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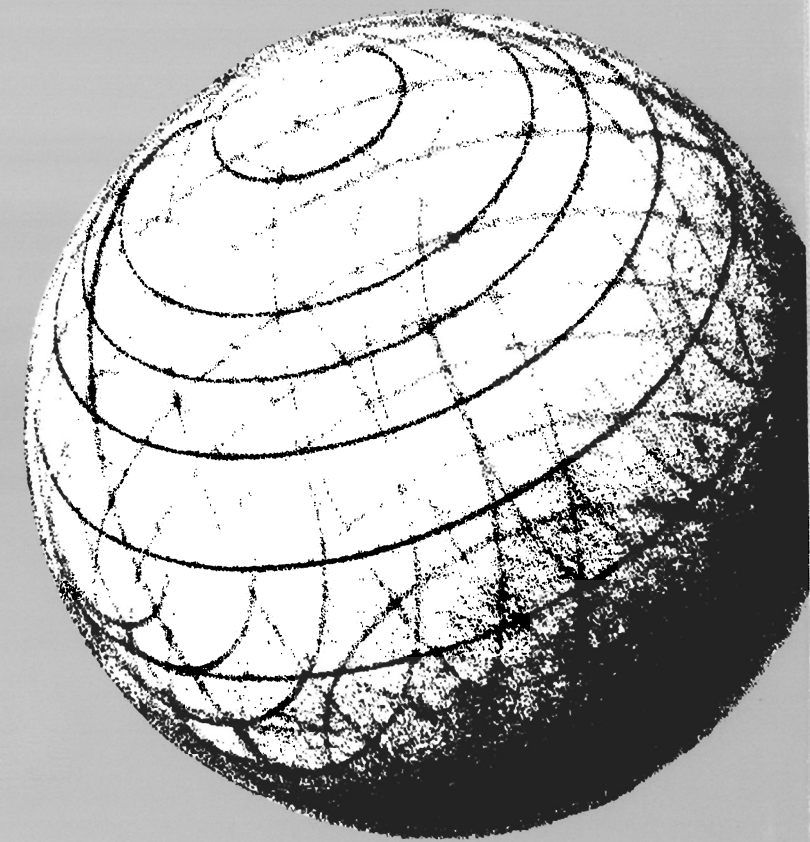
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## **SCIENCE ADVICE TO PRESIDENTS:**

From Test Bans  
to the Strategic  
Defense Initiative

**G. Allen Greb**



University of California  
Institute on Global Conflict  
and Cooperation

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**G. Allen Greb**

**G. Allen Greb** is associate director of the University of California Institute on Global Conflict and Cooperation and adjunct lecturer in the Department of History, University of California, San Diego. He is the author of numerous articles and co-editor of *Toward a Livable World: Leo Szilard and the Crusade for Arms Control*.

70. *Los Angeles Times*, May 28, 1985.

71. Mark Crawford, "In Defense of 'Star Wars'," *Science*, 228 (May 3, 1985), p. 563; Abrahamson, "Keynote Address," *MITRE Symposium*, pp. 5, 10-11.

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73. Robert C. Toth, "US Studying Nuclear-Power Space Defense," *Los Angeles Times*, May 18, 1985. See also Robert Scheer, "Flaws Peril Pivotal 'Star Wars' Laser," *Los Angeles Times*, September 23, 1985.

74. A. Hunter Dupree, "National Security and the Post-War Science Establishment in the United States," *Nature*, 323 (September 18, 1985), p. 216.

75. James R. Schlesinger, "Banquet Address," *MITRE Symposium*, p. 56. Schlesinger's speech is reprinted in full as "Rhetoric and Realities in the Star Wars Debate," *International Security*, 10 (Summer 1985), pp. 3-12.

76. "Kiss-Off for Science," *Los Angeles Times*, June 11, 1986.

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80. Marshall, "Keyworth Quits White House Post," p. 1251.

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55. Gerold Yonas, "The Strategic Defense Initiative," in Long, Hafner, and Boutwell, *Weapons in Space*, p. 89.
56. *Strategic Missile Defense: Necessities, Prospects, and Dangers in the Near Term*, A Special Report of the Center for International Security and Arms Control (Stanford University, April 1985), p. 1.
57. Leslie H. Gelb, "Vision of Space Defense Posing New Challenges," *New York Times*, March 3, 1985.
58. US Department of Defense, *Report to the Congress on the Strategic Defense Initiative* (1985).
59. "Pentagon Plans a Big Think Tank to Advise SDI," *Science & Government Report*, 16 (June 15, 1986), p. 6.
60. See, for example, Charles Mohr, "Professionals Vow to Boycott Grants on Missile Defense," *New York Times*, May 14, 1986.
61. "Star Wars: Budgeting Big for University Science," *Science & Government Report*, 15 (April 15, 1985), p. 1. See also Peter Grier, "US Companies Gear up for Reagan's 'Star Wars' Program," *Christian Science Monitor*, April 22, 1985; "Star Wars Grants Attract Universities," *Science*, 228 (April 19, 1985), p. 304; Robert Scheer, "'Star Wars': All-Out Push to Gain Funding," *Los Angeles Times*, December 29, 1985.
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63. Nitze, "On the Road to a More Stable Peace," *Department of State Bulletin*, No. 657 (February 20, 1985).
64. John B. Rhinelander, "How to Save the ABM Treaty," *Arms Control Today*, 15 (May 1985), p. 1.
65. Reagan, Remarks to National Space Club, Washington, DC (March 29, 1985) in Arms Control Association (ACA), *Star Wars: An Anthology of Quotes by the Administration, Congress and Outside Experts*, compiled by Jonathan Thompson and Julie Strawn (April 1985), p. 1.
66. Keyworth, *Security and Stability*, p. 4.
67. James Gerstenzang, "'Star Wars' Not Perfect, Weinberger Says," *Los Angeles Times*, June 18, 1986.
68. John H. Cushman, Jr., "Weinberger Terms Missile Defense Test a Success," *New York Times*, July 2, 1986.
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## SCIENCE ADVICE TO PRESIDENTS:

### FROM TEST BANS TO THE STRATEGIC DEFENSE INITIATIVE

On December 31, 1985, George A. Keyworth II quit his post as science adviser to the president and director of the White House Office of Science and Technology Policy (OSTP). Keyworth resigned amid charges that he had become little more than a "cheerleader" or "spearcarrier" for President Reagan's defense programs, in particular the Strategic Defense Initiative (SDI). The *National Journal*, for example, declared in November 1985 that "Within the White House, Keyworth functions more as a promoter of the President's policies than as an adviser with frequent access to the Oval Office."<sup>1</sup> Surprisingly, when asked directly about these charges in an interview with *Physics Today*, Keyworth responded:

The criticism is just. I served as an adviser and articulator of science and technology for the President's entire program. If I felt the science and technology parts of the program were wrong, I'd simply have left.<sup>2</sup>

Earlier, Keyworth similarly had maintained that his own advisory body, the White House Science Council (WHSC), "is a tool of the President, not a tool of the scientific community. This is the President's home and we are guests here. The WHSC members behave like very dedicated and responsible guests."<sup>3</sup>

Keyworth's statements, while perhaps admirable for their candor, are symptomatic of a disturbing trend toward politicization of the office of science adviser and a general decline in the presidential science advisory apparatus. This paper will chart the science-government relationship during the nuclear age, from the time of the great test ban debate in the 1950s and 1960s to the present controversy over the SDI.

