

The Rise and Fall of the Science Advisor to the President of the United States

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Abstract The president's science advisor was formally established in the days following the Soviet launch of Sputnik at the height of the Cold War, creating an impression of scientists at the center of presidential power. However, since that time the role of the science advisor has been far more prosaic, with a role that might be more aptly described as a coordinator of budgets and programs, and thus more closely related to the functions of the Office of Management and Budget than the development of presidential policy. This role dramatically enhances the position of the scientific community to argue for its share of federal expenditures. At the same time, scientific and technological expertise permeates every function of government policy and politics, and the science advisor is only rarely involved in wider White House decision making. The actual role of the science advisor as compared to its heady initial days, in the context of an overall rise of governmental expertise, provides ample reason to reconsider the role of the presidential science advisor, and to set our expectations for that role accordingly.

Keywords Science advice · Presidential science advisor · Science and government · Science and decision making

Introduction

Under the presidency of Barack Obama, many observers have expressed hopes that the science advisor to the President of the United States might be returned to a

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position of influence, following years of perceived neglect under George W. Bush. Understanding the historical role of the science advisor is central to evaluating the position under any administration. Our review of the history of the position, in conjunction with interviews of six former and one sitting science advisor, suggests that the position was highly influential in government only briefly in the immediate aftermath of Sputnik, and that the role has been elevated to an almost mythical status in the years since. Hence, hopes that the science advisor can return to an influential role may be based on unrealistic expectations about the position and its history.

Much attention has been devoted to the role of the science advisor during the presidency of Republican George W. Bush when many scientists openly confronted the administration over its decisions about an enormous range of science-related issues, from the funding of stem cell research to the stacking of science advisory committees.¹ In 2004 some scientists mobilized in opposition to President Bush's re-election campaign and the Union of Concerned Scientists (UCS), an advocacy group, supported John Kerry against President Bush in the 2004 presidential election. During the Bush presidency the typically prosaic pages of *Science* magazine published more than 40 editorials by its chief editor critical of the Bush Administration, whereas it published only a single such editorial critical of Democratic President Clinton's policies during his two terms in office.²

Responsibility for responding to such criticism fell upon John Marburger, science advisor to George W. Bush, who sought to defend the Bush Administration against allegations by the USC as well as Congressman Henry Waxman (D-CA) of a pattern of "misuse of science."³ His responses turned Dr. Marburger into an object of attack by his fellow scientists. For example, a prominent Harvard professor said on National Public Radio that Dr. Marburger had "become a prostitute" (Glanz 2004a), and one of his predecessors who served as a science advisor under President Clinton said that were he in Dr. Marburger's situation, he would have already resigned (Brumfiel 2004).

Before even assuming the positions of science advisor and director of the Office of Science and Technology Policy (OSTP), Dr. Marburger had seen the science advisor position demoted, at least formally, when President Bush decided not to confer upon him the title of "assistant to the president" that his immediate predecessors had carried (Brumfiel 2004). Soon after 9/11 the offices of OSTP were moved to a building down the street, away from the White House (Schultz 2001).⁴ In this context, the frequent conflicts between members of the scientific community and the Bush Administration should have been anticipated, despite President Bush's

¹ Some of these conflicts are chronicled in Mooney (2005).

² These numbers were arrived at by searching *Science* for editorials authored by its chief editors, Daniel Koshland, Floyd Bloom, and Donald Kennedy, from January, 2003 to December, 2008. The editorial critical of the Clinton Administration focused on its policies related to needle exchange programs.

³ See UCS (2004a, b) and Waxman (2003). For Dr. Marburger's response to the USC allegations see Marburger (2004).

⁴ Marburger's opinion about the significance of this move can be found in the transcript of his public interview during a science advisor lecture series that we organized at the University of Colorado, located at http://sciencepolicy.colorado.edu/scienceadvisors/marburger_transcript.html.

Chief of Staff Andrew Card's rather implausible comment concerning Dr. Marburger's limited role that "He is closer to the pulse in the White House than any of his predecessors, to my knowledge" (Glanz 2004a).

The battles between scientists and the Bush Administration—and the great passions that it stirred—obscured the fact that science advice at the highest levels of government has seen a long-term decline since what now appear to be, from the perspective of many scientists, the halcyon years of yore (see Greenberg 2001). The conflicts may have raised expectations for the position under President Obama to unrealistic levels. In June 2001, during the first months of the Bush Administration—before Dr. Marburger had been nominated, before Bush announced his efforts to implement a Solomon-like stem cell funding policy, before 9/11 and all that followed—the *New York Times* reported that, "some experts believe that science's influence in public policy matters has not been at such a low ebb since before World War I" (Glanz 2001). Part of this was no doubt due to the lengthy time that President Bush was taking to appoint a science advisor, but as this article will argue, part of this decline in influence is due also to the diminishment of the importance of the science advisor to the president—to any president, including President Obama.

In an era where scientific and technological content can be found in every issue of importance it may seem odd to suggest that there may no longer be a role for a "science advisor to the president" at least not as commonly understood in the scientific community. Instead, the "science advisor" has taken on a role that might be more aptly described as a coordinator of budgets and programs, and thus more closely related to the functions of the Office of Management and Budget than the development of presidential policy. This role dramatically enhances the position of the scientific community to argue for its share of federal expenditures. Yet, scientific and technological expertise permeates every function of government policy and politics, and the science advisor is only rarely involved in wider White House decision making.

In 2005 and 2006 the Center for Science and Technology Policy Research at the University of Colorado sponsored a lecture series focusing on the presidential science advisor organized by the co-authors. Seven science advisors who served presidents from Johnson to Bush participated in the series. Each advisor gave a public presentation and was interviewed by the first author of this article.⁵ Our conversations with the science advisors help to not only frame the recent conflicts of scientists and government, but also document the longer-term trend in the position, and suggest ways to think about its future. Drawing on these interviews, this article tells the story of the meteoric rise and long-term decline of the president's science advisor.

The Origins of a Myth

In the aftermath of World War II the scientific community was quick to capitalize on its newfound stature to obtain a presence at the highest levels of government

⁵ Transcripts of those presentations are available online and are referenced throughout this article.

(see, e.g. Hart 1998; Kleinman 1995). Most well chronicled of this period were the efforts that led to the establishment of the National Science Foundation (see, e.g., Kevles 1977; Kleinman 1994; Sherwood 1968). But at the same time scientists were actively seeking to establish a permanent beachhead at the highest levels of power in the White House.

