

## **LBJ, Science, and Technology Policy and Lessons for the Future**

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President Lyndon Baines Johnson is not commonly remembered for his contributions to United States science and technology policy. The Johnson Presidency is typically praised for historic legislation on civil rights, healthcare, and education, and criticized for the war in Vietnam.

But Johnson's political career coincided and was deeply intertwined with the biggest expansion of scientific and technical knowledge in the history of the world and with the United States' rise to unchallenged preeminence in science and technology, the two signature features of the 20th century.

LBJ came to power on the issue of rural electrification of Central Texas, an issue he addressed in his first week in Congress in 1937 (Woods, 133). Having grown up without electricity, Johnson was highly motivated to bring the benefits of electricity to his constituents in Texas' Tenth Congressional District. He made public power his number one issue. And when electricity came to the Central Texas region, radio soon followed, a technology which would become the Johnson family business in 1942, when Lady Bird Johnson bought KTBC radio in Austin (Woods, 172).

Johnson also witnessed, from a powerful position as a Congressional ally of President Roosevelt, the birth of the vast American science-based arsenal that won World War II. The war created the beginnings of a new partnership between the federal government and universities, as well as a new form of private sector research and development, each a piece of the foundation for a scientific and technical infrastructure that would dramatically change the world in the post-war years. When Johnson was elected to the Senate in 1948, the U.S. was just beginning to build this foundation of new relationships and institutions that would form the base of American power during the Cold War. Johnson's experiences with rural electrification, radio, and the success of American science and technology during the war gave him a strong faith in large, state-sponsored technological initiatives that would improve the lives of Americans. This was a faith that most Americans shared during LBJ's political career. Millions of men who left the military after World War II took advantage of the G.I. Bill to go to college, and then streamed into the new plants of the postwar defense and aerospace industries. American universities rapidly expanded their research facilities and programs. This era encompassed the after-effects of the Manhattan Project and the atomic bomb, the discovery of DNA, and, shortly after LBJ left the White House, the first men on the moon

and the first digital bits passed on a communications network that would eventually span and reshape the world, a system that would come to be called the Internet.

LBJ's political career was thus an integral part of what has come to be called a "golden age" of science in the United States, when government funding for science and technology was strong and rising, when scientists and engineers enjoyed a long period of influence and prestige, and when there was a general consensus among Americans about the value and benefit of scientific and technological progress. "Little agreement exists on the temporal whereabouts of the golden age of science," writes science policy journalist Daniel S. Greenberg, "but a number of commentators are fixed on the late 1960s or the end of that decade" (Greenberg, 60). LBJ left the White House when Richard Nixon replaced him in January 1969.

Under Nixon, the "golden age" of U.S. science policy quickly came to an end. Nixon disliked and distrusted scientists—he blamed elite scientists for Republican defeats, including his own in 1960—and as campus unrest over the war in Vietnam intensified and opposition to the war spread to academic science departments, Nixon and his aides became even angrier about government support for scientists and engineers (Greenberg, 164-165). Prominent scientists who had believed they were serving the nation with apolitical scientific advice were now plunged into a rancorous political fight with the White House, and, at the same time, the consensus view of science and technology as unalloyed benefits to society was being challenged by the new youth counterculture. Greenberg writes, "After Nixon, the scientists who served in the White House harbored no noble delusions about loyalty to values that transcend politics and presidents" (Greenberg, 164).

All Presidents since Roosevelt have believed that they have a "science policy," although this phrase has been used to describe very different relationships, programs, and priorities, with little consistency between administrations. Presidents have been highly selective about what scientific advice they heed or how they manage the politics of scientific controversies. Successive presidents after Eisenhower ignored the scientific community's skepticism about the value of manned space exploration, for example. Presidents have also imposed political calculations on the scientific community, such as distributions of research money based on geographic and political considerations instead of solely on scientific merit. Presidents have pushed programs that have little support in the scientific community, including expensive weapons programs, expensive space programs, or programs that threaten the autonomy of scientific institutions. In short, the relationship between the White House and scientists has often been a delicate dance of political power and principle.

Today, however, there is a chasm between the White House and the scientific community deeper than anyone alive can remember. While federal research and development funding has grown under President George W. Bush, there are multiple sources of friction between the Bush White House and the scientific and technical communities, and extreme partisanship has plagued the discussions of scientific and technical subjects in

Congress and within the executive branch. Many scientists feel that President Bush has pushed away the scientific community—in one sense quite literally, by demoting the White House Science Adviser and moving the Office of Science and Technology Policy out of the White House (Thompson, 2003). A February 2004 report from the Union of Concerned Scientists claimed that “There is significant evidence that the scope and scale of the manipulation, suppression, and misrepresentation of science by the Bush administration are unprecedented.” An accompanying statement, titled “Restoring Scientific Integrity in Policymaking,” was signed by over 15,000 scientists, and the 62 original signers included winners of the Nobel Prize and two former White House Science Advisers, John H. Gibbons and Neal Lane (Union of Concerned Scientists, 2004). The conflict between the White House and the scientific community has led Democrats to accuse Republicans of a “war on science” (Dean, 2004; Mooney, 2006).

Conflict between the White House and scientists has not been a major part of the presidential campaigns of 2008, although it was sometimes mentioned by Democratic Party candidates Senators Barack Obama and Joseph Biden. Nevertheless, there is an opportunity after the election to address the relationship between the White House and the scientific and technical communities, and many scientists and engineers hope that this relationship will improve in the near-term future. For a variety of reasons—primarily global climate change and the related challenge of finding new sources of energy—many people believe that scientific research is more important now than ever. But the U.S. is also facing global competition in scientific and technical research and education in ways that are new and alarming. The chronic apathy and underperformance of American students in math and science classes are routinely described as a national crisis, especially in light of the superior performance of Chinese, Indian, and other nations’ students. But many scientists and leaders in related fields worry that partisan political conflict over scientific issues has contributed to public doubt and confusion over science. The National Science Foundation’s Science and Engineering Indicators Report of 2008 says that while public support of science remains high—scientists have public esteem second only to the military—Americans “perceive a significant lack of consensus among scientists” on controversial issues, including global climate change and stem cell research (National Science Foundation, 2008). Because most scientists agree on climate change and stem cell research, there is concern that politicians are exaggerating the significance of dissent, and that this could have a side effect, in the minds of some Americans, of devaluing scientific advice at a time when the nation urgently needs scientific solutions to problems.

For all these reasons, attention to the relations between scientists and policymakers, and between scientists and the public, appears to be a job for the next president. The experience of President Johnson may be illuminating because the roots of many conflicts over science began during his administration. LBJ’s was the last White House administration of science’s “golden age,” and the last one before latent conflict over science’s role in society exploded into decades of political conflict. A reexamination of LBJ’s science and technology policy could therefore be helpful in understanding how we got to where we are today, and also help frame the big issues that the next president is

likely to confront.

## **Vannevar Bush and the Emergence of U.S. Science and Technology Policy**

In the field of science policy, the foundational role of Vannevar Bush, President Roosevelt's wartime science adviser, is a familiar one. Bush, an engineer from MIT who also co-founded what became the Raytheon Corporation, persuaded Roosevelt to launch a National Defense Research Committee in 1940, which Bush then chaired. The committee of scientists was absorbed a year later by the Office of Scientific Research and Development, with Bush as its director. Bush oversaw the mobilization of scientists throughout the United States to help the war effort, with dozens of technologies emerging out of OSRD programs. Bush created the Manhattan Project under OSRD and managed the atomic weapon program until 1943, when it was taken over by the Army.

