When and How Presidents Use Scientific Expertise: Criteria for Success Derived from Selected Case Studies

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Abstract of Dissertation

When and How Presidents Use Scientific Expertise: Criteria for Success Derived from Selected Case Studies

This research project sought to clarify the circumstances under which scientific expertise has been accepted as a basis for Presidential decisions by review of case studies where a President clearly used science advice. Presidential decisions were chosen as the focus of research because decisions at the Presidential level are important enough to justify seeking the best expertise available.

The study summarized the value of scientific expertise to policymaking using historical examples, and reviewed published literature in three areas: presidential decision-making, the role of expertise in policy advocacy, and academic studies of science advice. The literature review identified 16 variables that might increase the acceptability of scientific expertise in a President's decision-making process. Cases were selected based primarily on the judgement of a few persons who have provided science advice at the Presidential level. A case study was done on three Presidential decisions to see if the 16 variables were important to the use of scientific expertise in these cases. The decisions were: (1) President Ford's 1976 decision to begin a national program of vaccination for swine flu, (2) President Ford's later decision to suspend that program, and (3) President Reagan's decision to negotiate binding intertational reductions on the production of ozone-depleting chemicals.

Review of these three cases demonstrated that scientific expertise is sometimes extremely important to Presidential decisions. Analysis of the three case studies suggest that five of the variables from the science advice literature are not necessary to successful

science advice, since they are not present in at least one case. On the other hand, the analysis found that three of the variables were common across the cases: seeking experts from outside government, seeking evidence of a consensus among scientists on the appropriate course of action, and experts engaging directly with policymakers on the full range of policy option development and assessment (as opposed to isolated review of the scientific issues). The study suggests that focusing on those three elements may enhance the use of scientific advice to policymakers, and that these three variables (and possibly others) are appropriate for future research.

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## Chapter 1. Introduction

> *"One of the most bizarre features of our time, most bizarre features of any advanced industrial society in our time, is that the cardinal choices have to be made by a handful of men who cannot have a firsthand knowledge of what those choices depend upon, or what their results may be. … When I say cardinal choices, I mean those which determine in the crudest sense whether we live or whether we die. … It is in the making of weapons of absolute destruction that you can see my central theme at its sharpest and most dramatic … But the same reflections would apply to a whole assembly of decisions which are not designed to cause harm. For example some of the most important choices about a nation's physical health are made, or not made, by a handful of men … who normally are not able to comprehend the arguments in depth."*
>
> -- C.P. Snow, *Science & Government,* 1960

Ever since C.P. Snow pointed out that political leaders are often asked to make critical decisions that turn on scientific expertise they do not possess, many books and articles have addressed the need to increase the use of scientific expertise in the policymaking process. In such writings, policy choices that are widely judged to be in conflict with scientific consensus are presented as regrettable failures to engage scientific expertise, or decried as willful rejection of scientific understanding due to ideological or political considerations. Analysts of the policymaking process acknowledge that scientific insights are sometimes a critical input to important decisions. But most analysts of the policymaking process have little sympathy for the claim that scientific expertise should have a critical role in all decisions that involve science, technology or medicine. This research project begins to bridge the difference in perspective by studying the conditions under which scientific expertise has made a difference in Presidential decisions.

The first section of this chapter explains the rationale for seeking scientific expertise as an input to policymaking, and provides historical examples of five ways that scientific expertise has had a significant role in the development of public policy. The second section of the chapter addresses the primary critiques of the idea that scientific expertise is important in decision-making. The first two sections of this chapter clarify broad issues about the role of scientific expertise in policymaking. In the final section of the chapter, a rationale is presented for the research plan used in this study, focused on case studies of good examples where scientific expertise was important to Presidential decision-making. That section also establishes the scope and key assumptions for the research project and defines the project's primary research questions.

**The Rationale for a Significant Role for Scientific Expertise in Public Policy**

The fundamental argument that scientific expertise should play a major role in public policymaking is that so many national decisions involve science and technology. As long ago as the Eisenhower Administration, James Reston wrote in the New York Times, "An increasing number of the major foreign policy issues facing the nation are now, at bottom, scientific and technological issues on which the President must be guided by scientists and technicians" (Devine, 1978, p.172). Decisions about expensive multi-year weapon programs, arms control, intelligence estimates, treaty verification – in short, a wide variety of national security, environmental or health policies – can be catastrophically wrong if they are based on misunderstandings about the scientific underpinnings of the decision.