## POST-WAR DECENTRALIZATION

In the period 1945-1958, science enjoyed the strong support of US government officials at the highest levels. Both Presidents Truman and Eisenhower looked to the creation of organizations within government to take the place of the pathbreaking and highly successful wartime Office of Scientific Research and Development (OSRD), whose director, Vannevar Bush, worked directly with the chief executive. Truman established a number of formal institutions to fill the role of the OSRD, just as the new secretary of defense and Joint Chiefs of Staff took similar action in the Pentagon. Three successive science advisory mechanisms became active: The Joint Research and Development Board (JRDB), created within the War and Navy Departments in 1946; the Research and Development Board (RDB), created within the Pentagon in 1947; and the Science Advisory Committee, reporting to the White House Office of Defense Mobilization (SAC/ODM), born in 1951 in the wake of the Korean War.<sup>4</sup>

Each of these bodies proved to be an important training ground for scientists interested in government service. None, however, operated with clear statements of authority or with full-time memberships; all were characterized by extreme decentralization which limited their effectiveness. As reported by one contemporary scientist, for example, the RDB's "very organization makes it impossible for it to do a good job because [its] committees and panels consist largely of people who serve part time and are not in a position to analyze the problems and see the whole picture."<sup>5</sup> The chairman of the SAC/ODM, Oliver E. Buckley, explicitly defined his committee's role in a very restrictive way. The committee, Buckley argued, should be

advisory, not operating; have no budgetary responsibilities; work with and through existing agencies; avoid fanfare and minimize public appearances. By its structure and location, the contribution of the Committee is limited largely to policy and other general matters. It cannot be relied on as the principal source of imaginative, technical leadership in the Government.<sup>6</sup>

Given the absence of strong central players in the science advisory system, Truman and Eisenhower turned to special *ad hoc* arrangements for guidance on many national security questions. During the early 1950s, the government funded a plethora of so-called summer studies to address such diverse issues as antisubmarine warfare (Project Hartwell), continental air defense (Project Charles), tactical nuclear warfare (Project Vista), aerial reconnaissance and intelligence (Project Beacon Hill), and civil defense (Project East River).<sup>7</sup> Special arrangements were made for the direction of guided missile development as well, including the appointment of a "missile czar" in the Defense Department between 1950 and 1953 and the establishment in 1954 of a major scientific review panel—John von Neumann's Strategic Missile Evaluation Committee (SMEC)—that led to the initiation of several high priority programs for ICBMs. At Eisenhower's request, the SAC/ODM mobilized yet another set of study panels, the Technological Capabilities Panel (TCP) of 1954 and the Gaither Security Resources Panel of 1957, to conduct reviews of US strategic and defense needs.<sup>8</sup> Finally, the one serious effort to control atomic weapons during this period, the Baruch plan of 1946, also originated as a special study of J. Robert Oppenheimer, the scientific head of the Manhattan District Project, and government experts David Lilienthal and Dean Acheson.

Needless to say, the product of this flurry of *ad hoc* activity was mixed. The TCP report, for example, basically defined the parameters of US technological development for decades to come while the Gaither Panel report became little more than a political football in the national strategic debate. Into this inchoate picture came a watershed technological event, the Soviet launch of Sputnik on October 4, 1957. While this achievement produced no permanent changes in US nuclear hardware programs, it did trigger major structural changes in the science advisory apparatus.

43. Reagan alluded to these concerns in the speech itself. In an often ignored passage, he said, "In recent months, my advisers, *including in particular the Joint Chiefs of Staff*, have underscored the bleakness of the future before us [i.e., deterrence based on offensive threats]." *New York Times*, March 24, 1983 (emphasis added). See also James Skelton, "US Fears Soviet Leap in A-Arms," *Los Angeles Times*, February 15, 1985.

Newspaper accounts generally have stressed, perhaps overly so, the contributions of Teller and Graham in formulating Reagan's ideas. The conventional wisdom has it that Teller and his Livermore proteges convinced Reagan that defense was feasible. "In this case, the key actors were Reagan and Teller," Scheer reports for example. *Los Angeles Times*, July 10, 1983. In light of this new evidence, however, Teller's visits with the president and his enthusiasm over third generation nuclear devices in fact probably exacerbated Reagan's moral concerns and fears about such weapons.

44. Robert C. Toth, "Enhanced Role of Religious Faith at Pentagon Raises Questions, Doubts," *Los Angeles Times*, December 30, 1984; James D. Watkins, letter to the editor, *Los Angeles Times*, May 18, 1985; Frank Greve, "'Star Wars': How Reagan's Plan Caught Many Administration Insiders by Surprise," *San Jose Mercury News*, November 17, 1985.

45. *Ibid.*

46. George A. Keyworth II, *Security and Stability: The Role for Strategic Defense*, University of California Institute on Global Conflict and Cooperation (IGCC) Policy Paper No. 1 (May 1, 1985), pp. 2-3; Keyworth, "The Case for Arms Control and the Strategic Defense Initiative," *Arms Control Today*, 15 (April 1985), pp. 1-2, 8. See also Stein, *Star Wars*, p. 77.

47. Robert Scheer, *With Enough Shovels: Reagan, Bush and Nuclear War* (Random House, 1982), pp. 232-34.

48. Gregg Herken, "Dense Smoke and Rubber Mirrors," pp. 16-18 (draft made available to the author).

49. R. Jeffrey Smith, "The Knives Are Out for OSTP," *Science*, 230 (December 21, 1984), p. 1399.

50. Eliot Marshall, "Keyworth Quits White House Post," *Science*, 230 (December 13, 1985), pp. 1249-51; John Bardeen, letter to the editor, *Science*, 231 (January 17, 1986), p. 203.

51. Quoted in Warren Froelich, "Star Wars: Insurance Policy or Maginot Line?" *San Diego Union*, October 19, 1986.

52. Ball, "War for Star Wars," p. 39; Philip M. Boffey, "Small Agency Quietly Plays Powerful Role in Developing Exotic Research," *New York Times*, April 22, 1985.

This reluctance to consult the Pentagon perhaps can be explained in part because of that agency's cautious approach to prospects for defensive weapons systems resulting from its 1981-82 internal review of space policy. See Stein, *Star Wars*, pp. 55-56.

53. "The Department of Defense Directed Energy Program and its Relevance to Strategic Defense," statement by the Assistant for Directed Energy Weapons before the Senate Committee on Armed Services Subcommittee on Strategic and Theatre Nuclear Forces, 98th Cong., 1st sess. (March 23, 1983), p. 5.

54. "Panel Urges \$28 Billion Missile Defense R&D for Next 5 Years," *Physics Today* (December 1983), p. 44; James C. Fletcher, "The Technologies for Ballistic Missile Defense," *Issues in Science and Technology*, 1 (Fall 1984), pp. 15-29; Jeffrey Boutwell and Richard A. Scribner, *The Strategic Defense Initiative: Some Arms Control Implications* (AAAS, May 1985), pp. 12-13; Stein, *Star Wars*, pp. 61-62, 83; Donald Hafner, "Assessing the President's Vision: The Fletcher, Miller and Hoffman Panels," in Franklin A. Long, Donald Hafner, and Jeffrey Boutwell, eds., *Weapons in Space* (W.W. Norton and Company, 1986), pp. 91-107.