In November 1944, Roosevelt asked Bush to draft a plan for postwar science policy. FDR died in April of 1945; Bush's report was delivered to President Truman that July. *Science, The Endless Frontier* became the "blueprint" for postwar American science policy, an explanation for why the United States government should continue to invest in scientific and technical research, both basic and applied, for both national security and national prosperity. Bush also called for a National Research Foundation, to be controlled by a small board of members appointed by the president, and directed by someone chosen by the foundation members. Truman objected to this arrangement, preferring a director chosen by the president. After five years of debate and political bargaining, Truman signed the National Science Foundation Act of 1950, with a director and board appointed by the president. Bush and other scientists believed that the national research agenda should be controlled by scientists themselves. Truman and the Senate were persuaded by the director of the Bureau of the Budget, Harold Smith, that the federal government should not relinquish its constitutional authority to determine how federal funds were spent (Blanpied, 1998).

A key player in the five-year debate over the national research institution was West Virginia Democratic Senator Harvey Kilgore. He sponsored a bill to create the National Research Foundation, but he advocated a much larger role for the federal government in setting the research agenda, and he envisioned a program that looked more like the Department of Agriculture's Extension Service, with a focus on practical applications of research with a wide geographic distribution of research opportunities (Brooks 1996, 16-18). While the National Science Foundation took on a character more like Bush's vision, the counterargument of Kilgore would lay dormant for another 15 years.

The Promethean-like birth of the U.S. science establishment has taken on a mythical sort of narrative, which, 63 years after *Science, The Endless Frontier*, has been challenged by a number of historians and critics of the Vannevar Bush blueprint. David Hart, of the School of Public Affairs at George Mason University, has traced the complex relations that emerged out of World War II in his 1998 book, *Forged Consensus: Science, Technology, and Economic Policy in the United States, 1921-1953* (Hart, 1998). Bush, writes Hart, "was brilliant and effective in mobilizing the nation's scientific and

technological resources for World War II, but *Science, The Endless Frontier* is better seen as a political tactic than as an original blueprint” (Hart, 1998, 206). David S. Greenberg calls the “hagiography” of Bush’s plan “a creation myth” (Greenberg, 2001, 41). Dan Sarewitz of Arizona State University, and a former staff member of the House Science Committee, criticizes Bush’s “linear” model of benefit from basic research to applied development, and the implicit claim that the larger the research apparatus for the nation, the larger the benefits (Sarewitz, 1996, 17-21).

In retrospect, Bush’s report can be seen as both a visionary justification for federal spending on scientific and technological research in U.S. universities and research laboratories, and as a political tactic meant to protect the autonomy of scientists from the vagaries of political wrangling and influence. Isolating scientists from politics while also building a massive and expensive scientific and technical research infrastructure proved to be an impossible goal, although the success of American science in World War II created a general consensus among scientists from elite institutions that lasted a long time. Also, in retrospect, it was Bush’s call to bond the federal government to science and technology research that created the conditions for U.S. scientists and engineers to become entangled with political controversies thereafter.

The difficulties of the relationship between scientists and policymakers became evident immediately after the end of World War II, when Bush, Leo Szilard, Albert Einstein, Neils Bohr, and other prominent physicists called for international control of atomic energy. The scientists who had developed the first atomic bomb, or who, like Einstein, had made it possible, were vexed by regrets. President Truman, who had ordered the use of the bombs dropped on Nagasaki and Hiroshima, did not share these regrets—he called Robert Oppenheimer, after a personal meeting with the famous physicist, a “cry-baby” (Herken, 2000, 31). Truman was focused on retaining the power of the White House and competing with the Soviet Union, so he either ignored or rejected the advice of scientists with more idealistic and expansive goals, including Vannevar Bush (Herken, 2000, 37-38). Thus Truman not only retained the “atomic monopoly” of the United States, but ordered the development of the hydrogen bomb, which Bush and other science advisers opposed.

But the clearly vital importance of science and technology to national security did serve to embed science and technology policy into government affairs in the early postwar years. Throughout the 1950s, the competition between the Soviet Union and the United States was manifested primarily through scientific and technological developments, such as the H-bomb, the development of long-range jet bombers and, eventually, intercontinental rockets. Johns Hopkins University historian Stuart Leslie observed:

...the military-driven technologies of the Cold War defined the critical problems for the postwar generation of American scientists and engineers. Indeed, those technologies virtually redefined what it meant to be a scientist or engineer....The new challenges defined what scientists and engineers studied, what they designed

and built, where they went to work, and what they did when they got there (Leslie, 1993, 9).

Because of this context, in the 1950s nearly 100 percent of the research funding supported by the federal government was for military-related activities. This constrained the kind of advice that the president received from science advisers, and it also created a national security cadre of influential scientists, nearly all of whom came from a handful of elite universities, particularly from institutions in the Cambridge, Massachusetts, area. Through the decade of the 1950s, bridges were built between Washington and universities such as MIT, Harvard, Stanford, and the University of California. The universities sent prominent scientists and engineers to assist the federal government, and received in return the large defense-related research contracts that characterized the Cold War era. Federal spending on research and development grew 14 percent annually, on a dollar adjusted basis, between 1953 and 1961, an explosive rate of growth for any spending program over such a period of time (Smith, 1990, 39).

It was this blurring of the lines between the military agencies and university research labs that would create many flash points in the future. As more scientists were drawn into the politics of the Cold War, more of them began to express their reservations about U.S. policies, especially those who were at academic institutions.

At the same time, however, a large array of defense-related research institutes was growing and employing scientists for pure research. The national laboratories, largely holdovers from World War II, continued to grow, and organizations like the RAND Corporation, Lincoln Laboratories at MIT, the Stanford Research Institute, the MITRE Corporation, and others were set up to do research for the federal government. These institutions began to develop their own cultural identities which were more in tune with their Pentagon sponsors and with the booming defense and aerospace industries than with the academy. Within a short time, there were two camps in science policy: the “peace” scientists who favored arms control and international solutions to the nuclear stalemate, and the “war” scientists who believed in U.S. technological and military supremacy. In the former group were Einstein, Szilard, George Kistiakowsky (Eisenhower’s science adviser), and Jerome Wiesner (Kennedy’s science adviser). The “war” scientists were symbolized for decades by Edward Teller, known as the “father of the hydrogen bomb” and a co-founder and leader of Lawrence Livermore National Laboratory in California. Teller alienated his fellow physicists by testifying against Robert Oppenheimer during the latter’s appearance before the House Un-American Activities Committee in 1954, and later by vigorously opposing a comprehensive test ban treaty. But Teller was an unusually prominent and outspoken symbol of an immense new number of defense scientists and engineers employed by the defense industry, the Pentagon, and the new research labs and think tanks that were created by Cold War spending.

When President Eisenhower officially created the post of “special assistant to the president for science and technology,” in 1957, along with a new President’s Science Advisory Committee (PSAC), he appointed James Killian, the president of MIT,

someone familiar with what came to be called “the Cambridge crowd” of advisers that shuttled between Cambridge, Massachusetts, and the White House. The creation of PSAC came quickly after the Russian launch of the Sputnik satellite, on October 4, 1957, an event that famously shocked America, both because of the threat of a Soviet nuclear-armed missile reaching the U.S. and because the Russians had beaten America into space. On October 15, Eisenhower convened a meeting of scientific advisers, including Isidor Rabi, an MIT physicist who had worked on the Manhattan Project, won the Nobel Prize, and served as Truman’s science adviser. Rabi recommended a permanent science adviser to the president, advice that Eisenhower took with some ambivalence (Herken, 2000, 102, 104). Eisenhower offered the job of science adviser to Killian, and the new committee and position were announced on November 7, 1957.