Prior to 1957 there were several efforts to coordinate high-level scientific advice to government, most notably the establishment of a science advisory structure by President Truman during the Korean War (Bronk 1974). In 1950 William T. Golden, a well-connected investment banker, was invited by the Bureau of the Budget in the Executive Branch to serve as a special consultant with a focus on “special problems of scientific research in the Department of Defense and organization of the Government for the promotion of scientific activities generally during the emergency period” (Lawton 1950).⁶ After some debate President Truman approved the Science Advisory Committee of the Office of Defense Mobilization (SAC-ODM), initially chaired by Oliver Buckley, and subsequently by Lee DuBridg (Bronk 1974). Some on SAC-ODM viewed the effort as a “good-for-nothing committee” due to presidential neglect (Damms 2000). Dupree (1963) characterized science advice in the early 1950s as “useful but obscure.” As late as 1957 when President Eisenhower was asked whether he had considered appointing a science advisor, he replied that he “hadn’t given thought to any proposal to establish a scientist in a policy position in the White House or Cabinet.”⁷

In light of presidential ambivalence toward creating a more visible and influential position of science advisor to the president, top scientists in government recognized that they would have to wait for a window of opportunity.⁸ In 1950 Golden described a conversation with Lee DuBridg and James Killian where they agreed that there would

be no value in setting up now, or really even in planning an OSRD [Office of Scientific Research and Development] type mobilization for science organization. Their attitude is that when the crisis comes, the organization will spring up virtually automatically around the science leaders who will come to the fore spontaneously. (Golden 1950a)

The crisis came seven years later. On 4 October, 1957 the Soviet Union successfully launched the Sputnik satellite and everything changed. According to Grossberg (1974, p. 32), President Eisenhower “saw more scientists in the two weeks following Sputnik than he had seen in the year before.” President Eisenhower turned to the SAC-ODM for advice on how to respond to the perception (and reality) that the United States had been caught somewhat flatfooted by the launch of

⁶ Notably absent from the scholarly literature that discusses the history of the president’s science advisor is mention of the “Stewart Committee” of the late 1940s which recommended a science advisor to the president (for a cursory mention see Blanpied 1995).

⁷ As quoted in Grossberg (1974, p. 29).

⁸ Another factor undoubtedly influencing the president’s receptivity to a proposal to establish a science advisor was President Truman’s decision to develop an H-bomb contrary to the advice of leading scientists, and subsequent efforts by the Eisenhower Administration to remove J. Robert Oppenheimer from his advisory roles (Damms 2000; Greenberg 2001).

the Soviet satellite (Greene 2007). For the scientists seeking access and power, Sputnik provided the keys to the castle. The SAC-ODM, by that time chaired by Isidor I. Rabi, recommended to the President that he install a science advisor in the White House, at once satisfying the scientists' quest for a place in the White House and meeting the President's political need to demonstrate to the American public action in response to Sputnik (Killian 1982; Wiesner 1963). President Eisenhower accepted the recommendation.

The President's experience working with a subcommittee of the SAC-ODM (the Technology Capabilities Panel) established in the mid-1950s no doubt bolstered his views of the value of technical advice and familiarized him with leading scientists advising government (Damms 2000). Scientists who participated in the subcommittee's activities did so, in part, to forge better ties between their community and the Eisenhower Administration. They saw their effort pay off when following Sputnik the president elevated the SAC-ODM to its new status as the President's Science Advisory Committee (PSAC), and James Killian, the former chairman of the earlier Technology Capabilities Panel of the SAC-ODM, to the position of Science Advisor to the President.

Perhaps somewhat ironically, Killian was not a scientist at all. His academic training was in management and administration, and his experience included serving as the president of the Massachusetts Institute of Technology and on a number of government advisory committees.⁹ Indicative of how much has changed in the half-century since Killian's appointment, when President George W. Bush appointed Richard Russell—whose qualifications include a Bachelor's degree in biology, and who served as chief of staff to OSTP and as staff director for the Subcommittee on Technology of the House Science Committee—to an associate director position in OSTP under John Marburger, the Union of Concerned Scientists characterized the appointment as a "misuse of science" (UCS 2004a).¹⁰

In a move that is implausible today but which surely has reinforced visions of a mythical golden age of scientific advice, President Eisenhower assured Dr. Killian "that he would enjoy wide latitude in action and guaranteed access to information in every corner of government" (Grossberg 1974, p. 40). The President invoked a technocratic approach to decision making when he publicly announced Dr. Killian's appointment to the position of Special Assistant to the President for Science and Technology: "Dr. Killian will see to it that those projects which experts judge have the highest potential shall advance with the utmost speed" (Eisenhower 1957). The combination of latitude, access, and power must be the image in mind when scientists look to return to that mythical golden age of science advice. As one observer describes it, "never before or since have scientists had a firmer influence on the reins of power that direct national policies" (Rigden 2007). On the other

⁹ That the first science advisor was not a scientist does not appear to be widely appreciated, and it is not widely advertised in the science community that Killian did not earn a doctorate. Killian had been awarded an honorary doctorate from Middlebury College in 1945, see Anonymous (1945). Killian was later awarded honorary degrees from Union College, Drexel Institute of Technology, and the College of William and Mary, see Anonymous (1957).

¹⁰ Richard Russell's biography can be found here: http://www.ostp.gov/cs/about_ostp/richard_m_russell.

hand, a foreshadowing of the science advisor's decline can be found in President Eisenhower's remark upon departing from office that "in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite" (Greenberg 2001).

The establishment of the science advisor's role under Eisenhower had a lasting influence on the scientific community. For instance, in the aftermath of 9/11 one long-time observer of science in government expressed hopes that the tragedy would re-establish science at the top levels of government decision making, saying, "Our model is before World War II and after" (Broad 2001). Despite the "monumental presidential responsibilities" given to James Killian as first science advisor, contemporaries might have anticipated the fickleness of government's love affair with science when Dr. Killian's swearing in ceremony on November 15, 1957 was "unusually brief" because President Eisenhower was eager to leave for a golf vacation in Augusta, Georgia (Finney 1957; Grossberg 1974, p. 44).

Science Advice and the Professionalization of Expertise

The seven science advisors that we visited with related stories and vignettes reflecting a long-term trend that may have begun with latitude, access, and power more than five decades ago but which in more recent times is better characterized by constraint, insulation, and enervation. For example, Ed David's perception of how the role of science advisor has changed since he served under President Nixon (1970–1973) follows:

The old style science advisor, the distinguished person whom the president looked upon as his house intellectual, to be listened to on the complex and new issues, at that time, of course, of nuclear arms, nuclear defense, advanced technologies, infectious diseases, and so on, is not likely to recur soon.¹¹

Jerome Wiesner, who succeeded Killian as science advisor under John F. Kennedy, described the "old style" portfolio of responsibilities (Wiesner 1963):

Dr. Killian, as the first Presidential advisor on scientific matters, rapidly became involved in matters of the greatest national importance involving education, defense, disarmament, space, and international cooperation. In fact, I don't think it is stretching a point to say that the impartial assistance provided by Dr. Killian and the Science Advisory Committee made it possible for the President to arrive at many policy decisions which would have been impossible otherwise.

The role of every science advisor since Killian who served the president has been far less influential than that described by Wiesner, and much more consistent with that described by David.

¹¹ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/david_transcript.html.