23. Eisenhower to Rep. Sterling Cole, May 27, 1957, Dwight D. Eisenhower Papers, Diary Series, Eisenhower Library, Abilene, Kansas.
24. Lawrence to Raymond E. Odom, May 18, 1954; Lawrence to Odom, February 20, 1957, E.O. Lawrence Papers, Bancroft Library, University of California, Berkeley.
25. *New York Times*, June 20, 27, 1957; Charles J.V. Murphy, "Nuclear Inspection: A Near Miss," *Fortune*, 59 (March 1959), pp. 155-56; Edward Teller, *The Legacy of Hiroshima* (Doubleday, 1962), p. 68; Lewis L. Strauss, *Men and Decisions* (Doubleday, 1962), pp. 418-19; Harold Jacobson and Eric Stein, *Diplomats, Scientists, and Politicians: The United States and the Nuclear Test Ban Negotiations* (University of Michigan Press, 1966), pp. 27-28. See also Gregg Herken, *Counsels of War* (Knopf, 1985), pp. 180-82.
26. McGeorge Bundy, "Scientists, Decision-Makers, and H-Bombs: A Cautionary Tale, 1949-1954," Speech at Rockefeller University (March 8, 1982), pp. 15-17; Bundy, "The H-Bomb: The Missed Chance," *The New York Review of Books* (May 13, 1982), pp. 13-21; private communication, William T. Golden to Bundy, April 8, 1982.
27. Minutes of PSAC meetings, April 8, 9, 10, 1958; June 17, 18, 1958, PSAC Records, Eisenhower Library.
28. Killian, *Sputnik, Scientists, and Eisenhower*, p. 157.
29. See George B. Kistiakowsky, *A Scientist at the White House: The Private Diary of President Eisenhower's Special Assistant for Science and Technology* (Harvard University Press, 1976).
30. Minutes of PSAC meeting, April 8, 9, 10, 1958, PSAC Records, Eisenhower Library.
31. Senate Committee on Foreign Relations, *Hearings on Disarmament and Foreign Policy*, 86th Cong., 1st Sess. (1959), p. 178.
32. Robert A. Divine, "Eisenhower, Dulles, and the Nuclear Test Ban Issue: Memorandum of a White House Conference, March 24, 1958," *Diplomatic History*, 2 (Summer 1978), pp. 328-29.
33. Jerome B. Wiesner, "Science and Technology: Government and Politics," in Golden, *Science Advice*, p. 37. See also Wiesner, *Where Science and Politics Meet* (McGraw-Hill, 1961), pp. 165-296.
34. William G. Wells, Jr., "Science Advice and the Presidency: An Overview from Roosevelt to Ford," in Golden, *Science Advice*, p. 203.
35. *Ibid.*, p. 207. See also James S. Coleman, "The Life, Death, and Potential Future of PSAC," in Golden, *Science Advice*, pp. 136-38.
36. William T. Golden, "What Can You Scientists and Engineers Do for Me: Or, Why Should the President Want a Science Adviser?" Speech at Duke University (April 2, 1975), p. 6.
37. David Z. Beckler, "The Precarious Life of Science in the White House," *Daedalus* (Summer 1974), p. 115.
38. *New York Times*, March 24, 1983.
39. Zbigniew Brzezinski, "Far-Reaching and Risky: Reagan's Missile Defense Proposal," *Baltimore Sun*, March 28, 1983.
40. *New York Times*, March 30, 1983.
41. William J. Broad, "Reagan's 'Star Wars' Bid: Many Ideas Converging," *New York Times*, March 4, 1985; Broad, *Star Warriors: A Penetrating Look Into the Lives of the Young Scientists Behind Our Space Age Weaponry* (Simon and Schuster, 1985); George W. Ball, "The War for Star Wars," *The New York Review of Books* (April 11, 1985), pp. 38-44; Jonathan B. Stein, *From H-Bomb to Star Wars: The Politics of Strategic Decision Making* (Lexington Books, 1984), pp. 57-60.
42. "Max Hunter: The Force Behind Reagan's Star Wars Strategy," *Business Week* (June 20, 1983); Robert Scheer, "Teller's Obsession Became Reality in 'Star Wars' Plan," *Los Angeles Times*, July 10, 1983.

## PSAC

In the wake of Sputnik, Eisenhower established in November a new full-time post, the special assistant for science and technology. At the same time, he reconstituted and transferred into the White House the existing advisory machinery, the SAC/ODM, and rechristened it the President's Science Advisory Committee (PSAC). This new group was to provide the executive with direct guidance on defense and military matters. As Eisenhower explained in his national TV and radio address on November 7, the special assistant and PSAC "will have the active responsibility of helping me follow through on the program of scientific improvement of our defenses."<sup>9</sup> Ironically, this directive actually put into place a system that had been recommended fully seven years before. On December 18, 1950, William T. Golden, an investment banker and special consultant to the Bureau of the Budget, submitted a report to President Truman which advocated "the prompt appointment of an outstanding scientific leader as Scientific Adviser to the President." Among other duties, the scientific adviser was "to plan for and stand ready promptly to initiate a civilian Scientific Research Agency, roughly comparable to the . . . OSRD of World War II" and "to give the President independent and comprehensive advice on scientific matters inside and outside the Government, particularly those of military significance."<sup>10</sup>

As noted above, Eisenhower was not the first president to be a strong advocate of science nor was this the first time that scientists had been called into the policy arena in the face of a national security crisis. World War II had produced the legendary OSRD and the Korean War the ODM's Science Advisory Committee. But three important new elements were brought to the science advisory system with PSAC. The committee systematically incorporated in the decisionmaking process scientists who possessed (1) broad experience, (2) complex perspectives, particularly on nuclear questions, and (3) opposing viewpoints on issues, including technological enthusiasts and, for the first time, those interested in the idea of pursuing national security through diplomacy and negotiation. According to the first special assistant, James R. Killian, Jr., many of the scientists in the "Eisenhower PSAC felt strongly about the futility of trying to achieve additional security by the unlimited pursuit of weapons technology."<sup>11</sup> Killian himself, a former member of the SAC/ODM and president of MIT, was extraordinary in his ability to understand and deal with both the technological and political sides of the problems involved. Included among the other luminaries on PSAC were the physicists Robert Bacher from CalTech, a former member of the AEC; Hans A. Bethe of Cornell and the Los Alamos Scientific Laboratory; Edward M. Purcell of Harvard and the MIT Radiation Laboratory, a winner of the Nobel Prize in Physics in 1952; and Isidor I. Rabi of Columbia, winner of the Nobel Prize in 1944. Also named to the committee were the chemist George B. Kistiakowsky of Harvard; the physiologist Detlev W. Bronk,

president of the Rockefeller Institute for Medical Research and the NAS; and the engineers Jerome B. Wiesner of MIT and General James H. Doolittle, vice president of Shell Oil and a member of the President's Board on Foreign Intelligence Activities.<sup>12</sup>