The Sputnik shock created reverberations throughout the U.S. government, and the Soviet Union jolted Americans a month later with Sputnik II, on November 3, 1957, a second satellite that carried a half-ton payload and a live dog (Wang, 2008, 71). Americans had simply assumed, and scientists and political leaders had often affirmed this assumption, that the United States’ superiority in science and technology was unquestionable. Sputnik unleashed a burst of American soul-searching, as well as fear of nuclear war, to a degree that surprised and perplexed Eisenhower (Wang, 2008, 73).

Sputnik opened an opportunity for the opposition party, the Democrats, to both pound the White House for the “missile gap,” and to rush to propose new programs and legislation that would position the Democrats to take back the White House in the 1960 election. And leading the Democrats in the U.S. Senate was the Majority Leader, Lyndon Baines Johnson.

### **Johnson, Sputnik, and the “Missile Gap”**

LBJ had been part of the debates about U.S. military policy since his days in the House, when he served on the Naval Affairs Committee, and also as a reserve officer in the Navy. Roosevelt sent Johnson to the South Pacific during World War II as part of a three-man investigation of the theater. In 1948, Johnson was elected to the Senate and appointed to the Senate Armed Services Committee. In that role he created and then chaired an influential Preparedness Investigating Subcommittee, created in 1949 and highly visible during the Korean War. After that war ended, the subcommittee faded in importance, but Sputnik offered an opportunity to revive it and Johnson’s national role. LBJ was a protégé of Senator Richard Russell, the powerful southern Democrat who chaired the Senate Armed Services Committee. Russell was keen to let Johnson run with the agenda of U.S. control of space. George Reedy, Johnson’s close aide, said, “The issue is one which, if properly handled, would blast the Republicans out of the water, unify the Democratic Party, and elect you president” (Johnson, 2006, 80).

Johnson was not the only Democratic Senator to see the political potential in Sputnik. Senator John F. Kennedy blasted the Eisenhower administration for “complacent miscalculations, penny-pinching, budget cutbacks, incredibly confused mismanagement

and wasteful rivalries and jealousies” (Wang, 2008, 72). Both Kennedy and Johnson viewed Americans’ concern about Sputnik and Russian science as a way to craft a broad agenda of legislation and political opposition, into areas covering science, space exploration, defense policy and education. Out of this came the National Aeronautics and Space Administration (NASA), the Pentagon’s new Advanced Research Projects Agency (ARPA), and the National Defense Education Act, which was meant to stimulate math and science education in U.S. public schools.

Johnson called hearings on the “missile gap” and space before his long-dormant Preparedness Subcommittee in November 1957 and he asked prominent scientists to testify first in order to frame the issues around space and not just military squabbles over funding. The big names from science were Edward Teller, Vannevar Bush, and rocket scientist Werner von Braun. LBJ also added university scientists to the subcommittee staff from Harvard, Rice University, and Cal Tech (Woods, 2006, 333). Johnson, who dominated the hearings, turned the discussion away from arcane and mind-numbing debates about military technology to a broad reformulation of American society from top to bottom. George Reedy said, “The Romans dominated the world because they could build roads. They did not learn to build roads because they were planning a military weapons but because they needed them for their whole economy” (Woods, 2006, 335). LBJ ran with the space issue as a political winner. Eisenhower was annoyed. “Lyndon Johnson can keep his head in the stars if he wants. I’m going to keep my feet on the ground,” said the president (Wasser, 2005).

The “missile gap” issue was kept alive into the presidential election of 1960, after which it disappeared. In February 1961, just weeks after President John F. Kennedy’s inauguration, Secretary of Defense Robert McNamara briefed reporters that there was no “missile gap” between the U.S. and the Soviet Union (Raymond, 1961). But the “space race” was still on, and Kennedy asked LBJ to chair the new Space Council in April 1961 (Woods, 2006, 392). A few days later, the Soviet Union sent the first man into space, Yuri Gagarin. U.S. astronaut Alan Shepard then became the first American in space in May. Johnson, McNamara, and Werner von Braun all advised Kennedy that the main competition should be focused on “manned exploration of the moon” (Woods, 2006, 393). Just two weeks after Shepard’s orbital flight of about 15 minutes, President Kennedy told a joint session of Congress that he pledged the nation to put a man on the moon by the end of the decade.

Johnson’s key leadership role in the space program put him in routine contact with scientific leaders, especially Kennedy’s science adviser, Jerome Wiesner, an MIT engineer. Wiesner was part of the Cambridge scientific establishment that had settled in as advisers on science-related policy since the end of World War II. While Wiesner and Johnson are both on record as having pleasant things to say about one another, Wiesner was far more comfortable with Kennedy than Johnson was with Wiesner. Kennedy and Wiesner came from similar Cambridge university backgrounds, and Johnson thought of Kennedy’s Cambridge aides as “the Harvards.” Johnson was occasionally annoyed by scientists’ general skepticism about manned space exploration, which many scientists

thought cost too much for too little scientific value (a skepticism that remains today). Wiesner's rapport with Kennedy earned him the nickname "czar of science," particularly important in an administration that was ramping up science spending. But Johnson was often oriented more to his allies in Congress, where Texans helped locate the new federal space facility in Houston. Wiesner also discovered quickly that Johnson was not interested in the details of scientific controversy. "I found that if I wrote a memo that was too long," wrote Wiesner, he simply wouldn't read it, so I adopted the policy of never making a communication longer than one page, which was all he had the patience for" (Rosenblith, 2003, 283).

Wiesner and other members of the scientific establishment were smitten with Kennedy's charm, intelligence, and his mutual regard for their issues: space, education, and arms control. These people were shocked by Kennedy's assassination, like all Americans. They also sensed that there might be a change in atmospherics with President Johnson. Richard Garwin, a physicist who worked on the Manhattan Project and who was a member of PSAC, wrote Wiesner after Kennedy's assassination and said:

Brilliant, hard working, and effective as he [Kennedy] was, it was your tutelage in matters technological, military, and scientific, which made him very outstanding in these fields....Now we have a new President, and the educational process must begin again. Very likely President Johnson is not aware of the matters in which his Special Assistant for Science and Technology can aid him, nor of the recent accomplishments of the President's Science Advisory Committee (Quoted in Wang, 2008, 236).

Garwin's note suggests that perhaps Johnson was not as familiar with PSAC's agenda as the scientists would have preferred, and that Wiesner might have to put effort into the "educational process" of making Johnson a president comfortable with, and supportive of, scientists. Wiesner stayed in place after the assassination, but Kennedy had already picked his successor, Donald Hornig, chairman of the chemistry department at Princeton and a member of PSAC. Wiesner intended to return to MIT to become Dean of Science. Hornig sat in Princeton waiting for LBJ to decide whether or not to move along his appointment. Finally, LBJ accepted the appointment and brought Hornig to Washington as his new Special Assistant on Science and Technology in January 1964. The relationship would not be an easy one.

## **President Lyndon Johnson and Science**

Much has been written about the complexity and contradictory character of Lyndon Johnson. A charismatic and at times overwhelming personality, he was also plagued with insecurities about his poor Texas roots; in Johnson's day, Texas was regarded as backward, impoverished, and part of the Jim Crow South (which LBJ, more than any other person, helped repair). The Kennedys and Johnson were a shotgun wedding in 1960, and the friction between Kennedy's smooth Northeastern urbaneness and Johnson's Texas populism was a constant irritant to LBJ. He distrusted Kennedy's "brain

trust” of intellectuals, and, of course, Robert F. Kennedy emerged as his chief political rival and critic.