One reason for the diminished role of the science advisor is that expert advice to government has grown immensely, making Renaissance-like men or women unnecessary. In 1950 a total of approximately 350 scientists advised the federal government (Mullins 1981). By 2003 approximately 8,000 scientists served on about 400 federal advisory committees (GAO 2004).¹² One consequence of the professionalization of expert advice that mirrored the growth of the scientific establishment in the 1960s and 1970s was the evolution of science advice at the highest levels of government from the personal to the instructional. Mullins (1981) describes how rapidly this change occurred:

In 1950, many of the (approximately) 350 scientists who were serving on government advisory committees were either friends or “friends of friends.” Many had worked on the same projects during World War II. Relations between the relatively small scientific research community and the new agencies were relatively close. Even the ties between scientists and high officials were close and personal rather than official... By 1972, four administrations later, most of the original participants in the system had left the ranks of both advisors and persons being advised. In their place, and in the place of informal personal relations, were systems of rules and regulations. Government staff members holding jobs that required scientific advice knew that the advice would be given routinely, and that it was now attached to the office, not to specific occupants of the job.

The institutionalization of science diminished the importance of scientific advice at the very highest levels of political decision making even as its importance grew for policy implementation across government as a whole: “The process of institutionalization has been marked by the increasing isolation of the advisory system from influences other than the administrative” (Mullins 1981).

Historian Daniel Kevles attributes the diminishment of scientists’ influence to the complexity of modern policy issues: “The issues nowadays are unbelievably pluralistic. There is hardly an issue you can think of that doesn’t turn to some extent on technical knowledge” (Glanz 2001). In 2007 a physicist writing in *Physics Today* looked back to the Eisenhower and Kennedy days and, not surprisingly, found wanting every science advisor since:

After Kennedy, however, the prominence of science advice in matters of national policy began to deteriorate. When individuals from the social sciences, the biomedical sciences, and industry became members, PSAC itself lost the coherence it once enjoyed... The breaking point came during the administration of Richard Nixon... Through the presidencies of Jimmy Carter, Ronald Reagan, George H. W. Bush, Bill Clinton, and George W. Bush, the

¹² Contemporaneously, William T. Golden wrote, “As to how many top echelon or key scientists there are, around whom any mobilization would devolve, [Lee] DuBridge said that there is a continuous spectrum and it would be difficult to decide where to draw the line. However, it appears that the number is probably somewhere between 20 and 200” (Golden 1950b). GAO (2004) documents that the explosion of advice to the federal government has not been restricted to the scientific or technical, reporting that in 2003 there were 948 advisory committees with 62,497 members.

position of science advisor, while it continues to exist, has been largely isolated, if not muted. (Rigden 2007)

But holding science advisors to a standard set in the days soon after Sputnik may be setting unrealistic expectations for the role, reflecting a misunderstanding of the role of science advice in politics at the highest levels of government.

Science Advice as Politics

Accusations that the George W. Bush Administration encouraged the politicization of science focused a great deal of attention on science advice to the president. As one critic put it, the Bush Administration engaged in a “war on science” (Mooney 2005). Despite their different evaluations of the Bush Administration’s approach to science-related policies, however, the seven science advisors who participated in the lecture series agreed that politics and science have always been intermixed in complex ways.

Consider, for example, the following situation. The president has in his administration a range of scientific experts on the most important policy issues of the day. However, the president is denied access to that advice by the manipulative actions of one of his primary advisors, nicknamed “the Admiral.” The Admiral has the president’s ear on matters of science but he himself has never had any formal scientific training. He justifies his advice to the president by his fervent belief that the United States is engaged in a fundamental religious, political, and economic conflict between good and evil.

When two leading government scientists seek to provide advice to the president that differs from the Admiral’s, the Admiral asks the FBI to open investigations of these scientists. One of the scientists subsequently faces hearings on his loyalty to the United States and he never again works as a government scientist. The other scientist warns that this case indicated to scientists that scientific integrity and frankness in advising government on policy matters of a technical nature can lead to later reprisals against those whose earlier opinions have become unpopular.

One of the nation’s leading scientists writes that the relationship between government and scientists has been “gravely damaged” because the government has given the impression that it would “exclude anyone who does not conform to the judgment of those who in one way or another have acquired authority.”¹³ While this tale sounds like something that might have been reported as occurring under the administration of George W. Bush, in fact the year was 1954. The President was Dwight Eisenhower, and “the Admiral” was a man named Lewis Strauss. The scientists were the leading government science advisors from World War II, Robert Oppenheimer, Hans Bethe, and Vannevar Bush.

Another incident that occurred during the Eisenhower Administration further illustrates the long history of political conflicts involving science. The director of the National Bureau of Standards (NBS), Allen Astin, released results of a study

¹³ This episode in the history of scientific advice, and the sources for the quotes above, are documented in Greene (2007).

showing that battery additives failed to perform as advertised. One company whose owner had close ties to members of Congress demanded that its product, AD-X2, be reevaluated. Under pressure from a few members of Congress, the Bureau reran the test and again found the product failed to perform as advertised. The Secretary of Commerce, however, felt that the marketplace rather than the government was the best place for product claims to be evaluated, and subsequently fired Astin from his position. Congress held hearings under much public pressure as the issue gained visibility, and Secretary Weeks reinstated Astin to the directorship of NBS (Neumann and Keaton 1953–1954). Events such as this led one observer in 1955 to describe the “present strains between science and government” (Lamson 1955). These strains included the battery acid case, as well as scientists denied visas for international travel and restrictive communications policies.

Such vignettes call into question the characterization of science advice during the Eisenhower era as a “golden age.” To observe that the politicization of science has been a feature of politics for many decades, of course, does not excuse poor decisions by any administration. But it does serve to emphasize that, although science has come to occupy a more significant role in policy making over the last half-century, the ubiquity of politics has remained largely unchanged. As one political scientist observed in 1965, “the fact that the content of so many political decisions has become heavily scientific has not yet produced a transformation (or adaptation) of governmental decision-making processes to the scientific model for resolving conflicts of opinion, interest, or power” (Leiserson 1965).

We asked Donald Hornig, science advisor to Lyndon Johnson, to describe an instance when he was asked by the president to “arbitrate on some scientific question or to provide some scientific advice on an issue that he was handling,” Dr. Hornig replied that he knew “of no example of being called to arbitrate a scientific question.” Hornig explained that while science is pervasive in government, “I don’t think science is sort of a thing in the government. Science is kind of like economics, where we have a Council of Economic Advisors and such. [It is] a critical part of all sorts of things the government does”.¹⁴ Hornig’s response echoes similar comments made by Isidor Rabi reflecting on his experiences as an advisor to Presidents Truman and Kennedy. Science advice, he said,

does not mean, as far as the President is concerned, technical advice in the sense of detailed explanations of the operation of the laws of the universe or detailed descriptions of various devices. The advice one gives to the President must be broadly conceived and it must speak to the President in the sense of a translation into political terms of basic scientific, technical developments in all fields in which his decisions will be important, both for the national security and the national welfare. (quoted in Raloff 1981)

Ed David, science advisor to President Richard M. Nixon, explained to us the infamous incident when President Nixon demanded that David cut all federal funding to the Massachusetts Institute of Technology (MIT) because Nixon was unhappy with some of the political positions of its president:

¹⁴ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/hornig_transcript.html.

Well, the president of MIT at that time was Jerry Wiesner. Jerry Wiesner was my thesis advisor and I was his first doctoral student. You can imagine we had a very close relationship, and I got a call from the White House and went over there, and John Ehrlichman was there and other people were there, and at the end of the discussion, the president said, “Ed, I want you to go back and cut off all the funds from MIT.”