Since World War II, scientists have made an argument for a place at the table in policymaking. Physical scientists responsible for the atomic bomb, radar, sonar, and proximity fuses could make a case that their expertise was critical to winning the war. At least for similar issues where technology was critical to national security, many policymakers have felt scientific experts should be part of national councils. Scientists have specialized knowledge and experience relevant to policy decisions that turn on predictions about technology, disease processes, or natural science.

Nor is the need for science expertise an issue relegated to Cold War history. The issue is still very much in current public discourse. Consider two recent best-selling books with strong opinions about the scientific basis for decisions President Bush might have made about global warming. Michael Crichton's *State of Fear* (a novel, but with a long appendix on the science of climate change) and Chris Mooney's *The Republican War on Science* have very different perspectives on who is manipulating scientific results about climate change, but reach similar conclusions about what is needed to improve the use of science in public policy.

Both books argued that improvements in the independent development, assessment and communication of scientific findings is critical to policymaking in a modern society. And they argue that the lack of such expertise applied to our decisions is leading to bad policy. Crichton argues, "We desperately need a nonpartisan, blinded funding mechanism to conduct research to determine appropriate policy (Crichton, 2004, p.572)." He also says "there is only one hope for humankind to emerge from what Carl

Sagan called 'the demon-haunted world' of our past. That hope is science (Crichton, 2004, p.580)." While Crichton believes that a conscious suppression of critics is underway to present an unwarranted scientific consensus on the reality and impact of global warming, his primary answer to this problem is the increased use of good scientific data as the basis for policy decisions.

On the other side of the climate change debate, Mooney believes that conservatives have systematically suppressed, manipulated, and censored scientific conclusions on global warming through a variety of mechanisms. He also believes that industry representatives have funded misleading research studies to manufacture doubt about global warming. Mooney's solutions focus on mechanisms to "strengthen the role of legitimate expertise in informing government decision-making, protect that expertise from manipulation and abuse, and more generally seek to restore a spirit of candor and collaboration between the scientific community and our elected officials (Mooney, 2005, p.249)."

Crichton and Mooney disagree on what would be found if the best mechanisms were used to ensure that good science is available to inform good policy, but they both argue that improvements in the use of scientific expertise is critical to better governance.

The following subsections provide concrete examples of five roles that scientific expertise can play in the policy process. The examples are intended to demonstrate that scientific expertise sometimes has a significant role in the development of public policy, as well as indicating the variety of ways in which science expertise can be significant.

**Providing new options to solve policy problems.** The most commonly cited examples of science expertise fit into this model. The 1940-41 effort by Leo Szilard to make the U.S. Government aware of the potential for creating an atomic bomb is a classic example of how scientists can introduce new options to a government. Szilard famously talked Albert Einstein into signing a letter to President Roosevelt that encouraged secret government research on such a weapon, and raised concern over the potential of Nazi nuclear work. It is unlikely that the U.S. would have started a major effort to determine the feasibility of atomic weapons without this push by a small group of scientists who understood the potential of nuclear fission.

Another good example is how a small group of scientific experts advising President Eisenhower made a successful case for a U.S. space reconnaissance program at a time when the very idea of orbiting spacecraft was considered science fiction by most people (Herken, 2000, p. 82-100; McDougal, 1997, p. 112-130). By 1954, President Eisenhower had become increasingly worried about the lack of intelligence on the Soviet Union, and the danger of surprise attack. He had approved a variety of intelligence collection programs to resolve the issue, many of which were dangerous and few of which were providing any success. Eisenhower asked a panel of eminent U.S. scientists, led by James Killian, to look at the role technology might play in resolving the problem of surprise attack. Initially this Technological Capabilities Panel suggested production of the U-2 airplane and its use for high-altitude flights over the Soviet Union.