Johnson’s attitude about “the Harvards” extended to scientists, especially the elite scientists who were part of the establishment embedded in PSAC and other influential government committees. McGeorge Bundy, Johnson’s national security adviser, felt compelled to tell Johnson that “the prima donnas of science will be glad to work with and for” Hornig (Quoted in Wang, 2008, 237). Johnson himself never really warmed up to Hornig. (Hornig is not mentioned in LBJ’s own autobiography, *The Vantage Point: Perspectives of the Presidency 1963-1969*.) Hornig was quite different from the activist and gregarious Wiesner. A respected scientist who had climbed the tower at the famous Trinity atomic test in 1945 in order to guard against sabotage, Hornig was nevertheless confronted by an outsized political personality unfamiliar to him. “I had little feeling for the strong, dominant personality who saw everything in political terms, and President Johnson had little feeling for academicians and scientists, although he always held them in great respect” (Quoted in Wang, 2008, 238).

“I was never on easy personal terms with the president,” recalled Hornig. “There’s always been a certain gap in attitude and approach between a Texas rancher and an Ivy League professor. I was on much easier terms with Kennedy, who asked me to serve in the first place” (Boffey, 1969, 453). Wiesner later said that Hornig “had to carry the burden of Johnson’s alienation from scientists” (Herken, 2000, 147).

Nevertheless, Johnson owed some gratitude to scientists in the 1964 presidential election, when several prominent scientists concerned about Barry Goldwater started Scientists and Engineers for Johnson-Humphrey, a rare venture into partisan politics. Among those leading the group were George Kistiakowsky, Eisenhower’s science adviser, and Detlev Bronk, former president of the National Academy of Sciences (Harsha, 2004, 12). The organization quickly grew to 50,000 members and, using donations, published a booklet titled “The Alternative is Frightening.” Particularly damaging to Goldwater was a radio broadcast sponsored by the group that featured members of the Manhattan Project who declared that Goldwater could not be trusted with the “power that could destroy mankind” (Greenberg, 2001, 155). Goldwater never recovered from his “bomb-dropper” image and Johnson’s victory was a landslide.

Johnson thus had the backing of the scientific establishment when he was elected president in November 1964. Hornig was not an imposing or commanding figure in the Johnson White House, but scientists gave him credit for hard work, a low-key strength that helped resolve some complicated issues, and for navigating a difficult relationship between the scientific community and the White House that became increasingly strained because of the war in Vietnam (Boffey, 1969, 453). Hornig, however, didn’t learn the lesson that Wiesner learned about Johnson’s penchant for brevity. “Don talked too much,” one White House staffer told Philip Boffey of *Science* magazine, “and his memos were terribly long and complicated.”

Johnson was very interested in the space program, although not always in agreement with scientists about what the space program was all about. But Johnson was less interested in pure science, and he felt that for all the money that was being spent on research, there should be political benefits that were comprehensible to ordinary Americans. Hornig said that Johnson said to him, “For \$18 billion per year, there ought to be something to say at least once a week.” Johnson said he wanted to know “what science could do for grandma” (Herken, 2000, 149). There was a shift in presidential priorities toward applied research with political payoffs. LBJ was often deaf to the scientific adviser’s arguments about the importance of basic research. In 1966 and 1967, when Johnson met with directors of the National Institutes of Health to discuss biomedical research, Hornig was not invited (Boffey, 1969, 454).

LBJ’s interest in the practical applications of science and technology and in their political benefits led federal science and technology in some new directions. Prior to the Kennedy Administration, nearly all federal spending on R&D had some relationship to national security or nuclear technology. That began to change during the Kennedy years, as Kennedy and his advisers started to think about how to use science and technology policy to improve the economy. This trend accelerated under Johnson. Hornig was asked, for example, how scientists could contribute to the “War on Poverty,” and so the science adviser tried to develop programs for research on improving low-income housing (McComb, 1968, 22).

Scientists were also engaged in assessing the risk to the environment from pesticides, following the publication of Rachel Carson’s landmark book *Silent Spring* in 1962. PSAC created an Environmental Pollution Panel in 1964 and released the first comprehensive look at the environment by a federal commission, “Restoring the Quality of Environment,” which confirmed Carson’s claims about pesticides (Report of the Environmental Pollution Panel, 1965). Johnson wrote in the forward to the report, “Ours is a nation of affluence. But the technology that has permitted our affluence spews out vast quantities of wastes and spent products that pollute our air, poison our waters, and even impair our ability to feed ourselves” (Ibid.). Johnson’s commitment to environmental issues led to over 200 bills on environmental quality, more than any other president, and the issue became a lifelong passion of LBJ’s wife, Lady Bird. Johnson also set up, in 1965, the prototype for the Environmental Protection Agency, the Environmental Science Services within the Department of Commerce. Hornig, a chemist, had predicted that environmental pollution would become “one of the big political issues of our time,” and he eventually felt this prediction was “one of the prognostications I’m most proud of” (McComb, 1968, 21).

This expansion of the portfolio of science and policy technology in the White House led to a growing staff and budget in the White Office of Science and Technology. Hornig’s budget doubled in his five years in the White House, to \$1.8 million, and the full-time staff grew from 15 to 21 (Boffey, 1969, 457). PSAC was diversified to include new fields and people from different parts of the country.

But the science establishment was incubating a growing resistance to what would become LBJ's chief problem, the war in Vietnam. In late 1965, Wiesner and Kistiakowsky—both leaders of Scientists and Engineers for Johnson—wrote Johnson a letter asking him to reconsider the military escalation in Vietnam. Johnson did not reply, nor did anyone from the White House. Wiesner tried again, through Vice President Hubert Humphrey, in early 1966, and the result was the same (Herken, 2000, 150). This was the beginning of a widening rift between scientists and the Johnson White House, which would strain personal relations and eventually lead to a complete breakdown of the link between the White House and elite American science.

In January 1966, 29 prominent scientists from Cambridge-area universities signed a letter of protest over the use of chemical defoliants in Vietnam (Ibid.). Within a short time, Johnson stopped talking to his scientific advisers, and even threatened to skip the annual award ceremony bestowing the National Medal of Science (Ibid.). The scientific and engineering communities began to split into two camps: those looking for a technical solution to the war, and those developing a growing passion for resisting the war altogether. By the end of the Johnson Presidency, lamented George Kistiakowsky in a letter to *The New York Times*, the science advisory role had been “largely taken over by professional military scientists and those in the aerospace industry and think tanks” (Ibid.).

The alienation of academic scientists from the Pentagon and the White House extended to the issue of the proposed Anti-Ballistic Missile (ABM) system, which was opposed by the pro-disarmament scientists on PSAC and supported by Pentagon managers and the aerospace industry. James Killian, Kistiakowsky, Wiesner, Hornig, Herbert York, and others members and former members of PSAC all opposed the ABM. But Johnson was being taunted by Richard Nixon in 1967, when Nixon suggested that not deploying the ABM would mean a new “missile gap” accusation could be used against Johnson (Primack and von Hippel, 1974, 63).

The weight of Vietnam brought down LBJ; on March 31, 1968, he announced that he was dropping out of the race for reelection. The Democratic Party split into factions and, after the assassination of Robert F. Kennedy and the violent and bitter party convention in Chicago, the Democrats lost the White House to Richard Nixon. The “golden age” of science was over.