PSAC, moreover, possessed the institutional authority to do something about its concerns. Serving four-year staggered terms, the twenty scientists and engineers who made up the committee, recognized as among the best scientific minds in the country, had the power to initiate policy studies, formulate programs, and set agendas. In effect, they became a scientific brain trust within the White House. The explicit idea, again as Killian explains it, was "to assure the committee that it had freedom and independence in formulating advice for the president, and to encourage it to engage in outspoken discussion." PSAC specifically was not to become "a creature of the Administration, thus imposing on it an obligation to abide by the party line."<sup>13</sup>

The committee operated functionally by setting up smaller panels to examine specific issues, each of which remained closely tied to the parent organization. After extensive study and consultation with other scientists in industry, government, and education, the panels would report to the entire PSAC at its regular monthly meetings. At its first full meeting on December 9, 1957, Killian appointed a number of panels to deal with two general questions: (1) the future of science and technology in the United States and the western world, and (2) US national security. Within this second category, the panels provided advice on such diverse subjects as the civil and military space programs (leading to the formation of NASA), the ballistic missile program (leading to improvements in ICBMs and SLBMs), and nuclear arms control (leading to the establishment of ACDA). "I think the panel system was an unusually effective one for the kinds of problems we were dealing with at this time for Eisenhower," Killian later commented. "A number of the statements that went to him or that were discussed . . . with him resulted from panel work between [regular monthly] PSAC meetings."<sup>14</sup>

### THE TEST BAN

A key issue both before and after the creation of PSAC, the test ban provides an interesting case study of the impact of the institutionalization of science advice after 1957. Prior to that time, the test ban remained the captive of various competing forces within the Eisenhower administration, despite strong pressures for action from outside and much official interest from within.

The immediate impetus for the activity on the part of outsiders was the series of atmospheric nuclear tests conducted in 1954 known as Operation CASTLE. These tests, in particular the March 1 Bravo shot which

### NOTES

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1. Dick Kirschten, "If Reagan Needs Science Advice, He Looks to the Weapons Experts," *National Journal*, 17 (November 23, 1985), p. 2664.
2. "Keyworth: Parting Shots from the White House Science Office," *Physics Today*, 39 (February 1986), p. 60.
3. "Keyworth Comments," *SIPIScope*, 13 (January-February 1985), p. 5. See also *Science & Government Report* interview, 15 (January 15, 1985), pp. 2-3.
4. See Herbert F. York and G. Allen Greb, "Military Research and Development: A Postwar History," *Bulletin of the Atomic Scientists*, 33 (January 1977), pp. 13-22.
5. I.I. Rabi, "The Organization of Scientific Research for Defense," *Academy of Political Science Proceedings*, 24 (May 1951), p. 360.
6. See Detlev W. Bronk, "Science Advice in the White House: The Genesis of the President's Science Advisers and the National Science Foundation," *Science*, 186 (October 11, 1974), p. 119.
7. See Gregg Herken, *Counsels of War* (Knopf, 1985) pp. 60-73, 104-05.
8. York and Greb, "Military Research and Development," pp. 19-22.
9. James R. Killian, Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (MIT Press, 1977), pp. 27-28.
10. William T. Golden Memorandum for the President, "Mobilizing Science for War: A Scientific Adviser to the President," US Bureau of the Budget, December 18, 1950, PSAC Records, Eisenhower Library, Abilene, Kansas.
11. James R. Killian, Jr., "The Origin and Uses of a Scientific Presence in the White House," in William T. Golden, ed., *Science Advice to the President* (Pergamon Press, 1980), p. 30.
12. Killian, *Sputnik, Scientists, and Eisenhower*, pp. 227-79; Golden, *Science Advice*, pp. viii-ix.
13. Killian, *Sputnik, Scientists, and Eisenhower*, pp. 22-23.
14. Private communication, Killian to Herbert F. York, April 3, 1985.
15. Linus Pauling, *No More War!* (Dodd, Mead, and Co., 1958). A special twenty-fifth anniversary edition appeared in 1983.
16. *New York Times*, October 25, 1956; February 4, 1957.
17. J. Robert Oppenheimer, "Physics in the Contemporary World," *Bulletin of the Atomic Scientists*, 4 (March 1948), p. 66.
18. Herbert Childs, *An American Genius: The Life of Ernest Orlando Lawrence* (Random House, 1968), p. 405.
19. Robert A. Devine, *Blowing on the Wind: The Nuclear Test Ban Debate, 1954-1960* (Oxford University Press, 1978), p. 27. This study provides the most complete discussion of the fallout controversy during the 1950s.
20. "Fifth Annual Award Ceremony," *Department of State Bulletin*, 31 (November 1, 1954), p. 636.
21. Dwight D. Eisenhower, *Peace With Justice: Selected Addresses* (Columbia University Press, 1961), pp. 54-65, 123-28.
22. US Disarmament Administration, *A Chronology of the Development of United States Disarmament Policy*, Disarmament Doc. Series Ref. 161 (March 1961), Appendix C, p. 4.

political advocate has become nearly complete. Noting this development in an editorial titled "Kiss-Off For Science," the *Los Angeles Times* commented that "the science adviser has become just another spokesman for the President rather than a source of tough-minded, independent advice." Keyworth's "main qualification" for the job was "that he shared the President's political views."<sup>76</sup> This situation is not likely to change under the new science adviser, William R. Graham (not chosen for a full six months after Keyworth's resignation), if only because of the restraints on the system as it now exists.

Since the mid-1970s, the AAAS, FAS, National Academy of Sciences, and numerous individual scientists all have urged the federal government to reestablish a PSAC-like entity in the executive branch. It is perhaps time to once again take up these recommendations, although this may prove a formidable task in an era when science and scientists alike no longer enjoy their earlier untarnished image. Such a preeminent science council at the very least should have some degree of continuity and independence of action. It would act as a sounding board for the president, his science adviser, and the scientific community, and would again generate, in the words of Glenn Seaborg, "a greater diversity of scientific opinion" within government.<sup>77</sup> Or, as David Beckler puts it, "we need a strong and continuing science and technology function in the White House to suggest the tools and options needed to mitigate the next 'crisis', and to provide the President with a balanced view of science and technology as a whole. . . ."<sup>78</sup> In addition, such a body could serve, as the earlier PSAC panels did, as a valuable public policy and advisory training ground for young scientists.<sup>79</sup>

Neither the existing 45-person Office of Science and Technology Policy (OSTP) nor the 13-member White House Science Council seems to be a viable model for such an advisory body. The OSTP, for example, "has become a place where staffers 'on loan' from other places can add prestigious White House service to their resumes," one critic contends. "But it does not offer great visibility or administrative clout." The office's role has been defined almost solely "as one that is to support policy handed down from above."<sup>80</sup> Perhaps a better model would be the congressional Office of Technology Assessment (OTA), although *no* such group, even one legislated by Congress, can be expected to function effectively without active presidential tolerance and support.