I just sort of sat there dumbfounded, because you know enough about the government that that’s completely impossible, even if you wanted to do it. And, so I went back in my office, sat down in the office puzzled about this for a while and didn’t do anything. And then suddenly my phone rang, and it was John Ehrlichman. I said, “John, what did you think of the president today and what he had to say about MIT?” He said, “Ed, my advice is don’t do anything and it will all go away.” And I didn’t do anything and it all went away.¹⁵

While President Nixon’s termination of PSAC is part of the lore of presidential science advice, another story related by David appears to have been overlooked. David described how the scheduling of the Apollo missions was affected by political considerations related to the 1972 presidential election. In short, President Nixon was worried that an accident might hurt his re-election prospects.

Another interesting situation I found myself involved with was the Apollo program. When I arrived on the White House scene, two Apollo missions had already been cancelled. They were Apollo 18 and 19. There were originally plans, as I remember, for 20 and 21, but 21 never really got off the drawing board. The possible cancellation of Apollo 16 and 17 was in the wind, it was talked around, even though those two missions were slated to provide important scientific information about the moon, and they were basically the payoff of all of the efforts that went into the Apollo program. Most of the man-hours on the moon came during those two missions. In fact, most of the scientific measuring equipment the astronauts placed on the moon at that time are still there and many of them are still operational. So there’s an awful lot of data coming in... I wrote a memo to the president saying, in effect, that the nation had bought everything for these trips except the fuel, and that we ought to go ahead in light of the potential knowledge to be gained. That memo had some effect, and Apollo 16 and 17 proceeded, and Apollo 17 put the first scientist on the moon.

The interesting aspect of all this was the reason for considering canceling 16 and 17 in the first place. That reason was essentially political. It focused on the timing of those two launches vis-à-vis the 1972 presidential election. Apollo 17 was slated to launch about a month before the election day, early in November, 1972. The big worry by the political forces in the White House was that if there was an accident of Apollo 17, it would bear heavily on the election outcome negatively. I suggested that Apollo be postponed, however, until December after the election, a month after it, and that Apollo 16 was too

¹⁵ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/david_transcript.html.

early to have much influence on the outcome, we did win that day for the final two moon missions. This shows you how science hangs by a string in such situations. It illustrates that political thinking is very different from scientific thinking. Anyone coming to the science advisory post without considerable experience in politics is in for some rude shocks.¹⁶

When asked about how the politicization of science under the administration of George W. Bush compares with other administrations, Ed David suggested that the intermixing of politics and science is endemic and that such comparisons are not particularly useful:

I'd like to know what the metric is for [politicization], because I don't think there is a metric. You have opinions, and that's okay, everybody's got an opinion. But the idea that you can prove by any write-up that the Bush administration is worse than the administration I worked in or the administration that his father was in, is sort of ridiculous on the face of it. You can't make the case. I mean, you can cite instances, but the instances will go away. My advice is John Ehrlichman's advice: Don't do anything, and it will go away. And it will.¹⁷

David later explained that, "I'm not a strong supporter of what the [Bush] administration has done in science. I'm really not. But, on the other hand, I have to tell you, I don't think that what they're doing or what they have done is going to harm the scientific community."¹⁸

Frank Press, science advisor to Jimmy Carter, explained how during his tenure technical advice on alternative energy proposals was ignored for political reasons:

During President Carter's term in office, his political staff proposed that he should commit to a national goal that by the year 2000, the United States would draw 20% of its energy from renewable energy sources, that is, other than hydrocarbons and nuclear. They argued for this action on many grounds, among them that this would improve the President's political standing. These individuals implored [Dr. Press] to join them in their initiative out of concern that the President might not accept their proposal if the Science Advisor did not agree with them. The Science Advisor and his staff decided not to support their proposal, because though laudable, in their opinion it was not an achievable goal. However, despite this technical advice, the President decided to accept the proposal of the political staff. To set a national example, solar panels were installed on the roof of the colonnade between the President's House and the West Wing to provide hot water for the White House Mess. On this and several other occasions President Carter told us that he agreed with our technical evaluation but would follow another course for political reasons—a reasonable action, it seems to us, for a person in his position. (Press and Smith 2009, in press)

¹⁶ Ibid.

¹⁷ Ibid.

¹⁸ Ibid.

When asked about the allegations that the Bush Administration misused science, George Keyworth, science advisor to Ronald Reagan, gave an emphatic reply: “Let me say there are a lot of things the Bush Administration does that I don’t like, but I think that’s just unadulterated nonsense.”¹⁹ Keyworth’s views were likely shaped by the fact that he was, in his own words, “a single-issue Science Advisor” focused on issues of national defense and, in particular, the Strategic Defense Initiative (SDI). Perhaps for this reason Dr. Keyworth functioned in practice more as an advisor on military policy than science policy, as he describes his role for much of his time under President Reagan: “I was not OSTP director, effectively. I relinquished—not formally—but I basically made that low priority and I gave it to everybody else to do, because I was asked to do only one task.”²⁰ For Keyworth there was no “science advice,” simply policy advice on SDI in the context of the President’s political agenda.

Regrettably, the late D. Allan Bromley did not participate in our series, having died just before he was to visit. In his book on his time in the White House under George H. W. Bush he relates numerous experiences where science and politics were intermixed (Bromley 1994). He saw a proposal that the President focus attention on global population undercut by other White House officials, and he described how efforts to discuss technology policies were fruitless in a free-market oriented atmosphere. Other topics involving science were controversial during the first Bush administration, including efforts to redefine “wetlands” in such a way as to open up large tracts of previously protected land for development, and the editing of congressional testimony by a NASA scientist (Pielke 2004). Dr. Bromley did not think highly of the UCS report critical of President George W. Bush: “You know perfectly well that it is very clearly a politically motivated statement. The statements that are there are broad sweeping generalizations for which there is very little detailed backup” (Glanz 2004b).

Bromley, like other modern science advisors, was kept outside the circle of close presidential advisors. He suggests this was done intentionally due to concerns that he might be called to testify before Congress (then controlled by Democrats) as director of OSTP, whereas other special assistants were not required to testify. The dual nature of the science advisor position—special assistant to the president and Director of the Congressionally-established OSTP—resulted from efforts by Congress under President Ford to re-establish the office following its termination by President Nixon. The success in formalizing the position meant that the science advisor would be required to testify before Congress, unlike other assistants to the president, which had the effect of creating an incentive to keep the science advisor at some distance from the president’s inner circle of advisors.

We also asked John Gibbons, science advisor to Bill Clinton, directly about the Bush Administration’s science policies. He replied that the concerns were less a matter of the “misuse of science” and more a matter of good government:

¹⁹ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/keyworth_transcript.html.

²⁰ Ibid.