Killian and James Land, the primary authors of the intelligence recommendations, were appointed by Eisenhower to a new President's Foreign

Intelligence Advisory Board. They continued to work with a small group of scientists to develop proposals for improving intelligence and warning capabilities. Two years before the launch of Sputnik, they recommended the development of earth-orbiting satellites for missile warning and imaging of the Soviet Union as the key solution to the problem of surprise attack. In addition to the narrow questions of technical requirements for such a satellite, they also proposed modification of existing missile programs to provide the capability to launch spy satellites into space, and recommended the creation of a civilian space program to develop and launch scientific satellites. The scientific space program was primarily envisioned as a tool to establish the principle that satellite overflights were not a violation of national airspace, and therefore would not be as provocative as U-2 flights.

Eisenhower staffed these ideas through his highly structured National Security Council. The military were skeptical about the recommendations, and opposed modifications to the missile programs. The military experts thought that missile programs had finally received the priority required, and saw little value in modifications for a speculative proposal. They were equally opposed to the proposal for a civilian space program. But Eisenhower approved initial work on civilian, military and intelligence space programs because the scientists convinced him that satellites were a practical solution to his strategic dilemma.

Eisenhower's decision to accelerate development of satellite reconnaissance systems led to the launch of the first practical intelligence satellites at the end of the 1950s. Satellites eventually provided definitive information about the state of Soviet military capabilities, and for monitoring and detecting attack preparations and providing confident detection of missile launches. Creation of these capabilities at such an early point in the arms race was based largely on the President's confidence in the expertise of a small group of scientists and engineers.

**Transforming political issues into matters of empirical evidence.** Scientific expertise can sometimes transform issues that seem politically deadlocked by turning arguments about values into matters of empirical evidence. For example, the identification of HIV as the cause of AIDS infections, and subsequent determination of the characteristics and operation of this virus, changed the debates over the public health response to AIDS.

A good example of the transformation of a debate is the slow development of a policy consensus about fallout from nuclear weapons testing (Devine, 1978). Throughout the 1950s, a debate occurred over whether such fallout was a health danger, and, if so, whether the health risks required a change in nuclear testing practice. Scientists engaged in nuclear weapon research did not originally predict long-distance transport of contaminated material from nuclear explosions in the atmosphere. The effect was studied in detail only when the crew of a Japanese fishing vessel experienced radiation sickness after they passed downwind, but outside the restricted zone, of a Pacific nuclear test in 1954.

Bureaucratic pressures and political hardliners argued for ignoring the implication that there was a health hazard from atmospheric nuclear testing. Military leaders wanted realistic tests of nuclear weapon effects and argued that testing should be done in the operational environments of land, sea, and air, using targets like they would see in actual warfare. The scientific community involved in nuclear weapons development, while under civilian control, none-the-less resisted changes in the testing program because they only knew how to conduct meaningful nuclear tests in the atmosphere. They had no idea how else to get information on weapon performance and weapon effects, and therefore they were skeptical about any argument that claimed such testing should stop. Government scientists pointed out that without atmospheric testing they never would have discovered that fallout effects could be important in an atomic war.

Initially the policy debate seemed to be about opinions: whether fallout outside of properly defined test zones represented a significant health issue, and whether the risk from fallout was acceptable given the national security requirement to maintain and improve our nuclear arsenal during a nuclear arms race with the Soviet Union. Over time, the ability scientists developed to carefully measure effects from atmospheric tests made it possible to demonstrate the reality of long-distance transport of radioactive fallout. When you can measure something, it is hard to argue that it doesn't exist.

In parallel, military planners worked with scientists to develop high-fidelity models of the environment they would face on a nuclear battlefield. As such models incorporated the new data, the planners began to see the potential for widespread transport of deadly radiation under some weather conditions. The models also predicted that some radioactive material would spread around the world from even small nuclear weapon tests. Scientists and military planners could not accept the models for military planning and simultaneously disregard their implications for public health.

To the surprise of many lay critics of nuclear testing, scientists within the nuclear weapons establishment were instrumental in developing information about fallout effects.