### **After LBJ: The Partisan Wars**

After the Johnson Presidency, the relations between the federal government and the scientific community see-sawed between collaboration and conflict. While funding continued to flow, and there were major breakthroughs made possible by government support, the deep divisions caused by the war in Vietnam and controversies over strategic nuclear weapons ended the post-war consensus and began years of mutual suspicion. In the Nixon White House, writes science policy historian Gregg Herken, “Distrust and the effects of partisan politics were increasingly evident in White House relations with

PSAC” (Herken, 2000, 176). Nixon ignored PSAC in the Strategic Arms Limitation Talks (SALT) preparation. Nixon fumed at scientists on campus who were writing letters and joining campus protests over the war. When Nixon was reelected in 1972, he dissolved PSAC and the Office of Science and Technology, and turned science advising over to the director of the National Science Foundation.

Similar struggles over science policy continued through the Carter and Reagan years in the White House. Disputes raged over strategic weapons systems such as the MX missile and the Strategic Defense Initiative over how to achieve a comprehensive test ban treaty, and over environmental controversies. President Reagan deliberately kept his plans for a giant anti-missile system, the SDI, secret so that the scientific community could not sabotage it before its birth. George Keyworth, Reagan’s science adviser, did not even learn of Reagan’s speech announcing the SDI until four days before it was delivered, a development that “stunned” Keyworth (Herken, 2000, 211). Reagan’s plan was greeted with harsh criticism from scientists and engineers, who questioned its feasibility. One of the chief critics was Richard Garwin, one of the most familiar public scientists, who had angered Nixon when he testified against the SuperSonic Transport (SST), and Carter when he tried to push the White House on a comprehensive test ban.

Garwin had broken with the traditional White House model of science adviser when he decided to go public with his criticisms of the SST program, after heading the “ad hoc SST Review Committee” within Nixon’s Office of Science and Technology. The White House withheld the Garwin committee’s report, and the White House and industry lobbyists were pushing for funds to build the SST. Garwin felt he had to act “no longer as adviser but as citizen” (Herken, 2000, 179).

The cultural upheavals of the 1960s and ’70s did not leave the scientific community unaffected. There was a new attention and new thinking about the “social responsibility” of scientists and engineers. At MIT there was a strike of the faculty in January 1969 in order to promote “a public discussion of problems and dangers related to the present role of science and technology in the life of our nation” (Leslie, 1993, 233). A student-faculty study group on this issue quickly evolved into a public interest organization called the Union of Concerned Scientists. Other organizations of scientists were already developed, particularly the Council for a Livable World, founded by Leo Szilard, and the Federation of American Scientists, which was founded by members of the Manhattan Project, including Hans Bethe.

At the same time, pockets of conservative scientists were found at the national laboratories—especially at Lawrence Livermore National Laboratory, under the tutelage of Edward Teller—and at defense-related think tanks such as the RAND Corporation and the Marshall Institute, which was founded in 1984 as a home to outspoken champions of the SDI.

Political leaders of various political leanings could thus mobilize scientists against each other, by favoring one group of scientists or another. Reagan had a high regard for Teller

and his “O Group” at Livermore, while the Democratic Congress found its own scientific advice through the Congressional Office of Technology Assessment and the Congressional Research Service, as well as by calling on scientists and engineers to testify in hearings.

George Keyworth, Reagan’s science adviser, succumbed to the pressure within the Reagan White House to support the president’s programs, particularly the SDI, which had been derisively labeled “Star Wars.” Keyworth admitted that he became a “cheerleader” for the program that was held in low esteem by most scientists and academic engineers, and especially by the prestigious physicists of the Cold War generation who had long fought Teller. “By the second anniversary of Reagan’s SDI announcement,” writes Herken, “relations between the science adviser and the scientific community were under more strain than at any time since their nadir in the closing days of the Nixon Administration” (Herken, 2000, 215).

These disputes damaged the prestige of the science adviser position. The scientific community was struggling with a dilemma: how to revive the respect and influence of the “golden age” after World War II, but also adapt to an increasingly partisan political environment that made most decisions involving science and technology subservient to partisan political ends. The Vietnam war and the bitter fights over strategic weapons ended the framework of consensus that existed well into the Johnson Presidency. Once these two issues cracked that consensus, there were no obvious ways to put it back together again.

When the Soviet Union collapsed in August of 1991, the science policy community was not prepared. There had been some talk in the previous years about a “post-Vannevar Bush science and technology policy,” but there was little substantive thinking about what would hold U.S. science policy together after the end of the Cold War. In the latter years of the first Bush Presidency, a downturn in the economy and the rise of Japan and other economies fostered more talk about a U.S. technology policy that might help America compete. But Bush’s advisers on the economy were free market loyalists who objected to any government intervention. These advisers were at odds with Bush’s science adviser, Alan Bromley, whose office produced a document in 1990 titled “U.S. Science and Technology Policy” (Bromley, 1990). Scientists and engineers within the Bush White House battled economists and budget managers over how much the government should do to help U.S. technology. The result was a confusing and hodge-podge array of programs and ideas. Lewis Branscomb, a veteran technology policy expert at Harvard University, said “all the elements of an adequate technology policy are already part of the Bush administration—except coordination, a clear rationale, sufficient funding and political will” (Chapman, 1992, 45).

It was not until the Clinton administration came to the White House in 1993 that the idea of a “post-Cold War” science and technology policy began to sink in. Bill Clinton and Al Gore released a white paper on technology policy as one of the first documents to come out of their administration, in February 1993, just weeks after the inauguration. The

white paper, titled “Technology for America’s Growth: A New Direction to Build Economic Strength,” attempted a distinct break with the past:

The traditional federal role in technology development has been limited to support of basic science and mission-oriented research in the Defense Department, NASA, and other agencies. This strategy was appropriate for a previous generation but not for today’s profound challenges. We cannot rely on the serendipitous application of defense technology to private sector. We must aim directly at these new challenges and focus our efforts on the new opportunities before us, recognizing that government can play a key role helping private firms develop and profit from innovations (Clinton and Gore, 1993, 7).

Clinton and Gore proposed a dramatic and expensive R&D program aimed at improving America’s economic competitiveness. But these ambitions ran into the economic realities of large federal budget deficits, and Clinton’s own economic advisers were advocating policies to balance the federal budget. Clinton was also distracted by an even bigger issue, reforming U.S. health care, which absorbed the attention of most of the people in the White House working with Congressional leaders.

In 1994, the mid-term elections put the Republicans in control of Congress, and particularly under the control of the new Speaker of the House, Rep. Newt Gingrich, who had his own ideas about the role of science and technology in the U.S. Gingrich put one of his chief allies, Rep. Robert Walker of Pennsylvania, in charge of the newly renamed House Science Committee. Walker set about dismantling all of the Clinton-Gore proposals for science and technology, and he cut the federal R&D budget by 34 percent over five years. The professional staff of the House Science Committee was turned over to political appointees, and a highly partisan and rancorous atmosphere descended on the committee.

In 2000, Walker became the technology adviser to presidential candidate George W. Bush. When the Bush-Gore race unfolded, the partisan divisions in the science and engineering communities deepened, and plunged even further when the election became essentially a statistical stalemate, resolved by a Supreme Court decision. After the inauguration of President George W. Bush in 2001, a new science adviser was not appointed for nine months. Even then, the new appointee, John H. Marburger III, was stripped of the title of “special assistant to the president,” an effective demotion of the job.

George W. Bush and his staff brought the partisan conflict that had simmered in science policy to a roiling boil. Bush’s publicly expressed skepticism about global climate change, his opposition to stem cell research, and his ambivalence about the theory of evolution all alienated scientists in the U.S. and around the world. But it has been the Bush administration’s penchant for distorting scientific evidence for political purposes that has set off a firestorm of anger and accusations from scientists, and brought the relations between the White House and scientists to their lowest point in a generation. Democratic opponents of the White House have accused Republicans of a “war on

science” (Dean,2004; Mooney, 2006).