[The criticisms of the Bush Administration are] a reflection of a very genuine concern. Not so much about the misuse of science, but the misrepresentation of science, of a very selective representation of scientific results. Of the extraordinarily creative and selective labeling of proposed projects. Like you all have heard of the Healthy Forests Act. And you know about the Clear Skies program. These are wonderful terms, and cleverly developed, but totally misrepresent what the state of science is on those very issues and what's in it. So it's much more of a PR game than it is a substantive change for the improvement of these issues. So that causes a great deal of angst. I must say it's not just science the angst, I think, is based on but a basic concern about openness of government, about the way that facts are, and opinions are represented in an almost totally politically oriented way. I have to blame a lot of this on [presidential advisor] Karl Rove, who's an absolute mastermind in political maneuvering...

But I think it is a matter of concern. Honesty in terms of representation, a fair representation of what the community has to say. And it was badly misrepresented in climate change, and it's still—they're still trying to work out of that one. But they fudge around on things such as stem cells. They claim there are so many lines of stem cells, and everyone knew that was wrong. They had just taken all of the marginal stuff they could and thrown into it. And I think it genuinely causes angst on the part of our community, which they are sort of quoting indirectly. And we ought to be raising concern about it.²¹

Gibbons' focus on good government is repeated in his description of the role of the science advisor:

[T]here are three main activities for the science advisor. And first is to be the President's eyes and ears. And not to bother him when he doesn't need to know something, but be sure to notify him and acquaint him when things do need to be known. The second is to act on behalf of the President in terms of the budgets, interagency activities, public/private interactions, international negotiations, and the implementation of his initiatives. And that's a very large measure for a very small office... And the third bullet is the thing that we devised early on in the Clinton Administration. Namely, to try to identify the presidential initiatives that reflect on national, major overarching national goals. And science is not an overarching national goal for the President. It's only as it serves to help achieve these larger goals that science takes its place in the crown of important activities for the president.²²

Neal Lane, science advisor to Bill Clinton following Gibbons, explained his participation in signing the UCS statement critical of the Bush Administration:

The reason we signed the statement is because the administration, for whatever reason, had false information on the website of the National Cancer

²¹ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/gibbons_transcript.html.

²² Ibid.

Institute about the alleged relationship between breast cancer and abortion because they were pushed by conservative groups to do that, so they did it. They put false information out—or took correct information, valuable health information, off of one of the health websites on the effectiveness of condoms and preventing disease, and replaced it with abstinence only information that was highly misleading. They doctored it, I would say, in a way that went well beyond any kind of editing we would have suggested in government reports.

The State Department reported first, and then the Environmental Protection Agency reported climate change, essentially changing those words so that it was totally misleading what the science was all about. They muzzled a scientist in the Department of Agriculture and wouldn't let him publish his work because they found a connection between pesticides, I guess, and the potential for antibiotic resistance to human beings living in the area or something like that. So the health effects of agricultural practices that some agricultural company didn't like. So it was just becoming very clear that there were some lobbies whose voices were being heard and things were being done that we considered abuse of science.

It's not that policy decisions were made that we disagreed with, where many considerations applied. We didn't complain about stem cell decisions because nobody was misrepresenting the science. The President made a decision, some of us liked it, maybe some of us didn't like it, but that's not the same as the government misrepresenting or falsifying what the scientific record really is. That's what we were complaining about.

So why did I say reach out after all that? Well, you can't give up. I didn't expect that we'd all be welcomed into the offices of the people who were just slammed, and we never said—and never believed—I certainly don't, that the President directed all of these things to happen, or there was some conspiracy in which these high level officials all got together and said, "Hey let's falsify science to please us." It just happened.

As Jack Marburger himself said, when he was defending the administration, "Sometimes people do dumb things." Well, these were some of them, so we felt it was a very bad situation.²³

Lane also hinted at several decisions under the Clinton administration that he might have made differently:

And there was also an issue of needle exchange, and the science is pretty clear on needle exchange if you want to cut down on HIV, but the President didn't go for federal funding for needle exchange, so I know that was an issue that was often talked about. And so there are these issues where the President makes policy decisions...²⁴

²³ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/lane_transcript.html

²⁴ Ibid.

Lane could not recall any complaints from the scientific community about the Clinton Administration's use of science in policy making. However, there are several notable issues during the Clinton Administration for which science was at the center of political conflict, including regulation of mercury in the environment, the health effects of second hand smoke, justifications for a missile attack on a factory in Sudan, and the firing of a Department of Energy official who disagreed with Al Gore on climate issues (Pielke 2004).

Like Bromley and Gibbons before him, Lane also describes himself as being outside the circle of close presidential advisors, explaining that those closest to the president had their ties—to him and among each other—forged during the intense experiences of the presidential campaign²⁵:

[President Clinton] would see his political advisors frequently. They're really the inner-circle. They came off the campaign. They're old buddies, they play hearts together, you know, and that's their focus. Their focus is this president will succeed. This president will succeed. You know, if something is going on, we will figure out how to fix it. They are totally focused on the president's political agenda and his legacy, so those people see him frequently...

I'd see the president sometimes once a week and sometimes I wouldn't see him for three weeks. It just depends on what's going on. If he had an interview coming up, if he's got a speech coming up that has something to do with science and technology, if there's something in his State of the Union Address on science and technology, any of those kind of things, he will call me in and I'll go in and I'll brief him on it.²⁶

When asked about the allegations that the Bush Administration misused science, John Marburger, President Bush's science advisor, responded: "I didn't like the allegations. I thought they wrapped up a large number of disparate complaints into a, what I called at the time, a conspiracy theory. And that was my biggest objection. I just didn't think it made sense to wrap all of these things up into one big ball and try to draw a conclusion from it."²⁷ Marburger was of course the sitting science advisor when he made these comments. Perhaps when his term is long over, he might be asked if his views have changed.

There are a few summary observations to make about the perspectives of the science advisors on the politicization of science under the Bush Administration. First, despite the general unpopularity of George W. Bush among the advisors, their degree of criticism follows political lines, as might have been expected, with Keyworth and David somewhat less critical of the Bush Administration than the science advisors who served under Democratic presidents. The passage of time may also explain some of the views as well, with recent political battles still evoking an emotional response. Of the advisors serving Democratic presidents we see Clinton advisors Lane and Gibbons most critical of the Bush Administration, and Carter and

²⁵ The only science advisor to play an active role in a presidential campaign appears to be Jerome Wiesner, who participated in John Kennedy's presidential campaign (Grossberg 1974).

²⁶ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/lane_transcript.html.

²⁷ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/marburger_transcript.html.

Johnson advisors Press and Hornig not passing judgment. Of the three men serving Republican Presidents, Marburger strongly defends his boss, while advisors Keyworth and David are less supportive. But all agree that at the highest levels of government issues involving science will always be influenced by the politics of the sitting administration.

Guston (2009, in press) suggests that aspects of science advice might be characterized as “unicorns” or mythical beasts. These “unicorns” are the notion of a “science budget,” the “scientific community,” and even potentially the notion of “science itself” which Guston claims is “not unitary, comprehensive, collective, and even readily identifiable.” This last point is apparent in the conceptual fuzziness seen in the debates over the alleged misuse of science under the Bush Administration. The logical conclusion to be taken from Guston’s argument, and the stories related by the science advisors themselves, is that “science advice to the president” may also be a unicorn-like myth. Since World War II the nature of both science and government has changed. Science has become a sprawling, impressive global endeavor, touching on every aspect of modern life. Similarly, government has expanded to the point that it now touches every aspect of modern life.