It seems appropriate to conclude with an anecdote from a new memoir, *The Education of a College President*. In 1958, James Killian and Herbert York were invited to breakfast with Eisenhower to discuss defense issues. "As we were leaving," Killian recalls,

the president mentioned that the Republican National Committee had complained that the scientists he had selected were not out campaigning and whooping it up for the Republican Party. "Don't you know, Mr. President, that all scientists are Democrats?" said York with his tongue in cheek. "I don't believe it," said Eisenhower, "but anyway, I like scientists for their science and not for their politics."<sup>81</sup>

produced one indirect death, dramatically underscored the dangers of radioactive fallout. Individual scientists, primarily from the natural sciences, reacted during the next several years with treatises on the harmful pathological and genetic effects of radiation and with demonstrations against the government's testing program. In April 1957, Albert Schweitzer issued a public appeal for a test cessation and in 1958, Linus Pauling, a Nobel Prize winner in chemistry from Cal Tech, organized a petition for the same purpose. These activities, capped by Pauling's publication of the book *No More War!*, won him the Nobel Peace Prize in 1962.<sup>15</sup> The test ban provided a rallying point for the near moribund Federation of American Scientists (FAS) as well. That organization, founded originally in 1945 by two scientists from Los Alamos, William Higginbotham and Robert R. Wilson, called upon the Eisenhower administration to initiate a unilateral test moratorium in 1957.<sup>16</sup>

All of these people were strongly motivated by their personal knowledge about the underlying destructive capability and the political implications of atomic weaponry. At least a sizeable minority was stimulated by a sense of foreboding and guilt, best expressed in J. Robert Oppenheimer's famous remark: "In some sort of crude sense which no vulgarity, no humor, no overstatement can quite extinguish, the physicists have known sin; and this is a knowledge which they cannot lose."<sup>17</sup> Of course, not everyone thought the same way. Ernest O. Lawrence and Edward Teller, for example, continued to argue that the proper business of scientists was science, and that political questions should be left to those with special training or experience. "I am a physicist," Lawrence replied to Oppenheimer, "and I have no knowledge to lose in which physics caused me to know sin."<sup>18</sup>

The public scientists' campaign mounted by Pauling, the FAS, and others played a crucial role in mobilizing widespread public interest in nuclear weapons and their potential for harm. The campaign, however, did little to change actual national security policy in Washington between 1954 and 1958. Indeed, as Robert A. Devine concludes, the prevailing pattern became one of "sudden interest in nuclear tests, intense debate and public discussion, and then the equally abrupt dropping of the issue."<sup>19</sup>

This lack of official response was not the result of indifference or ignorance at the top. In fact, from the beginning of his term Eisenhower deeply believed that the nuclear danger was something entirely novel in warfare and that it was imperative to find some way to reduce and, ultimately, eliminate it. "Since the advent of nuclear weapons," he told a State Department group in 1954, "it seems clear that there is no longer any alternative to peace, if there is to be a happy and well world."<sup>20</sup>

Even as he took actions which resulted in a near-term increase in America's nuclear capability, the president searched for means to reduce the nuclear threat in the long run. He set the tone of concern with his famous 1953 "Atoms for Peace" and 1955 "Open Skies" proposals.<sup>21</sup> He took steps, moreover, to make it easier to center high-level government attention on

arms control problems. On March 19, 1955, he appointed Harold E. Stassen, former governor of Minnesota and perennial candidate for the Republican presidential nomination, as his special assistant for disarmament with cabinet rank. Stassen in turn organized eight separate advisory task forces "to provide the technical basis" for effective arms control.<sup>22</sup>

Still, prior to 1958, Eisenhower moved with extreme caution regarding a test ban and resisted pressures to initiate negotiations, despite private assertions that the "whole question of testing of atomic weapons has engaged my concern from the time I first took office."<sup>23</sup> Within the administration, Atomic Energy Commission (AEC) and Pentagon officials insisted that weapons testing and development must continue to counter the Soviet threat. Significantly (and not without a touch of irony), they utilized many of the scientific experts recruited by Stassen to support their views. While Stassen himself eagerly pushed the idea of arms control and a test ban, these experts did not. In particular, Stassen's Nuclear Task Force, one of the original eight *ad hoc* committees he set up, brought together a close-knit group of weapons technology advocates. Chaired by Lawrence, the Task Force included Teller and Mark Mills of the University of California Berkeley Radiation Laboratory as well as two influential RAND scientists, David Griggs and Ernst Plesset.<sup>24</sup> The Task Force members, independent of Stassen, not only supported the AEC and the military positions but also went out of their way to counter the independent scientists' movement for a test ban.

A classic instance of the very great influence exercised by this small *ad hoc* group over US policy in the 1954-1958 period is the "clean bomb" episode of June 1957. At that time, Eisenhower entertained the notion of at least a temporary halt to testing. "I would be perfectly delighted to make some satisfactory arrangement for [a] temporary suspension of tests," he reported at a June 19 press conference. Just five days later, three members of the Nuclear Task Force—Lawrence, Teller, and Mills—were discussing the possibility of developing "clean" nuclear weapons in secret congressional testimony. AEC Chairman Lewis Strauss and Senator Henry Jackson arranged for the three scientists to meet with the president. According to Strauss, Lawrence and his colleagues told Eisenhower at the June 25 meeting that "with three to five years of research and tests, it should be possible to reduce fallout . . . and perhaps to eliminate it entirely." Impressed with the idea of a "wholly radiation-free nuclear bomb," Eisenhower called a special press conference the next day at which he backed away from a moratorium. He returned instead to the position that several more general US-Soviet foreign policy problems must be settled first in addition to linking a test ban to more comprehensive arms control measures.<sup>25</sup>

The new institutional voice of PSAC managed to bring some semblance of order to this chaotic internal situation. Killian, Hans Bethe, Isidor I. Rabi, and a core group of other PSAC members refocused government attention on the idea of a nuclear test ban and pursued it on their own

which have been suggested for the SDI. Reagan and Keyworth have emphasized over and over that any SDI system would depend on *nonnuclear* defensive weapons. Yet the Defense Department continues to investigate and indeed is intensifying its research efforts on nuclear-powered defense in the form of the third-generation nuclear-pumped X-ray laser. Scientists at the Livermore Laboratory have been working on this system under the code name Excalibur for almost five years. In February 1985, both Secretary of Defense Weinberger and Secretary of Energy John S. Herrington signed a brief policy directive that defined the "long term goal of the research program" as "a truly effective nonnuclear defense." They added, however, that research would continue on "some new concepts which could, if proven feasible, convert nuclear energy in a carefully directed, controlled way so as to destroy attacking missiles, after they are launched, at a great distance."<sup>72</sup> Underlining this point, Dr. Richard Wagner, former assistant to the secretary of defense for atomic energy and chairman of the Military Liaison Committee, commented separately that "in the very long run, eventually" nonnuclear interceptors will be developed, but that nuclear technologies are the most promising in the near term.<sup>73</sup>

## CONCLUSION

Returning again to the problem of the structure of science advice in the White House, in the case of the test ban the president had a permanent group of the country's most eminent scientists to study the problem and provide a range of alternatives and policy options. Eisenhower had his own inclinations, but he tested them with PSAC *before* expressing them as part of national policy. By contrast, in the case of the SDI, the president basically followed his innermost instincts supported by a few key individuals. As the historian A. Hunter Dupree notes and as we have seen, virtually "no advice from scientists was sought or received."<sup>74</sup> In its technological hyperbole and moralistic overtones, the March 23 speech set inappropriate parameters for debate and discourse. Former Secretary of Defense James Schlesinger neatly summarized this point in a keynote address to the MITRE Corporation in December 1984. While emphasizing that he has "no objection to a vigorous R&D program" for the SDI, he added that "the justification for strategic defense should never be based on assertions regarding the 'immorality' of deterrence. Those were—and are—reckless words,"<sup>75</sup> words that perhaps could have been avoided with thorough scientific inquiry and advice.