Predictions from models developed in weapons programs led some scientists to search for and find radioisotopes in the food supply. The discovery of low levels of strontium-90, a long-lived radioisotope that does not occur naturally, throughout the world in mothers' milk and babies' teeth was a turning point in public concern over fallout.

An evolving scientific consensus on the reality, scale, and dangers from fallout forced even the most committed advocate of nuclear weapon programs to seek an alternative method for nuclear testing. This consensus was made into international law with the signing of the Limited Nuclear Test Ban Treaty in 1963, which banned testing in the atmosphere, the oceans, or in outer space. Scientific understanding and expertise changed the definition of the policy questions about fallout, narrowed the policy options, and eventually established a view of the facts about nuclear testing that continues to influence policy decisions long after the original scientific work was done. Even North Korea, which assertively defies international law about nuclear weapon proliferation, conducted their first nuclear test underground to avoid releasing atmospheric fallout.

**Forming a consensus on the need for new policy.** While it is possible for science to transform a debate with a single insight or piece of data, forming a policy consensus is more commonly formed through a long-term process of interaction between the scientific and policy communities. Policy issues and research questions often produce an iterative feedback loop that eventually produces a consensus on policy. Back-and-forth between providing private counsels and the openness of scientific research can make the development of a consensus challenging, especially since politicians often view open discussion of the issues on which they seek advice as betrayal of confidence.

Most politicians and bureaucrats would prefer to present the public with a completed decision, buttressed by the authority of science. Scientists, on the other hand, have great faith in the value of open debate within the scientific community. None-the-less, forming a policy consensus is a role often played by a scientific advisory board or special committee.

The development of new policy on antiarrhythmic drugs during the Reagan Administration is a good example of how scientific expertise can be used to address a policy problem by developing a new consensus (Jasanoff, 1990, p. 156-165). For most of the 1970s and 1980s, only two drugs were approved for the treatment of heart arrhythmia. Such drugs are inherently dangerous because they have complex interactions with the kidneys, the heart itself, and with other organs. But the drugs also have the potential to extend life by decades for patients faced with serious heart malfunctions. Public pressure, pharmaceutical interests and Congressional direction contributed to a new look at antiarrhythmic drugs in the mid-1980s. The Food and Drug Administration (FDA) asked for a formal review from the existing Cardio-Renal Committee of external scientific experts. The FDA largely turned to the panel as a tool to defer the pressure, but with some hope that the panel would provide a new perspective on balancing the risks that had paralyzed the FDA through the early 1980s.

The Cardio-Renal Committee was a standing advisory committee within the FDA, and was already familiar with the challenges of regulatory work. Members knew how to work with the FDA in a structured manner that preserved their independence but addressed the real challenges of new regulation. The Cardio-Renal Committee worked on aspects of antiarrhythmic drugs from July 1985 through October 1989. One early conclusion of the panel was that the two approved drugs were no less dangerous than the new ones proposed for approval.  A new set of warning advisories for physicians were developed for the existing drugs.  This decision transformed the context of approving the new drugs from a search for safe drugs into an analysis of the tradeoffs appropriate for patients facing poor prospects without intervention.  The Committee made recommendations that modified an on-going clinical trial to ensure that the well-known problems with these drugs were not overly emphasized by the protocols, therefore allowing a realistic perspective on the new drugs.  Their advice also led to exclusion of some patients from the trial because they would be at unreasonable risk from any available antiarrhythmic drug, new or old.

The Committee used a structured methodology to avoid an adversarial relationship with FDA scientists and regulators.  Members chose to develop draft guidelines within subcommittees, rather than reviewing drafts developed by FDA. FDA regulators, including the head of the Division of Cardio-Renal Drug Products, worked actively with the committee, but focused their guidance on defining the questions of most importance to the FDA's regulatory responsibilities, and explaining the capabilities and limitations of agency action. The FDA staff avoided proposing new regulations of their own, although their preferences were sometimes obvious. The Committee as a whole conducted a peer review of each subcommittee's draft guidelines, in a conscious attempt to avoid the potential narrowness and premature commitment of individual experts. Committee members were initially uncomfortable with the limited amount of double blind testing to provide confidence on the absolute risk and benefit of these drugs, but the committee became comfortable over time with the conclusion that conditions and patient risk considerations would always provide less than perfect data. Work on this issue over a long period allowed the members to influence and interact with on-going research in ways that increased the relevance of those studies to the policy questions of regulation. The guidelines for antiarrhythmic drug approval developed by the Cardio-Renal Committee have produced continuing improvement of antiarrhythmic drugs since 1988, and provided a new model for FDA policymaking about drugs designed for life-threatening conditions.