For many reasons we have seen the diminishment of the president’s science advisor, from wise man at the right hand of the president to, in the case of John Marburger, a lower-tier appointee with an office a few streets away from the center of power in the Executive Offices of the President.²⁸ The Bush Administration’s devaluing of the science advisor can thus be seen as part of a long-term trend of institutional decline, exacerbated in this case, many would argue, by the administration’s heavy-handed control of information and ideological agenda. While some science advisors got along with their president more collegially than others, and various presidents have been more or less interested in matters of science, the long-term decline of the institution of the science advisor appears to overshadow these idiosyncrasies, and thus might be expected to continue under future administrations, including that of President Obama.

Science Advice as Science Budgeting

The president’s science advisory apparatus is often seen as a proxy for a “Department of Science.” In the years that followed President Eisenhower’s creation of the science advisor position there was much debate about the possibility of creating such a department (Grossberg 1974). The idea was revived in 1995 by Representative Robert Walker but failed to gain support (see Greenberg 2001,

²⁸ Since World War II, if not longer, science has played an important role in international relations (see, e.g., Doel and Harper 2006; Krige and Barth 2006; Miller 2006). As Donald Hornig told us, “Science is a wonderful lubricant for foreign policy initiatives.” For policy makers, the scientific and technological are central to some of the most important questions that they face in international politics, such as trade, defense, and health, while for scientists participation in international relations offers the tantalizing prospect of “additional resources while enhancing their scientific authority and social capital” (Krige and Barth 2006). This topic has been well documented elsewhere (e.g., see the excellent review of Krige and Barth 2006), and thus is not covered here. However, many of the science advisors did refer to international relations as a key element of their tenure.

pp. 32–34). The scientific community saw a Department of Science as a way to further enhance the stature of science—and thus science budgets—at the highest levels of government. However, critics of this proposal saw little need to centralize science when it served so many disparate agencies in different ways. Science, they argued, was more often a means to government action than an end.

The National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Office of Science and Technology (OST) in the Department of Energy (DOE) are the only three U.S. agencies whose legislated missions include “basic research”—i.e., scientific research conducted for purposes of enlightenment rather than in support of an agency mission such as defense or health care. In 2007, the collective budgets of these three agencies for “basic research” was about \$8.5 billion out of a total of about \$145 billion in federal research and development (R&D) funding.

Even though there is no “Department of Science” we know that the U.S. government spends \$145 billion on research and development because Congress has directed the NSF since its inception to collect data on government-wide R&D spending. Studies of government science spending date back to 1947 when the first survey was conducted by the President’s Scientific Research Board, a precursor to the subsequent science advisory structure in the White House (Godin 2006). Because science budgets are so carefully measured across agencies they are also used as a metric to evaluate government science policies. Sarewitz (2007), among others, has asked whether federal science policy is nothing more than federal science budget policy. The institution of the science advisor and his portfolio arguably reinforce a focus on federal science budgets as science policy.

John Marburger²⁹ told us that engagement with the budget process was one of the important jobs of the president’s science advisor. When interviewed, Marburger explained that opportunities to provide science advice, per se, were actually quite rare during his tenure:

Most of the decisions that really have technical content get made within the government agencies at a level far below the White House. And it’s only rarely that science issues, or issues with technical content, actually come up to the White House for decisions or for policy direction change, but probably the most common way they come up is in the budget process, and that’s where a lot of the discussions that I have with my colleagues takes place.³⁰

He continued by explaining that while he participated in meetings with senior White House officials, his role as science advisor was often less important than other advisors:

What I actually do is I begin my day every morning with a meeting with the Senior White House Staff. We talk about events that are very current, day-by-day, salient and I offer whatever comments I can make about science, but usually science is not part of those salient issues.

²⁹ Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/marburger_transcript.html.

³⁰ Ibid.

Rarely, but on important occasions, issues do come up where the President has to make a decision about something that has a technical component. And in those cases, my office helps me to prepare briefing documents that I share with my White House colleagues. We decide if there is any controversy or difference of opinion, try to work those out to the extent that we can, and leave the remaining items for the President to decide on. This is the policy process, policy coordination process, within the White House.

And so most of my interactions where advice is given occur in this formal context with briefings for the President that are prepared in cooperation with other policy offices in advance, and usually reflect very substantial input from the Agency or the Department that is responsible for that area. For example, when the Department of Energy was ready to recommend—make a recommendation about Yucca Mountain, whether the nation should move ahead to develop and open Yucca Mountain for the storage of nuclear waste or nuclear radiological material. The Department of Energy prepared some materials, I reviewed it with my office, we sat with other relevant offices, like the National Economic Advisors' Office, and then sat with the President and gave him the range of options and he made the decision at the meeting. That's an example.

Another different kind of briefing was after the recent Tsunami that devastated so much of the periphery of the Indian Ocean just after Christmas last year. The President was interested in Tsunamis and how they worked and what caused them and what a warning system would look like in preparation for a decision that he made about how America should participate in the international response to that terrible disaster.³¹

The science advisor's role in the mid-1960s, as described by Donald Hornig who was science advisor to President Johnson (1964–1969), as assisting the president “in all matters which require scientific and technical judgments,” does indeed seem Neolithic, as Hornig suggested.³² Consider that at no point in Dr. Hornig's interview or public lecture did he mention the science advisor playing a role in the federal budget process.

In 1973 during the Nixon Administration Ed David recommended that the science advisor's office share responsibility with the White House Office of Management and Budget (OMB) for preparing the president's annual budget submission to Congress. But such a role would have to wait, as OMB had little interest in sharing its budgetary role, at least formally. However, the president's science advisor began to play an increasingly important but unofficial role in science budgets beginning at least with the administration of John Kennedy, which formally established the Office of Science and Technology in 1962 amidst considerable Congressional interest in managing the nation's burgeoning scientific enterprise (Grossberg 1974). After President Nixon unceremoniously terminated the

³¹ Ibid.

³² Transcript at http://sciencepolicy.colorado.edu/scienceadvisors/hornig_transcript.html.

science advisor's office, Congress chose to re-establish the office with a mandate to "advise the President on scientific and technological considerations with regard to Federal budgets." When Gerald Ford signed into law the bill that created the President's Office of Science and Technology Policy (OSTP), his public remarks mentioned coordination of the overall science budget as a measure of the new office's success, foretelling future evaluations focused on the ups (and very few downs) of the federal research portfolio (Woolley and Peters 2007a).

In 1978 President Jimmy Carter reorganized the government science advisory structure, further formalizing the relationship of OSTP with OMB (Woolley and Peters 2007b).

Each science advisor since Keyworth emphasized to us the importance of assisting OMB with budget matters. No other interest group that receives funding across agencies has such a unique status in the federal government as do scientists. The creation and focused role of OSTP is likely an important factor in explaining why the federal R&D budget has been stable if not steadily growing for several decades (Pielke 2004; Sarewitz 2007).