Whereas science advice in the 1950s and 1960s within the White House was rationalized and nonpartisan, the science advice Reagan receives is from a highly selective group which defines loyalty as perhaps the highest criterion for national service. There is little or no room for the kind of internal opposition and debate which leads to more productive policy outcomes. In fact, with Keyworth the transformation from science adviser to

"global elimination of nuclear weapons." In addition, he provided very specific and "demanding" criteria for defensive forces. They must be, he argued, militarily feasible, survivable, and cost-effective at the margin.<sup>63</sup>

While perhaps the "most-sophisticated and subtle SDI posture" presented thus far, Nitze's Strategic Concept nonetheless has not stopped the tide of conflicting internal views on this issue.<sup>64</sup> Certain officials—most notably former science adviser Keyworth, Secretary of Defense Caspar Weinberger, and Reagan himself—remain true to the original "astrodome" concept of the SDI, while others—Abrahamson and Yonas, to name the most prominent—stress more limited objectives. These two fundamentally different positions continue to dominate public pronouncements regarding the SDI.

On March 29, 1985, Reagan made the following remarks to the National Space Club:

We seek to render obsolete the balance of terror . . . and replace it with a system incapable of initiating armed conflict or causing mass destruction, yet effective in preventing war. Now, this is not, and should never be misconstrued as just another method of protecting missile silos.<sup>65</sup>

On May 1, 1985, Keyworth similarly commented to a San Diego audience that the "SDI is intended to protect populations, not weapons, and it's intended to protect not just the United States, but our Allies as well."<sup>66</sup> On two separate recent occasions, Secretary of Defense Weinberger underscored Reagan's and Keyworth's definition. At a press briefing in June 1986 Weinberger declared, "We're not interested in site defense. We're not interested in protecting the missiles. We're interested in protecting the people."<sup>67</sup> In response to the Senate Armed Services Committee call for "realistic goals" and a reduced budget for SDI the same month, he reiterated that the committee's recommendations "would destroy the principal goal of the President's program: it is not our missiles we seek to protect but our people, and we must never lose sight of that goal."<sup>68</sup>

Conversely, from the deterrence-enhancement camp, Abrahamson argued before a congressional committee on March 19, 1985, that the SDI "must enhance and strengthen deterrence and could provide critical leverage for truly meaningful reductions in nuclear ballistic missiles. These criteria drive the direction and scope of the SDI program."<sup>69</sup> And Yonas, before a May 1985 meeting of the American Association for the Advancement of Science (AAAS), maintained that the objective had moved from protecting cities to building a system in which "the leakage [of enemy missiles] would be of such a low military value that it would discourage a first strike."<sup>70</sup> It is little wonder, then, as Keyworth concedes, that "ambiguity over SDI's goals remains in people's minds," or as Abrahamson puts it, "we are having a difficult time" with getting "people to understand what we are doing."<sup>71</sup> In fact, the intragovernment process of policy formation and criticism with regard to strategic defense has really just begun.

The same problem exists in considering the variety of technologies

initiative in early 1958, something not possible under previous administrative arrangements. Bethe and Rabi already had shown a keen interest in this subject; at the beginning of the decade, they had been involved in an abortive effort to ban the testing specifically of thermonuclear weapons, but not their development.<sup>26</sup> Now both joined the PSAC panel studying the twin problems of whether a test ban was in the national interest and whether it could be verified (then discussed as monitoring). Bethe also chaired a special interagency panel on the subject which reported directly to the NSC. Finally, PSAC as a whole, after a private meeting held at Ramey Air Force base in Puerto Rico devoted exclusively to the test ban issue, provided Eisenhower with technical and political advice on April 17 that led directly to the calling of the 1958 Geneva Conference of Experts, a beginning step in the long road to the 1963 Limited Test Ban Treaty (LTBT).<sup>27</sup>

Interestingly, Herbert York, alone among PSAC scientists, expressed misgivings about the role of PSAC and initially resisted submitting the committee's findings to the president. As he later explained:

My main reason for dissenting was my feeling that the whole matter of a nuclear test ban was largely political, and that therefore it was not entirely proper for a science advisory group to be making recommendations about whether it should be done and whether it would be to our net advantage. Rather, I felt that some sort of state department group should be doing what we were trying to do. In short, my view was the common one [and the one propounded by his mentor at the time, Ernest Lawrence] that it was the scientist's job to discover what the technological possibilities inherent in nature were and the politician's job to decide what to do with them.

Later . . . , Jerry Wiesner told me simply and flatly that there was no one else who either would or could cope with this problem, and that . . . a science oriented group was the only forum that had any chance of doing the right thing. I mulled that all over, and decided he probably knew what he was talking about.<sup>28</sup>

First under Killian, then under George Kistiakowsky of Harvard,<sup>29</sup> the prominent nuclear physicists and others who made up the Eisenhower PSAC specifically stressed the value of a test ban not as a health and environmental measure to prevent fallout, but as a "first step" in controlling superpower competition. Rabi, for example, at the pivotal PSAC meeting of April 8-10 in Puerto Rico, maintained that a "test ban as such never meant anything per se; only as a step towards something else. Any ban should have [a] time limitation on it tied to progress in other areas."<sup>30</sup> Bethe later similarly argued before a congressional committee that "if we once get one controlled disarmament agreement [a test ban], I believe that others may follow and that the principle will thereby be established." This was, he believed, the "overriding argument."<sup>31</sup>

The arguments of PSAC members came at a pivotal juncture in the decisionmaking process, influencing both Eisenhower and other major government figures, such as Secretary of State John Foster Dulles. They provided officials with a range of options and policy choices which had been

lacking earlier, in effect broadening the base from which to make decisions. On March 24, Eisenhower and Dulles raised the possibility of a ban before a top-level internal group that included AEC Chairman Strauss, Secretary of Defense Neil McElroy, JCS Chairman Nathan Twining, CIA Director Allen Dulles, and National Security Adviser General Robert Cutler, who all opposed the idea in one form or another. The meeting ended, according to the notes of the executive staff secretary General Andrew J. Goodpaster, with Secretary of State Dulles backing away from the proposal and Eisenhower asking the group "to think about what could be done to get rid of the terrible impasse in which we now find ourselves with regard to disarmament."<sup>32</sup> Later, technical advice provided by PSAC helped break this impasse, giving those who favored a ban support and providing them with a defense against opponents. Even though the DoD, JCS, and AEC continued to oppose a moratorium, the negotiation of a test ban became a national objective.