Accusations and evidence piled up about political distortions of scientific information in government reports. Both academic and government scientists deplored the political manipulation of scientific data and conclusions. “Science and facts are not a factor in decisions, and ideology dominates,” said Kevin Trenberth, a climate scientist at the National Center for Atmospheric Research to the Web site Live Science (Britt, 2008). David Baltimore, a Nobel laureate, president of Cal Tech until 2006 and president of the American Association for the Advancement of Science in 2007 called the interference of White House politics in scientific reports “unprecedented” (Knight, 2004). Baltimore joined 19 other Nobel laureates—such as Leon Lederman, Harold Varmus, Steven Weinberg, and Norman F. Ramsey—in signing the letter created by the Union of Concerned Scientists in February 2004, a letter that asserted that the Bush administration had deliberately distorted scientific evidence in reports and programs on health, biomedical research, and nuclear weapons (Union of Concerned Scientists, 2004). Sidney Drell, a Stanford physicist who served as a science adviser to both the Johnson and Nixon administrations, who did not sign the UCS statement, told *The New York Times*, “The input from individuals whose views are not in the main line of their policy don’t seem to be sought or welcomed” (Glanz, 2004).

A dramatic case of the bitter partisan fights unfolded when Susan F. Wood, assistant commissioner for women’s health and director of the Office of Women’s Health at the Food and Drug Administration, resigned in protest, in September 2005, over delays imposed on an approved women’s contraceptive known as the “morning after pill.” Wood charged that political interference was keeping the FDA from a final ruling that would move the drug to market. “I can no longer serve as staff when scientific and clinical evidence, fully evaluated and recommended for approval by the professional staff here, has been overruled,” she wrote in her e-mail announcement of her resignation (Kauffman, 2005). In July 2007, former Surgeon General Richard H. Carmona testified before a Congressional panel that his office was routinely deterred by administration officials from reporting correct information on birth control, sex education, or global health issues (Harris, 2007).

Scientists also chafed at the persistent pressure of conservative religious activists to introduce “creationism” into public school science curricula. When President Bush said in August 2005 that “intelligent design,” a variation of “creationism,” should be taught alongside evolution in public schools, his science adviser, John Marburger, had to insist that “intelligent design is not a scientific concept.” Marburger, reported *The New York Times*, “said it would be ‘over-interpreting’ Mr. Bush’s remarks to say that the president believed that intelligent design and evolution should be given equal treatment in schools,” but the *Times* then noted that conservative religious activists interpreted the president’s remarks in exactly this way (Bumiller, 2005).

Finally, medical scientists and the Bush administration clashed over stem cell research. Stem cells are widely regarded as a key tool in future medical discoveries in gene

therapy. Congress passed a bill lifting restrictions on stem cell research in 2007, but President Bush vetoed the bill—only his second veto—in June of that year. Three Harvard University stem cell researchers, Kevin Eggan, Chad Cowan, and Douglas Melton, were surprised to learn that their work was being used in a White House report opposing embryonic stem cell research. The three wrote to members of Congress and said “We are surprised to see our work on reprogramming adult stem cells used to support arguments that research involving human embryonic stem cells is unnecessary. Our work directly involves the use of human embryonic stem cells... [and] is precisely the type of research that is currently being harmed by the President’s arbitrary limitation on federal funding for human embryonic stem cell research.” The three researchers accused the White House of “a clear misrepresentation of our work” (Eggan, Cowan, and Melton, 2007).

In the last two years of his presidency, George W. Bush attempted to reach out to scientists with a new burst of funding for the physical sciences, and a new American Competitiveness Initiative (ACI), which focuses on improving math and science education and the “pipeline” of skilled workers. In his 2006 State of the Union speech, Bush promised to double the budgets, over ten years, of the National Science Foundation, the Department of Energy’s Office of Science, and the National Institute for Standards and Technology (Bush, 2006). Congress refused to fully fund the president’s funding request for science agencies for FY 2007. But for the FY 2009 budget under consideration in 2008, Bush reiterated his support for the ACI and for doubling funding for the physical sciences (Jones, 2008). The ACI bill passed by Congress required an annual “National Science and Technology Summit” of national leaders, and the first one was held at Oak Ridge National Laboratory in Tennessee in August 2008.

The ACI agenda happened to dovetail with a major report from the National Academies of Science, released in 2005, titled “Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.” The committee that produced this report was chaired by Norman Augustine, former CEO of Lockheed Martin and a longtime White House science adviser, and the members included a distinguished list of national leaders, such as Craig Barrett, chairman of Intel Corporation; Robert Gates, who became Secretary of Defense; Charles Vest, president emeritus of MIT; and Nobel laureates Steven Chu and Joshua Lederberg, among others (National Academies of Science, 2007). The report called for, among other things, large increases in funding for K-12 math and science education, long-term commitment to funding basic research, a new ARPA-like technology office within the Department of Energy, and a new Presidential Innovation Award. The committee also recommended reform of the U.S. intellectual property system, assuring broadband Internet access for all Americans, and tax incentives for U.S. R&D and innovation (Ibid.).

After many years of a federal science budget that was basically flat in inflation-adjusted dollars, Bush’s commitment to the ACI goals gave hope to some scientists and disappointed others. Robert Berdahl, president of the Association of American Universities, said, “Question: Is the President’s budget good or bad for the vital research

and education that is performed by America's research universities? Answer: Yes.” (Science, 2008). The National Institutes of Health and NASA budgets are flat, while there are large increases for the National Science Foundation and scientific research work at the Department of Energy. Science projects at the National Institute of Standards and Technology also received a 22 percent increase (Science, 2008).

While these funding requests encouraged scientists in fields that were favored, anxiety, wariness, and discouragement are still strong in the science policy community. Some scientists feel that the “war on science” during the Bush administration has eroded the stature of science in the minds of Americans, although the National Science Foundation’s 2008 “Science and Engineering Indicators” report shows that the public trusts scientists more than any other profession except the military (National Science Foundation, 2008). There is still a sense among many prominent scientists that the U.S. system of funding research and development is broken. There is concern that President Bush’s long neglect of science and his science adviser will become the norm for the future. And there is gloom about the fiscal prospects of the nation after an expensive war and the financial meltdown on Wall Street. Privately, many scientists wonder whether the United States is capable anymore of meeting any “grand challenges” in science. Scientists have been dismayed by the federal government’s priorities—such as pursuing the International Space Station and the Space Shuttle but not the Superconducting Supercollider—and by the loss of talent in previously world-class institutions such as the national laboratories. The glory days of large research and development labs such as Bell Labs appear to be gone for good. The financial success of companies like Google and Facebook, emblematic of the Internet age and largely decoupled from science-based innovation, raises the question of whether the long relationship of privately funded R&D and government-steered R&D will flourish again, the way it did in LBJ’s era. The strong pessimists wonder if anti-intellectualism and rancor over “elites” will continue to block the development of a national consensus on how science can help solve global problems.

Science and technology policy has not been a strong element of the 2008 presidential campaigns. Both candidates have expressed support for scientific and technological research, without committing any to any specific dollar figures for funding. A group of volunteers who created a Web site called ScienceDebate2008.com posed 14 questions to each candidate about science and technology policy, and those questions were answered by both Senators Obama and McCain by September 15th. The positions of the candidates do not diverge in many ways—they both support basic research, more and better science and math education, and a strong military—but, as expected, President-elect Obama favors more government action on expanding broadband Internet access, and Senator McCain supports limits on what kind of stem cell research will be funded.