Conclusion: The Triumph of Science Advice as the Demise of the Science Advisor

Over the second half of the 20th century and into the 21st governance can be characterized by an ever increasing reliance on specialized expertise. There are several reasons for this trend, which include the challenges of dealing with risks to human well being and security—from terrorism to the safety of food supplies, from natural disasters to human influences on the environment, from economic shocks, globalization, and many more. Some of these risks are the result of purposive technological innovation, such as the invention and proliferation of nuclear technologies beginning with the Manhattan Project during World War II. Because innovation can create new risks, a new proactive politics has emerged seeking to limit technological innovation and diffusion. Examples of this dynamic can be seen in efforts to limit the presence of genetically modified crops in Europe, to contain research on stem cells in the United States, and to militate against the consequences of economic globalization around the world.

In this context, the need for expert advice in government has increased exponentially. But one of the effects of the triumph of expertise has been the diminishment of the president's science advisor as the "go-to" individual on issues with a scientific or technical component. In many respects, the science advisor is just another person with a Ph.D. staffing the Executive Offices of the President. President Obama received high marks from the scientific community for appointing a number of prominent scientists to administrative positions, including a Nobel Prize-winning physicist to Secretary of Energy, illustrating that the science advisor is but one of many highly qualified people in an administration. The science advisor does have a very unique role in helping to oversee and coordinate the budgets of agencies that support science, but even here the science advisor's role is subject to the idiosyncrasies of each administration.

In the future it seems improbable that the science advisor's role would return to the exalted position that it held for a brief time during the Eisenhower Administration. In any case, that exalted position may be more mythical than real, which has set the stage today for some unrealistic expectations about the position. Instead, it seems that the science advisor's role will include some or all of the following responsibilities, subject to the idiosyncrasies of future presidents and their staff:

Budget champion. The science advisor seems likely to continue serving as a coordinator, and at times, a champion for research and development funding across the federal government. The scientific community may look to the science advisor as its "embedded lobbyist" for the scientific community. All of the science advisors that we spoke with expressed caution about taking on the role of defender of the interests of the science lobby, lest they further erode the advisor's authority in government. Yet, it seems clear that many in the scientific community view the position in exactly this fashion, and it is easy to understand how this perspective might come about when the science advisor repeatedly invokes the size of the federal R&D budget as a metric of science policy success. It may be more than a coincidence that criticisms of President George W. Bush by the scientific community peaked during his 2004 re-election campaign, and reached a nadir while he was pressing for Congressional action on a 2007 authorization bill that would call for doubling the research budgets of NSF, NIST, and DOE.

Issue expert. The science advisor has a unique ability to assemble expertise to focus on specialized or cross-cutting policy issues. When a top scientist in academia or industry receives a call from the president's science advisor, that call is certain to be returned. This power to convene can quickly bring together top experts to consider issues of national importance. For example, John Marburger described how his office was asked on short notice to prepare a briefing for the president on earthquakes and tsunamis after the 2005 Sumatran earthquake that killed almost 300,000 people in Southeast Asia. Congress can also utilize OSTP based on its legislative mandate to analyze specific cross-cutting science policies relevant to the federal agencies. For example, in 2007, Congress asked OSTP to develop new guidelines for the communication practices of federal agencies involving science and scientists after some scientists complained that public relations officials in their agencies had not allowed them to communicate with the media. But in addition to the desire to improve communication practices, this request also reflected the ongoing political conflict between the Bush Administration and a Democratic-held Congress. Perhaps not surprisingly the request went unfulfilled under the Bush Administration. OSTP is uniquely situated to provide advice as it can equally well draw on expertise in science policy as in science; however, like any agency it can find itself entwined into political conflicts.

"Options Czar" Yankelovich (2003) suggests that the science advisor could take on "the broader role of framer of policy options" and observes that "the more technical the scientific input, the less its relevance to policymakers' most basic concerns." While this role would be of value to decision makers (cf. Pielke 2007), the use of the science advisor in this manner would depend upon how the president organizes his office and solicits advice. It is difficult to imagine a president like

George W. Bush, who relied on a close circle of political advisors for important decisions, using a science advisor in this manner, but less difficult to envision a president like Barack Obama doing so. This, perhaps more so than the other roles, depends a great deal on the personalities of the president, top staff, and the science advisor. As Neal Lane explained, top advisors often come from the president's campaign staff, and scientists have been notably absent from such staffs in recent campaigns.

The position of science advisor has evolved and changed over the past half-century, as has both science and government. The experiences of the science advisors that we were fortunate to visit with chronicle those changes. Underneath the anecdotes and stories that describe presidents over the past half-century is a deeper story, one of the long-term decline of the influence of the president's science advisor while at the same time, the importance of expertise to government has increased tremendously. The decline of the science advisor, juxtaposed against the rise of government expertise, provides ample reason to reconsider the future role of the presidential science advisor, and to set our expectations for that role accordingly.

References

- Anonymous. 1945. Middlebury gives Killian honorary doctor's degree. *The Tech* 65: 4, June 1. http://www-tech.mit.edu/archives/VOL_065/TECH_V065_S0085_P004.pdf.
- Anonymous. 1957. Degree for Killian. *The Tech* 77: 1, April 26.
- Blanpied, William A. 1995. *Introduction to impacts of the early Cold War on the formulation of U.S. science policy*. Washington, DC: AAAS. <http://www.aaas.org/spp/cstc/pne/pubs/golden/golden.pdf>.
- Broad, William. 2001. Government reviving ties to scientists. *The New York Times*, November 20.
- Bromley, David. 1994. *The president's scientists: Reminiscences of a White House science advisor*. New Haven: Yale University Press.
- Bronk, Detlev. 1974. Science advice in the White House: The genesis of the president's science advisers and the National Science Foundation. *Science* 186: 116–121. doi:10.1126/science.186.4159.116.
- Brumfiel, Geoff. 2004. US science policy: Mission impossible? *Nature* 428: 250–251. doi:10.1038/428250a.
- Damms, Richard. 2000. James Killian, the technological capabilities panel, and the emergence of President Eisenhower's "scientific-technological elite". *Diplomatic History* 24: 57–78. doi:10.1111/1467-7709.00198.
- Doel, Ronald, and Kristine Harper. 2006. Prometheus unleashed: Science as a diplomatic weapon in the Lyndon B. Johnson administration. *Global Power Knowledge: Science and Technology in International Affairs* 21: 66–85.
- Dupree, A.Hunter. 1963. Central scientific organization in the United States government. *Minerva* 1: 453–469. doi:10.1007/BF01107188.
- Eisenhower, Dwight. 1957. Text of address by the President delivered from the oval office in the White House on "science in national security". November 7: 6. <http://www.eisenhower.utexas.edu/dl/Sputnik/PresidentialAddressNov71957pg6.pdf>.
- Finney, John. 1957. Killian takes the oath as U.S. scientific coordinator. *The New York Times*, November 16: 1.
- GAO (Government Accountability Office). 2004. Federal advisory committees: Additional guidance could help agencies better ensure independence and balance. GAO-04-328.
- Glanz, James. 2001. The nation: Blue sky; sure, it's rocket science, but who needs scientists? *The New York Times*, June 17.
- Glanz, James. 2004a. At the center of the storm over Bush and science. *The New York Times*, March 30.
- Glanz, James. 2004b. Scientists say administration distorts facts. *The New York Times*, February 19.