The diverse combination of factors pushing arms control in general and the test ban in particular carried over to the administration of John Kennedy. PSAC continued to flourish under Kennedy and his new special assistant for science and technology, Jerome Wiesner. Like Killian and Kistiakowsky, Wiesner had a close relationship with the president and he understood the inner workings of Washington. Again, as Wiesner himself puts it, "The most important thing I used to do for the President, for that matter, for Bob McNamara as Secretary of Defense, was to broaden their range of options for decisionmaking."<sup>33</sup> According to one analyst of this period, Wiesner "played an active role in insuring that Kennedy was exposed to all sides of a problem—and did not appear to be threatened if the President heard advice which differed from his own."<sup>34</sup>

Following the Kennedy administration, however, PSAC's influence on the national security decisionmaking process steadily declined. Several factors contributed to this phenomenon. Most important, during the Johnson and Nixon years, PSAC, under the direction of Donald Hornig, Lee DuBridge, and Edward David, became embroiled in the problem of the Vietnam War. Specifically, the emergence of new bureaucratic actors—for example, the special assistant for national security affairs and an expanded National Security Council—reduced the science adviser's direct access to the president on important issues. The highly effective active panel system of PSAC also atrophied after the conclusion of the 1963 LTBT, again replaced by more specialized *ad hoc* panels or mechanisms. Increasingly, primarily because of Vietnam, the science advisory "apparatus was not seen as being responsive to the President's needs,"<sup>35</sup> but rather as representative of general scientific opposition to presidential policies. Public entanglement of several of its members in two other highly controversial issues, the ABM and SST debates, dealt the final blows to PSAC. "The image of science and of scientists," William Golden writes, "was tarnished in the public's eye: horns appeared and cloven hoofs; feathered wings fluttered to invisibility."<sup>36</sup>

opposed to the SDI have seized on this deficiency in an attempt to defeat the entire project. In retrospect, it might have been more useful to try to integrate the teams at the outset.<sup>55</sup>

Prominent scientific critics of SDI, such as Sidney Drell and Richard Garwin, continue to look for "alternative approaches."<sup>56</sup> Indeed, as Paul Warnke observes, the SDI in large measure has become "all things to all people."<sup>57</sup>

Confusion reigns within the administration on the basic problem of defining exactly what the SDI is and what its goals are. For many, the goals have evolved from replacing MAD to enhancing it and even to offering the SDI as a bargaining chip in the Geneva Nuclear and Space Talks. It has been variously defined at one extreme as a comprehensive "peace" shield and at the other as a research program to provide a hedge against Soviet programs in the same area. In large measure, this confusion flows inexorably from the relatively spontaneous nature of the president's speech and his failure to consult with the scientific community.

In the short term, the administration has taken several concrete steps to cement the SDI within the bureaucracy. First, it established a completely new office within the Pentagon, known as the SDI Organization (SDIO), with Air Force Lieutenant General James A. Abrahamson as program manager and Gerold Yonas as deputy director and chief scientist. The SDIO in turn has been actively lobbying Congress for the unprecedented five-year \$26 billion research and technology program asked for by Reagan to explore defensive options.<sup>58</sup> The Pentagon may create in addition a separate in-house "think tank," the Strategic Defense Initiative Institute (SDII), at a cost of \$20-\$30 million a year with a staff of 100-200 people.<sup>59</sup> Second, overtures have been made to many US and foreign firms to join in SDI research through the SDIO's Innovative Science and Technology Office, headed by the physicist James A. Ionson, who is on leave from NASA's Goddard Space Flight Center. Although this has created somewhat of a backlash in academic circles,<sup>60</sup> it generally has produced what the independent *Science and Government Report* calls a "Gold Rush spirit [in the industrial-educational complex] reminiscent of the robust startup days of the Apollo moon-landing program."<sup>61</sup> Third, the services have geared up organizationally by creating separate space commands, and Reagan approved in late 1984 Defense Department plans to establish a unified space command.<sup>62</sup>

In an effort to establish some semblance of uniformity in the administration position, Ambassador Paul Nitze, special assistant to the president for arms control and long-time national security adviser, introduced the notion of an overall Strategic Concept on February 20, 1985. In defining US strategic objectives, Nitze described a phased transition from offense to defense involving first "radical reductions" in offensive nuclear arsenals coupled with SDI research over at least the next decade, the gradual introduction of defensive technologies if they prove feasible, and ultimately the

since the day the speech was given. There are people in this Administration who wish that I'd been struck by a car on that evening."<sup>49</sup> This support, moreover, has not waned because of Keyworth's resignation.

Significantly, neither Reagan nor Keyworth submitted their ideas to available technical experts outside or inside the bureaucracy for critical review before March 23. Keyworth in fact did not consult his own White House Science Council on this issue. According to one of its former members, physicist John Bardeen, the full Council "had no opportunity to discuss the [SDI] proposal with Keyworth" before the speech, although a smaller panel on missile defense technology had been independently looking at the military applicability of advanced defense technologies during 1982, with decidedly mixed results.<sup>50</sup> Another member of the Science Council who was summoned to Washington to help work on the speech just before it was given, Edward Frieman, recalled that "I was terribly surprised; 'stunned' would be a better word for it." Frieman, now director of the Scripps Institution of Oceanography at UC San Diego, added that "To see it all emerge in that form, to see a whole notion change from an offense-dominated policy to a defense-dominated policy, it was all new. I don't think any of us understood it. It was an enormous leap."<sup>51</sup>

Pentagon scientists and researchers, such as those at the Defense Advanced Research Projects Agency, were caught off guard by the announcement. Then Undersecretary of Defense for Research and Engineering Richard DeLauer, for example, reported he "had no major input" into the speech. Similarly, the head of DARPA, Dr. Robert S. Cooper, and John Gardner, director of Pentagon Defensive Systems, reported they had not been advised or informed before the president's talk.<sup>52</sup> Interestingly, a major Pentagon spokesman reported on the Defense Department's Directed Energy Program before a congressional committee on the very day of the president's remarks, but he gave no indication that he had any knowledge of the speech or its contents. In fact, unlike the tone of Reagan's presentation, the spokesman stressed that in the area of directed energy weapons, "Our goals . . . are rather modest."<sup>53</sup>

The actual implementation of the SDI since the March 23 proposal has proved difficult. The two special scientific study panels appointed by Reagan to identify a specific R&D program, for example, reached very different conclusions in their October 1983 reports. While the Defensive Technologies Study Team (DTST), chaired by current NASA Director James Fletcher, supported the notion that "taking an optimistic view of newly emerging technologies, a robust, multitiered ballistic-missile defense system can be made to work eventually," the Future Security Strategy Study, directed by Fred Hoffman of Pan Hueristics, recommended first exploring more "immediate options," such as terminal defense.<sup>54</sup> Dr. Gerold Yonas, a member of the DTST, remarked later on this disparity:

It is my opinion that, although the policy and technology studies were individually valuable, their conclusions were never fully integrated. Those

In 1973, Nixon terminated the post of special assistant and dismissed the members of the committee. Thus, while the post of science adviser enjoyed a brief renaissance with President Ford's appointment of Guyford Stever in 1976 and Carter's appointment of Frank Press, the principal high level inside group which promoted a broad perspective on national security and arms control policy did not survive the 1970s and no comparable body has taken its place. As the executive officer to PSAC, David Z. Beckler, noted at the time of the committee's demise, Nixon "in one fell swoop . . . eliminated the entire White House science and technology mechanism that had been painstakingly erected in the years following the Soviet Sputnik in 1957."<sup>37</sup>

## THE STRATEGIC DEFENSE INITIATIVE

Today, White House science advice again comes almost exclusively from one philosophical direction, just as it did during the earliest years of the Eisenhower presidency. It is again characterized by decentralization, monopolized by a narrow ideological perspective, and involves several key figures, such as Lowell Wood, who do not have broad policy experience. A vivid illustration of this development is provided by the manner in which President Reagan chose to introduce his most dramatic national security decision to date, the Strategic Defense Initiative (SDI). The background to the March 23, 1983, speech on SDI stands in sharp contrast to the decisionmaking process involving PSAC in the national security sphere during the 1950s and 1960s.

