	1971-73	Chemistry
Calvin, Melvin	University of California	1963-66	Organic chemistry
Chance, Britton	University of Pennsylvania	1959	Biophysics, biochemistry
Coleman, James S.	Johns Hopkins University (1971-72) University of Chicago (1973)	1971-73	Sociology
Conant, James B.	Harvard University	1951-53	Chemistry
David, Edward E., Jr.	Science Adviser to the President	1971-73	Physics, electrical eng.
Doolittle, James H.	Shell Oil Co.	1957-58	Aeronautical engineering
Doty, Paul M.	Harvard University	1961-64	Biochemistry
Drell, Sidney D.	Stanford Linear Accelerator Center	1966-70	Theoretical physics
Dryden, Hugh L.	NASA	1951-56	Physics
DuBridge, Lee A.[b]	California Institute of Technology Science Adviser to the President (1969-70)	1951-56, 1969-73	Physics
Ference, Michael, Jr.	Ford Motor Company	1967-70	Physics
Fisk, James B.	Bell Telephone Laboratories	1951-60	Physics
Fitch, Val L.	Princeton University	1970-73	Physics
Fletcher, James C.	University of Utah	1967-70	Physics
Friedman, Herbert	E.O. Hulburt Center for Space Research, U.S. Naval Research Lab.	1970-73	Physics
Garwin, Richard L.	IBM Corporation	1962-65, 1969-72	Physics
Gell-Mann, Murray	California Institute of Technology	1969-73	Theoretical physics
Gilliland, Edwin R.	Massachusetts Inst. of Technology	1961-64	Chemical engineering
Goldberger, Marvin L.	Princeton University	1965-69	Physics
Haggerty, Patrick E.	Texas Instruments, Inc.	1969-71	Electrical engineering
Handler, Philip	Duke University Medical Center	1964-67	Biochemistry
Haskins, Caryl P.	Carnegie Inst. of Washington	1955-58	Genetics, physiology
Hewlett, William R.	Hewlett-Packard Co.	1966-69	Electrical engineering
Hornig, Donald F.	Princeton University (1960-64) Science Adviser to Pres. (1964-69)	1960-69	Chemistry
Killian, James R., Jr.	Massachusetts Inst. of Technology (1951-57, 1960—) Science Adviser to Pres. (1957-59)	1951-61	Administration
Kistiakowsky, George B.	Harvard Univ. (1957-59, 1961-63) Science Adviser to Pres. (1959-61)	1957-63	Physical chemistry

Name	Affiliation[a]	Years	Field
Land, Edwin H.	Polaroid Corp.	1956-59	Physics
Lauritsen, Charles C.	California Institute of Technology	1952-57	Physics
Loeb, Robert F.	Columbia University	1951-55, 1960-62	Internal medicine
Long, Franklin A.	Cornell University	1961-62, 1963-66	Physical chemistry
MacDonald, Gordon J.F.	Inst. Defense Analyses (1966-68) University of Calif. (1968-69)	1965-69	Geophysics
MacLeod, Colin M.	New York University	1961-64	Microbiology
McElroy, William D.	Johns Hopkins University	1963-66	Biology, biochemistry
Moynihan, Daniel P.	Harvard University	1971-73	Economics
Old, Bruce S.	Arthur D. Little, Inc.	1951-56	Metallurgy
Olsen, Kenneth H.	Digital Equipment Corporation	1971-73	Electrical engineering
Oppenheimer, J. Robert	Institute for Advanced Study	1951-54	Physics
Pake, George E.	Washington University	1965-69	Physics
Panofsky, Wolfgang K.H.	Stanford University	1963-64	Physics
Pierce, John R.	Bell Telephone Laboratories	1963-66	Electrical engineering
Piore, Emanuel R.	IBM Corporation	1959-62	Physics
Pitzer, Kenneth S.	Rice University	1965-68	Physical chemistry
Press, Frank	California Inst. of Technology	1961-64	Geophysics
Purcell, Edward M.	Harvard University	1957-60, 1962-65	Physics
Rabi, Isidor I.[b]	Columbia University	1952-60	Physics
Robertson, H.P.	California Institute of Technology	1957-59	Mathematical physics
Seaborg, Glenn T.	University of California	1959-61	Chemistry
Seitz, Frederick	National Academy of Sciences	1962-70	Physics
Simon, Herbert A.	Carnegie-Mellon University	1968-71	Psychology, computer sci.
Slichter, Charles P.	University of Illinois	1964-69	Physics
Smith, Cyril	University of Chicago	1959	Physical metallurgy
Smith, Lloyd H., Jr.	Univ. of Calif. at San Francisco	1970-73	Physician
Tape, Gerald F.	Associated Universities, Inc.	1969-73	Physics
Thomas, Charles A.	Monsanto Chemical Corp.	1951-55	Chemistry
Thomas, Lewis	NYU Medical School (1967-68) Yale Univ. Med. School (1969-70)	1967-70	Physician
Townes, Charles H.	Massachusetts Inst. of Technology (1966-67) Univ. of Calif., Berkeley (1967-70)	1966-70	Physics
Truxal, John G.	State Univ. of N.Y., Stony Brook	1970-73	Electrical engineering
Tukey, John W.	Princeton University	1960-63	Mathematics
Turner, Howard S.	Turner Construction Company	1972	Chemistry
Waterman, Alan T.	National Science Foundation	1951-56	Physics
Webster, William	New England Electric System	1951	Physics
Weinberg, Alvin M.	Oak Ridge National Laboratory	1960-62	Nuclear physics
Weiss, Paul A.	The Rockefeller Institute	1958-59	Biology
Westheimer, F.H.	Harvard University	1967-70	Chemistry
Whitman, Walter G.	Massachusetts Inst. of Technology	1951-55	Chemical engineering
Wiesner, Jerome B.	Massachusetts Inst. of Technology Science Adviser to Pres. (1961-64)	1956-64	Electrical engineering
Wood, Harland G.	Case Western Reserve University	1968-72	Biochemistry
Wyngaarden, James B.	Duke University Medical School	1972-73	Medicine, biochemistry
York, Herbert F., Jr.	Livermore Laboratory	1957-58, 1964-67	Physics
Zacharias, Jerrold R.	Mass. Institute of Technology	1952-58, 1961-64	Physics
Zinn, Walter H.	Combustion Engineering, Inc.	1960-62	Physics

[a] Affiliation is at time of service.

[b] Chairmen of the Science Advisory Committee, ODM, were also Presidential Science Advisers, including Oliver E. Buckley (1951-52), Lee A. DuBridge (1952-56), and Isidor I. Rabi (1956-57).