- Godin, Benoît. 2006. The linear model of innovation: The historical construction of an analytical framework. *Science, Technology & Human Values* 31: 631–667. doi:10.1177/0162243906291865.
- Golden, William. 1950a. Conversation with Dr. Lee A. DuBridge, president of California Tech, Dr. James R. Killian, Jr., president of Massachusetts Institute of Technology, and Irvin Stewart, president of the University of West Virginia. October 25. http://archives.aaas.org/golden/pdf/049_19501025.pdf.
- Golden, William T. 1950b. Mobilizing science for war: The science advisor to the president, memorandum for the president. December 18. http://archives.aaas.org/golden/pdf/393_19501218.pdf.
- Greenberg, Daniel. 2001. *Science, money, and politics: Political triumph and ethical erosion*. Chicago: University of Chicago Press.
- Greene, Benjamin. 2007. *Eisenhower, science advice, and the nuclear test-ban debate, 1945–1963*. Stanford: Stanford University Press.
- Grossberg, Israel. 1974. The special assistant to the president for science and technology, 1957–1968. Doctoral dissertation, New York University.
- Guston, David. 2009. Science, politics, and two unicorns: An academic critique of science advice. In *Presidential science advisors: Perspectives and reflections on science, policy and politics*, eds. Pielke Jr., Roger, and Roberta, Klein (in press).
- Hart, David. 1998. *Forged consensus: Science, technology, and economic policy in the United States, 1921–1953*. Princeton, NJ: Princeton University Press.
- Kevels, Daniel. 1977. The National Science Foundation and the debate over postwar research policy, 1942–1945. *Isis* 68: 5–26. doi:10.1086/351711.
- Killian, James. 1982. *Sputnik, scientists, and Eisenhower: A memoir of the first special assistant to the president for science and technology*. Cambridge: MIT Press.
- Kleinman, Daniel Lee. 1994. Layers of interests, layers of influence: Business and the genesis of the National Science Foundation. *Science, Technology & Human Values* 19: 259–282. doi:10.1177/016224399401900301.
- Kleinman, Daniel Lee. 1995. *Politics on the endless frontier: Postwar research policy in the United States*. Durham: Duke University Press.
- Krige, John, and K. Kai-Henrik Barth. 2006. Introduction: Science, technology, and international affairs. In *Global power knowledge. Science and technology in international affairs. Osiris, Second Series*, vol. 21. Chicago: University of Chicago Press.
- Lamson, Robert. 1955. The present strains between science and government. *Social Forces* 33: 360–367. doi:10.2307/2573008.
- Lawton, Fred. 1950. Letter to William T. Golden. September 19. http://archives.aaas.org/golden/pdf/405_19500919.pdf.
- Leiserson, Avery. 1965. Scientists and the policy process. *The American Political Science Review* 59: 408–416. doi:10.2307/1953058.
- Marburger, John. 2004. Statement of the honorable John H. Marburger, III on scientific integrity in the Bush administration April 2, 2004. <http://www.ostp.gov/html/ucs/ResponsetoCongressonUCSDocumentApril2004.pdf>.
- Miller, Clark. 2006. An effective instrument of peace: Scientific cooperation as an instrument of U.S. foreign policy, 1938–1950. *Global power knowledge. Science and technology in international affairs. Osiris, Second Series* 21: 133–160.
- Mooney, Chris. 2005. *The republican war on science*. New York: Basic Books.
- Mullins, Nicholas. 1981. Power, social structure, and advice in American science: The United States national advisory system, 1950–1972. *Science, Technology & Human Values* 7: 4–19. doi:10.1177/016224398100600402.
- Neumann, Frank, and Harry Keaton. 1953–1954. Congress and the faithful execution of laws. Should legislators supervise administrators? *California Law Review* 41: 565–595. doi:10.2307/3478195.
- Pielke Jr., Roger, (ed.). 2004. Report on the misuse of science in the administrations of George H.W. Bush (1989–1993) and William J. Clinton (1993–2001). By the Students in ENV5 4800: Maymester, University of Colorado, June.
- Pielke Jr., Roger, and Roberta, Klein (eds.). 2009. *Presidential science advisors: Perspectives and reflections on science, policy and politics* (in press).
- Pielke, Roger. 2007. *The honest broker: Making sense of science in policy and politics*. Cambridge: Cambridge University Press.
- Press, Frank, and Philip M. Smith. 2009. Science and technology in the Carter Presidency. In *Presidential science advisors: Perspectives and reflections on science, policy and politics*, eds. Pielke Jr., Roger, and Roberta, Klein (in press).

- Raloff, Janet. 1981. Mr. Keyworth goes to Washington. *Science News* 120: 45–46. doi:10.2307/3966032.
- Rigden, John. 2007. Eisenhower, scientists, and sputnik. *Physics Today* (June): 49.
- Sarewitz, Daniel. 2007. Does science policy matter? *Issues in Science and Technology* (Summer): 31–38.
- Schultz, William. 2001. Advising the president. *Chemical and Engineering News* 79: 23–27.
- Sherwood, Morgan. 1968. Federal policy for basic research: Presidential staff and the National Science Foundation 1950–1956. *The Journal of American History* 55: 599–615. doi:10.2307/1891016.
- UCS (Union of Concerned Scientists). 2004a. Scientific integrity in policy making: An investigation into the Bush administration's misuse of science. Union of Concerned Scientists. March. http://www.ucsusa.org/assets/documents/scientific_integrity/RSI_final_fullreport_1.pdf.
- UCS (Union of Concerned Scientists). 2004b. Scientific integrity in policy making: Further investigation of the Bush administration's misuse of science. Union of Concerned Scientists. July. http://www.ucsusa.org/assets/documents/scientific_integrity/Scientific_Integrity_in_Policy_Making_July_2004_1.pdf.
- Waxman, Henry. 2003. Politics and science in the Bush administration. U.S. House of Representatives, Committee of Government Reform. *Political Science (Wellington, N.Z.)* (November): 13. http://democrats.reform.house.gov/features/politics_and_science/pdfs/pdf_politics_and_science_rep.pdf.
- Wiesner, Jerome. 1963. The role of science in universities, government, and industry: Science and public policy. *Proceedings of the National Academy of Sciences of the United States of America* 50: 1201–1207. doi:10.1073/pnas.50.6.1201.
- Woolley, John, and Gerhard Peters. 2007a. *The American presidency project*. Santa Barbara, CA: University of California (hosted), Gerhard Peters (database). <http://www.presidency.ucsb.edu/ws/?pid=5968>. Accessed 10 August 2007.
- Woolley, John, and Gerhard Peters. 2007b. *The American presidency project*. Santa Barbara, CA: University of California (hosted), Gerhard Peters (database). <http://www.presidency.ucsb.edu/ws/?pid=30416>. Accessed 10 August 2007.
- Yankelovich, Daniel. 2003. Winning greater influence for science. *Issues in Science and Technology* 19 (Summer).