Surely the biggest hurdle facing scientists and engineers in the United States today is the fiscal state of the nation, after many years of budget deficits, an expensive war that has not yet ended, and an epochal, historic disaster on Wall Street that will require unprecedented government funds to repair. To put this in perspective, the entire FY 2009 budget request for the National Science Foundation, for \$6.85 billion, is equivalent to

approximately 17 days of spending on the war in Iraq. Linda Blimes, former chief financial officer for the U.S. Department of Commerce, and Nobel-winning economist Joseph Stiglitz have estimated that the total cost of the war in Iraq to the U.S. government could be \$3 trillion (Blimes and Stiglitz, 2008). In September 2008, an emergency rescue package for distressed financial firms in the U.S. added hundreds of billions of dollars—the exact amount is not yet clear—to the federal government’s obligations.

In contrast, as the American Association for the Advancement of Science points out, “Federal research investments are shrinking as a share of the U.S. economy, just as other nations are increasing their investments” (American Association for the Advancement of Science, 2008). Currently, “...federal support for research is now in decline, with potential gains in the physical sciences more than offset by eroding support for biomedical research and other disciplines. The 2009 budget would continue the downward slide in federal research funding and leave the federal research portfolio 9.1 percent below the 2004 level in inflation-adjusted dollars” (Ibid.).

The federal government, like all institutions in the United States, is about to enter uncharted terrain as the nation’s largest-ever age cohort, the “baby boomers,” begins to retire in increasing numbers. Not only will this add more strain to the fiscal picture of the country, but a generation rich in scientific and technical talent will need to be replaced in the workforce. This will be particularly challenging for federal government agencies that need scientists and skilled engineers. As the title of the National Academies’ report “The Gathering Storm” meant to convey to the public, there is a growing feeling of crisis and alarm about the future of science, technology, and innovation in the United States.

Recalling one of the periods of LBJ’s political life, the economist Robert J. Samuelson wrote in *The Washington Post* in 2005:

Americans are having another Sputnik moment, one of those periodic alarms about some foreign technological and economic menace. It was the Soviets in the 1950s and early 1960s, the Germans and Japanese in the 1970s and 1980s, and now it’s the Chinese and Indians (Samuelson, 2005).

Samuelson argued that “the apparent American deficit in scientists and engineers is also exaggerated” (Ibid.). But others disagree, using the same analogy. “China is where we were in the early 1960s, and they look at us as the big Sputnik target,” said Eric Haseltine, former chief scientist for the Director of National Intelligence. “They are very hungry, and not so concerned about immediate economic payback” (Estrin, 2008, 153). The National Academies’ report cites a number of factors worrying American scientists and policymakers, including rising global competition in education for scientists and engineers, the decline of long-term and basic R&D by private companies, competition with low-wage workers in other countries, and severe fiscal constraints in government (National Academies of Science, 2007).

For all these reasons, combined with the looming challenges of the coming decades—energy, global climate change, terrorism, affordable health care, and demographic

transformation—the idea that the United State is at another “Sputnik moment” is not far-fetched. Lyndon Johnson turned the Sputnik incident into a broad, far-reaching reform that changed U.S. society, especially in science and technology. Zuoyue Wang, a historian of science policy, writes:

It took the Sputnik crisis to neutralize the traditional resistance to the presence of scientists at the center of the American political power that was shared by Eisenhower, his close political advisers, and the public at large.... (Wang, 2008 319).

While Americans are increasingly worried about the future prosperity of the country, it remains to be seen whether there is a politician with the talent, vision, and political skill of Lyndon Johnson who can seize this moment to forge a new era in science, technology, and American progress.

### **The Next Administration: Goals, Advice, and Trust**

Throughout the post-war history of science and technology policy there has been an underlying debate about whether federal funding for research is, or should be, tied to “national goals.” And the corollary questions about national goals include “what should they be?” and “who gets to choose?”

Vannevar Bush’s report, *Science, The Endless Frontier*, offered only the broadest goals of national security, economic well-being and health. Senator Kilgore, on the other hand, wanted science and technology investments to be much more closely tied to specific national needs, with a much more active role for government in choosing what scientists and engineers should research (Brooks, 1996, 16). Bush wanted government support of scientific research to be controlled primarily by scientists, who would pursue science itself, while most post-World War II presidents, including Johnson, have been more interested in research that produces practical benefits (and which can be used as a political asset).

After the Soviet Union collapsed in August 1991, there was renewed interest in science, technology, and national goals, if for no other reason than to search for a framework of support for science funding that might replace the Cold War. In September 1992, the Carnegie Commission on Science, Technology, and Government released a report titled “Enabling the Future: Linking Science and Technology to Societal Goals” (Carnegie Commission, 1992). It was produced by a committee headed by H. Guyford Stever, former science adviser to President Nixon, former chief of NSF and a former president of Carnegie Mellon University. The committee of seven distinguished science policy advisers recommended the creation of a new National Forum on Science and Technology Goals, “a diverse and broad-based group of individuals who are both critical and innovative, and who can examine societal goals and the ways in which science and technology can best contribute to their achievement” (Ibid., 50). In 1993, the National Academies of Science Committee on Science, Engineering and Public Policy followed

with its own report, “Science, Technology and the Federal Government: National Goals for a New Era” (National Academies, 1993).

The brief discussion of a “post-Cold War science and technology policy,” framed by new national goals, came to a quick end when the Congress switched its majority to the Republican Party in 1994 and the new Speaker of the House, Newt Gingrich, launched his own agenda. While Gingrich and his ally Robert Walker, the chairman of the House Science Committee, were outspoken champions of advanced technology (particularly hydrogen energy, in Walker’s case), they were not interested in federally-sponsored studies, and one of the first casualties was the Congressional Office of Technology Assessment, which was killed in 1995. The Gingrich agenda did not include any new assessment of national goals for science and technology.

In the absence of any framework of national goals, and with the Cold War in the rear-view mirror, the default *modus operandi* of the scientific community became “every man for himself,” meaning that every scientific and engineering field was competing with every other field for a shrinking pie of funding. The main controversy over science funding became whether or not money was going to “merit,” a code-word for elite schools, or whether it was being locked into “earmarks,” the Congressional term for government spending on specifically designated projects, as a form of political “pork.” The larger dimensions of what science and technology could do for the nation were drowned out in the cacophony of scientists and engineers scrambling for funding. And this had the collateral effect of making scientists and engineers appear to be just another interest group at the federal trough.

To a large extent, scientists and engineers have been in this wild wilderness ever since. While there have been almost routine calls for more funding, more attention to education, and more presidential and public support for science, scientists and engineers have not been able to “get in harness” the way they were in the 1950s and 1960s. No one has asked them to think of themselves this way, and no one has managed to organize scientists and engineers in a way that bonds them to a coherent national purpose. Roy Schwitters, a physicist who was once the head of the Superconducting Supercollider at The University of Texas at Austin, and who is now professor of physics and director of UT’s Center for Particle Physics, has noted that “9-11 blew away all the raw feelings left over from Vietnam and the struggles over strategic weapons. Scientists were ready to help. But no one asked us to do anything” (Schwitters, 2008).

The importance of national goals is not well understood by government leaders, nor by many scientists and engineers. National goals can help program managers make choices, appeal to the public for support, and portray scientists and engineers as national assets, not merely as supplicants for funding. A mechanism for helping democratize the process of specifying national goals can, as the Carnegie committee noted 16 years ago, both legitimize the work of scientists and engineers and add continuity to long-term research initiatives. A stable consensus, such as we witnessed during the 1950s and early 1960s, can be enormously productive.