Like Eisenhower, Reagan's concerns about the nuclear threat have grown during his term of office. From initial statements about the possibility of fighting and winning limited nuclear wars (and misstatements about strategic forces in general), the president seems to have adopted the more traditional view that there could be no winner in any nuclear exchange. But instead of submitting his concerns to extensive internal review, as Eisenhower did, Reagan presented his long-term answer to the nuclear predicament before a national audience on March 23, 1983, in the form of a "vision of the future which offers hope. It is that we embark on a program to counter the awesome Soviet missile threat with measures that are defensive. Let us turn to the very strengths in technology that spawned our great industrial base and that have given us the quality of life we enjoy today." With only the bare minimum of scientific consultation and input, he offered this new departure in US policy and challenged the scientific community, "who gave us nuclear weapons to turn their great talents to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete."<sup>38</sup>

Many commentators immediately questioned the president's motives in making this speech, arguing that it was a clever diversion designed both to

undermine the US nuclear freeze movement and to gain support for increased defense spending. Others, such as former national security adviser, Zbigniew Brzezinski, took a different perspective. "It's quite clear to me," Brzezinski maintained after seeing Reagan, "that the president attaches very great importance to what he said and this was not a casual undertaking, but one which reflects rather deeply felt views."<sup>39</sup> From Reagan's long-standing interest in the virtue of defenses in general and his persistence in his stand on the SDI in particular, it appears that this latter view is closest to the mark. Reagan's unprepared remarks at a March 29, 1983, press conference perhaps best reflect his visceral feelings on the subject. When asked why he introduced the SDI, he responded: "It is unthinkable . . . to look down to an endless future with both of us sitting here with these horrible missiles aimed at each other and the only thing preventing a holocaust is just so long as no one pulls the trigger."<sup>40</sup>

What, then, was the genesis of the March 23 speech? Initial technical advice apparently came from two sources: (1) Edward Teller, today senior research fellow at the Hoover Institution, and (2) retired Army Lieutenant General Daniel Graham, former director of the Defense Intelligence Agency. On the one hand, Teller and his group of young proteges at the Lawrence Livermore National Laboratory, including Lowell Wood and members of his O group, have promoted a set of exotic technologies—so-called directed energy weapons—to solve the defense problem. On the other, General Graham, supported financially by the conservative Heritage Foundation, has pushed High Frontier, a new national strategy based on kinetic energy defensive technologies already available, at least in principle.<sup>41</sup> Teller continues to disagree fundamentally with Graham over the vulnerabilities of such potential space-based systems.

Although with contrasting views on how to implement a specific strategy, both Teller and Graham advised and influenced Reagan on the virtues of defense during his presidential campaigns, and Teller continued to have personal access to the executive office before the SDI speech. Teller and Graham also shared ideas with a group of conservative industrialists (another so-called Gang of Four: Maxwell W. Hunter II of Lockheed and three others from TRW, Perkin-Elmer, and the Charles Stark Draper Laboratory), members of Reagan's "Kitchen Cabinet" (business and personal associates Karl Bendetsen, William Wilson, and Joseph Coors), and several members of Congress, including Senator Malcolm Wallop (R-Wyoming), who were looking for ways to overcome perceived Soviet military advantages. Wallop began promoting the development of space-based laser battle stations as early as 1979 with an article in *Strategic Review*. He and other influential conservative supporters of ballistic-missile defense urged their ideas on Reagan before and after the 1980 election.<sup>42</sup>

From discussions with officials close to the president and sketchy public reports, it appears that Reagan's decision to launch the SDI had other important sources as well. The Joint Chiefs of Staff, in particular former

Chairman John Vessey and Chief of Naval Operations Admiral James D. Watkins, seem to have played a key role in the move to an emphasis on defense. The JCS became troubled over the problems of US nuclear modernization programs (for example, basing of the MX missile and the deployment of P-2s and GLCMs in western Europe), and, influenced by the moral concerns of the yet unfinished Bishops' letter as well, presented the case to Reagan in February 1983 that the time had come for a new strategic vision incorporating a defense dimension.<sup>43</sup>

Watkins especially stressed the moral value of defenses to the president (with "almost evangelical" fervor, according to some). It was he, for example, who first asked at one of the Joint Chiefs' monthly meetings with Reagan, "Wouldn't it be better to save lives than to avenge them?"—which later became a key phrase in the SDI speech.<sup>44</sup> The JCS offered no specific blueprint for their strategic defense idea, however. "Our recommendation was that we move into the defensive in the long run," Vessey explained.<sup>45</sup>

These discussions helped confirm what appear to have been Reagan's own basic instincts about the problem. As defined by his former science adviser, George Keyworth II, these included a longstanding discomfort with the MAD concept, belief in the immorality of nuclear weapons, and lack of confidence in the nuclear arms control process.<sup>46</sup> Reagan's predisposition toward defense was revealed as early as 1980 during the Republican primary election campaign. In an interview with Robert Scheer of the *Los Angeles Times*, candidate Reagan commented on his 1979 visit to NORAD:

NORAD is an amazing place—that's out in Colorado, you know, under the mountain there . . . I think the thing that struck me was the irony that here, with this great technology of ours, we can do all of this [tracking of space objects] yet we cannot stop any of the weapons that are coming at us. I don't think there's been a time in history when there wasn't a defense against some kind of thrust, even back in the old-fashioned days when we had coast artillery that would stop invading ships if they came.

He went on to maintain that the Soviets had not kept their part of the 1972 bargain to honor the "Mutual Assured Destruction plan" and that the United States must improve its "defensive capability" as a result.<sup>47</sup>

Reagan as president expressed these general concerns with Keyworth, and with Judge William Clark and Robert McFarlane of the National Security Council, in 1981. The issue simmered, however, until 1983 and the meetings with the Chiefs. McFarlane, also present at those meetings and cognizant of Reagan's strong endorsement of strategic defense, gathered together a small group of NSC staff and secretly began to develop a document that would form the basis of the March 23 SDI announcement. McFarlane did not share the contents of this document with Keyworth until March 19.<sup>48</sup> The science adviser, initially lukewarm to the idea, nonetheless agreed to contribute to the speech and became a major spokesman for the president's ultimate vision of defending US and allied populations. "As you know," he told reporters in December 1984, "I've been a vocal supporter