**Reducing risk and uncertainty for decision-makers.** Scientific experts often describe their work on advisory panels in terms of communicating and managing risk. Scientific advisory panels contribute to risk reduction by ruling out the policy options least likely to work, or at least ones more poorly justified by existing evidence. An advisory group of scientists can also suggest research or experiments that are critical to determining the practicality of an approach.

An example of recommending critical experiments comes from the Army's efforts on antiballistic missile (ABM) defense in the late 1970s. By that time, the technical community working on ABM problems increasingly came to view the 20-year effort on nuclear-armed ballistic missile defense interceptors as having reached a dead end. Nuclear-armed interceptors were the technical basis for the ABM systems proposed for deployment in the 1960s and for the systems actually deployed by the U.S. and the U.S.S.R in the 1970s. But much of the controversy over ABM systems related to the use of nuclear warheads. It wasn't clear that exploding nuclear warheads over one's own country was much less damaging than allowing the enemy warheads to land, and the initial nuclear explosions significantly reduced the ability of the ABM system's radars to guide interceptors against later waves of incoming missiles.

The Army's Scientific Advisory Board began to encourage work on non-nuclear kill mechanisms, but significant questions were raised about the ability for a kinetic intercept to occur at the high velocities of an incoming ICBM warhead. A particular concern was whether the guidance capabilities of a practical interceptor as it neared the warhead at such high velocities could actually use practical rocket technology to close on the target. It was possible that an interceptor would be forced to repeatedly overshoot the correct position in a series of futile back-and-forth maneuvers. To respond to this concern, the Army developed a project called the Homing Overlay Experiment to determine if the proposed hit-to-kill approach to missile defense was fundamentally feasible. Success in what was referred to as "hitting a bullet with a bullet" on June 10, 1984, laid the groundwork for almost all current work on ballistic missile defense systems. This research provided the technical basis for theater missile defense systems developed to counter the short-range ballistic missiles used in the Middle East today.

An alternative risk reduction approach is the creation of back-up technical options when the preferred solution includes many unproven elements. Scientific experts often recommend such back-up projects in the development of complex weapon systems, where budget pressures drive towards pursuing a single option. It is likely that the development of the atomic bomb during World War II was successful largely because of an early decision to pursue all possible approaches to producing fissionable material for use in a weapon.

Another example of recommending back-up approaches, but reflecting the results of a formal committee of scientific experts, deals with the development of the Intercontinental Ballistic Missile (ICBM). In 1954, the U.S. Air Force's Strategic Missiles Evaluation Committee (usually referred to as the Teapot Committee), led by the famous mathematician John von Neumann, recommended that the Eisenhower Administration pursue an urgent program to develop an ICBM as the most effective deterrent weapon for the evolving arms race with the Soviet Union. The committee recognized the vast range of technical problems in developing the first multi-stage missiles that could fly to a precise point on the other side of the globe. Although the committee believed that all technical problems were solvable eventually, in 1954 the U.S. had no multi-stage missiles, no nuclear weapons that would fit an ICBM, and no clear answer to many of the guidance and control problems for such a long-range missile.

The Teapot Committee therefore proposed pursuing two alternative missile designs for the ICBM, one of which did not require developing the sequential staging that would be the most efficient design for an ICBM. The committee also emphasized the need to pursue intermediate-range ballistic missiles, which could be launched at the Soviet Union from America's overseas Allies, in case the ICBM proved even more difficult to develop than expected. In many ways, such a recommendation is counter to the usual request by policymakers, who want the experts to tell them what is the best option to solve a problem. Implementing the Teapot panel's recommendations cost much more money than picking a single best approach to developing nuclear-tipped missiles, but made it almost certain that the U.S. would have a missile delivery system that could strike the Soviet Union by the end of the decade. The parallel path recommendation reduced the technical risk of putting all the effort into one project.