Susan Cozzens, an expert on technology policy at Georgia Tech, notes that “All true national goals are fuzzy and permit many definitions, because they represent broad consensus instead of scholarly precision (Cozzens, 1996, 184). Nevertheless, today there are several obvious candidates for a short list of national goals, such as a transition to non-fossil fuel energy, solving the problem of global climate change, defeating terrorism and building a system of high-quality, affordable healthcare. The United States should also be looking beyond the time horizons of private companies and investing in “grand challenges” that will help transform the entire economy. One such challenge will be to figure out what comes after the current architecture of the computer semiconductor, when physics will impose an end to “Moore’s Law,” the 43-year-old rule that has made integrated circuits smaller and smaller.

Whenever there is a surge in attention to national goals for science and technology, scientists engaged in basic research get nervous, and sometimes even “hysterical” (Cozzens, 1996, 185). Scientists in particular are educated to believe that unfettered basic research is a positive good in and of itself, and its benefits to society cannot be “steered” or commanded. But this argument has never been persuasive to the American public or its political leaders. It took the Sputnik “crisis” to galvanize public opinion and launch new programs that became the bedrock of U.S. leadership in science and technology. Today, with much of the nation’s science and technology policy in disarray, there is a basic agenda of how to “renew the compact between science and government,” as the late Donald E. Stokes put it in his 1997 book *Pascal’s Quadrant* (Stokes, 1997, 90). Stokes, who advocated “use-inspired research,” and a balance between “needs and seeds,” wrote, “We need a more realistic view of the relationship between basic science and technological innovation to frame science and technology policies for a new century” (Stokes, 1997, 2). National needs, in other words, include not just social goals like better energy use or improved healthcare, but also a new structure of science and technology that is more effective for achieving national goals.

Reconstituting the nation’s ability to succeed with “grand challenges” and launch a new era of science and technology under a framework of national goals will require exceptional leadership. In May 2008, the editors of *Scientific American* magazine—which has been published since 1845—published an editorial titled “Why the Next President Needs a Powerful Science Adviser” (*Scientific American*, 2008). A committee of the National Academies, chaired by John Edward Porter, a former Congressman from Illinois, outlined three steps for a new administration. The first is for the newly elected president to select a science adviser “immediately after the election,” and, after inauguration, to make this person Assistant to the President for Science and Technology and elevate this position to cabinet-level status. The other two steps involve filling important scientific and technical positions in federal agencies and streamlining the hiring and appointment processes to “reduce the financial and vocational obstacles to government service” (Porter, et. al. 2008, 4). This committee identified 54 presidential appointment positions that “form the core leadership of the government’s role in S&T (science technology)” (Ibid., 6).

It is imperative that the next administration restore the prestige and influence of the Assistant to the President for Science and Technology. The editors of *Scientific American* lamented that “the tenure of George W. Bush marks a new nadir,” and that the Bush administration had stripped the science adviser position of its “special assistant to the president” status (*Scientific American*, 2008). Most of the decisions on science policy had been made before John H. Marburger III took his position as science policy adviser nine months after George W. Bush’s inauguration.

As LBJ’s experience illustrated, it is important that the president’s science adviser be someone with whom the president is comfortable. The science adviser must figure out how to adapt to the president’s style of leadership, recognizing that there are endless demands on the president’s attention. At the same time, the science adviser should not be “out of sight, out of mind,” and should instead be regarded as one of the key “insiders” in the next White House.

Finally, the next administration must restore a framework of trust between government policymakers and scientists and engineers, and between policymakers, scientists, and the public. There are several important elements of this requirement. Scientific integrity of government information is paramount, something that has been damaged over the past several years. The role of science adviser should be one of honest broker, in contrast to a role as “cheerleader” or advocate for the administration’s policies. This is a significant challenge, for an adviser to be both an “insider” and an honest broker who may disagree with the president. It is a relationship that takes skill and mutual understanding. But it is essential to rebuilding the trust relationships between government, the scientific and technical communities, and the general public.

Over the past several White House administrations, the line between politics and governing has blurred, with top leaders in the White House playing strongly political roles in what has come to be called a “permanent campaign.” The people damaged the most by this trend have been government officials responsible for scientific and technical information and maintaining trust with the public. A regrettable by-product of this deterioration of trust is that it has become more difficult to attract top scientific talent to government service. While there are still talented people in federal government positions, scientists with the stature of Killian, Wiesner, Kistiakowsky, Rabi, and Hornig are more often on the outside today rather than on the inside of public service. It is likely to take a long time to reconstitute a trust relationship in the midst of what can be expected to be uninterrupted hyper-partisan politics. Nevertheless, both the scientific and engineering communities and the White House leadership should focus on the task of rebuilding trust.

### **The Lessons of the LBJ Era for Science and Technology Policy**

The problems that ended the “golden era” of science were becoming evident during the Johnson Presidency, particularly the deep divisions over the war in Vietnam. Lyndon Johnson was increasingly angry with academics over their opposition to the war, and Nixon intensified the White House’s alienation from the academy, even to the point of including Jerome Wiesner, former White House science adviser, on his famous “enemies list.” Since then, scientists and engineers, especially those in universities, have been buffeted by partisan politics. This turmoil has contrasted with a period of remarkable consensus that produced numerous transformations of American society, including the use of space and the development of the information age.

Thus one lesson of the time when Lyndon Johnson shared the leadership of the United States is that political consensus can harness the abilities of scientists and engineers to achieve national goals and move the country forward. Leaders have been searching for the “moral equivalent of war” to replace the motivation that the Soviet threat inspired in Americans. But clearly the ability of political leaders and prestigious scientists and engineers to work together, under a framework of broad national goals, is a product of leadership itself, as Lyndon Johnson so grandly demonstrated.

The features of the Cold War consensus should not be exaggerated, of course—there were plenty of disagreements and even the early signs of cultural upheaval. But Johnson’s faith in change—in civil rights, in healthcare and education—made everyone else ambitious. While LBJ is often criticized today for being too ambitious and trying to do too much all at once, Johnson-sized ambition seems far more suited to the challenges we face today. The country urgently needs a transition to new sources of energy, ways to address global climate change, and a better system of healthcare. The current, fractured and fractious array of scientific programs seems ill-suited to these tasks.

Johnson understood that scientists and engineers funded by government need to be part of something that the public supports. Johnson was an instinctive critic of the argument that unfettered basic research is a national goal in itself; science policy experts have since come around to the more complex view that the linear model of connection between basic research and new social goods is flawed, and that there needs to be attention paid to how we solve pressing problems through science and technology. Restarting the country’s innovation engine is going to take broad and open minds, not simply repeating patterns that scientists and engineers believe in.

Johnson’s biggest legacy was one of opening American civic life to more participants, by expanding civil rights and educational opportunities. The scientific and engineering communities in the United States have not yet figured out how to embrace this way of thinking, by becoming full participants in American democracy without being trapped and diverted by partisan politics. Prominent scientists and engineers have not yet developed a way to communicate the role of science and engineering in American society

that speaks to the concerns of ordinary Americans. Johnson had an undeniable gift in this respect, of being able to translate complex policy goals into straightforward appeals whose legitimacy was contained in the way these appeals were expressed. Now, after years of squabbling over White House science policies, scientists and engineers are going to have to rediscover how to communicate the broad national consensus that the country needs.

The United States of America is entering what may be its most difficult period of fiscal challenge ever. The country's capacity for innovation is flagging at just the time we need it most, to push through economic difficulties to a new ascent to economic prosperity. The contributions of science and technology are more important than ever, but our national assets have been weakened by neglect and a loss of scientific integrity. Thus the opportunities for a new president are clear: to restore U.S. science and engineering to a new "golden age," an era of integrity, leadership, public purpose, and national will, not unlike the time of President Lyndon Baines Johnson.

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