**Avoiding wasted or counter-productive public efforts based on unlikely technical premise.** President Eisenhower once indicated that most scientists suggest new things to pursue more often than they told him which existing efforts could be abandoned. He argued that there was a great need for the scientists to tell him what government programs could be avoided or terminated, and asked his scientific advisors to focus on that question.

Scientific expertise has been a major contributor to minimizing government pursuit of projects that are questionable in the eyes of current scientific knowledge. For example, efforts were made to explore the potential of psychic spying during the Cold War. But the concept faced high skepticism because it was difficult to apply normal scientific standards to the research. Efforts remained exploratory, and the results of so-called remote viewing research were never used as the basis for national decisions. Similarly, concepts for nuclear-powered aircraft were soundly criticized by scientific advisory committees, and constrained, at least in part, by that criticism. In the 1990s, scientific societies and expert review panels fought an effective battle against granting patents or government funding for research on so-called zero-point energy devices, even in the presence of vocal support from some members of Congress. Physicists maintained that such devices would violate fundamental principles of physics, and therefore were not worth investigating unless someone produced a working model that could not be explained by more conventional principles.

**Scientific expertise matters, at least sometimes**. The strongest argument for engaging scientific expertise in developing public policy remains the evidence that such expertise has been critical to important policy decisions. Without the advice of scientific experts, examples given above – the Manhattan Project, the development of space-based reconnaissance, and U.S. commitment to limitations on nuclear testing – would likely have happened only much latter, and possibly in ways that would have dramatically reduced American national security. For advocates of a significant role for scientific expertise in policymaking, the historical evidence that scientific expertise has made a difference is sufficient argument for using scientific expertise in policymaking and seeking better mechanisms for its use. U.S. policymakers will want to ensure that comparable future opportunities are identified.

**Why Scientific Expertise Might Not be a Significant Factor in Policymaking**

It may be hard to imagine rejecting the case that policymakers should seek the best scientific knowledge and expertise as an input to relevant decisions. Respect for a scientific approach to policy is strongly embedded in U.S. discourse, and respect for scientific knowledge is even more widespread. But there are reasons to question the significance of scientific expertise in the practice of policymaking. Although there is some overlap, criticisms of a role for science expertise can reasonably be divided into those that derive from skepticism about science, skepticism about scientists as advisors, and skepticism about quality decision-making as the driving factor in policymaking.

**Skepticism about Science**. One argument against emphasizing scientific expertise in relevant policy decisions is the position taken by some critics that science provides no better guide to truth or facts of an issue than any other form of knowledge, including intuition, traditional or religious values, ideology or philosophy. If science has no basis for claiming special insights even within its sphere of specialization, the results of science embodied in scientific expertise lose any claim to a special or valuable role in policymaking. There are several variants of this critique of science, from the extreme anti-scientism* that would claim science is no more than a tool of power struggles among the elite, to a more restrained concern that decision-makers should recognize the limits on the universality of scientific conclusions.

The popular view of science reflects a 19th Century perspective that science is an objective method for determining the truth about nature, creates theories only in response to observations about nature as reflected in carefully controlled experiments, and follows a scientific method that provides protection against errors and a confident basis for predicting future observations about nature and the performance of technology. Modern studies in philosophy of science would criticize all of those premises, even for the most experimental of physical sciences. The idea that science tests its theories against an objective standard of validity has, in an absolute sense, been effectively rejected since the publication of Thomas Kuhn's *Structure of Scientific Revolutions*.

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* The Merriam-Webster dictionary defines "scientism" as an exaggerated trust in the efficacy of the methods of natural science applied to all areas of investigation (as in philosophy, the social sciences and the humanities). Research in the philosophy and sociology of science – which is well beyond the scope of this work – provides significant reasons to avoid such an exaggerated trust. But I use the term "anti-scientism" to reflect a similarly exaggerated *dis*trust of scientific expertise within the areas where scientists work.

The current picture of scientific research focuses on the social construction of scientific knowledge. In this perspective, the current scientific position on any issue is more a reflection of the consensus among scientific leaders than an objective analysis of observations. Distinguishing scientific thought from non-scientific ideas has proven difficult. Popper's criterion that scientific theories must be falsifiable has given way, in light of quantum mechanics, to an understanding of the probabilistic nature of scientific conclusions. A basis for claiming that science is a body of work that provides insight into an objective natural reality, rather than a constructed model of reality that is useful in practice, has proven elusive. Philosophical arguments for a connection between science and reality have proven tautological or otherwise fundamentally flawed. No current research that relies on a model of how science operates can easily make the claims to objectivity, or to universal and certain knowledge about nature, that would have been common in the first half of the 20$^{th}$ Century.

The most extreme anti-scientism claims that because science has often been wrong it should be irrelevant to logical discourse. For example, Stephen Cole, in *Making Science: Between Nature and Society*, says "Given that facts can easily become errors, what sense does it make to see what is at Time 1 a `fact' and at Time 2 an `error' as being determined by nature?" (Cole, 1990, p. 12) Cole represents a strain of argument that points out that scientists have been *certain* about important aspects of how the world works at any given point in history, but often judge earlier scientific pronouncements of certainty as fundamentally wrong-headed. Some of the deconstructivist analyses of science argue that claiming to have scientific facts on an issue is merely intellectual arrogance masquerading as objectivity, and should be rejected on philosophical grounds.

While the more extreme version of anti-scientism can be set aside as mainly an issue for philosophy, a scholarly study concerned with scientific expertise must be aware of the insights derived from the understanding of science as a socially constructed enterprise. If science claims authority from defining and explaining the facts about a social issue, it is important to understand that the facts are themselves probabilistic and contingent on the context in which the knowledge is applied. Two books that make that point clearly in the context of policy analysis are Deborah Stone's *Policy Paradox: The Art of Political Decisionmaking* (1997), and Theodore Porter's *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (1995). These books provide many examples of how the facts discovered in research are very dependent on the research question chosen, the policy questions in society which stimulate the research, the researcher's value judgments about those policy questions, and the ease of conducting research and quantifying results. Shelia Jasanoff illustrates how facts were constructed by expert committees in several case studies on policymaking about food safety and environmental policy (Jasanoff, 1990). Scientific control on the definition of facts is an important element of successful science advisory panels. At best, facts are determined by a conscious effort to find useful generalizations that work for both the scientific and non-scientific persons involved in policymaking.

**Skepticism about Scientists as Advisers**. If the former critique is primarily of concern in academia, skepticism about scientists as advisers has a long history as a concern among policymakers. In part, this skepticism is a reflection of the ambivalent attitude among the American public about the role of intellectuals and experts in a democracy. But there are several credible reasons for skepticism about the efficacy of scientists in particular as advisers in the policymaking process.

Perhaps the most important criticism offered by policymakers is the evidence that engaging scientific expertise, *per se*, does not always lead to better decisions. More disturbingly, this conclusion can be true even for those decisions where a scientific question is the primary concern driving a policy decision. Scientific expertise should be the best guide when the policy question is primarily about whether a proposed device will work as advertised, or what will actually happen if we do nothing about a postulated environmental problem.

A clear example of an excellent science adviser giving bad advice is position of Vannevar Bush against pursuing an ICBM in the early post-war period. By the end of the war, Bush was perhaps the most successful scientist at creating a role for himself in policymaking. During World War II, Vannevar Bush was responsible for mobilizing science and engineering talent to support the war effort. As head of the Office of Scientific Research and Development, Bush made hard decisions about the prioritization of hundreds of critical scientific and engineering projects. Some historians would argue that his advice and expertise were prime factors in U.S. technical success during the war.

After the war, Bush created a basic model for continuing U.S. government support for science in a famous monograph requested by President Roosevelt and published as *Science: The Endless Frontier.* That study provided the rationale for the creation of the post-war U.S. scientific research structure, including the establishment of the National Science Foundation, military funding of university basic research, and the wide-spread adoption of scientific advisory boards. In summary, Vannevar Bush is perhaps the person who most fits the ideal model of someone to provide science expertise for policymaking. He was an admired research scientist, had extensive practical experience in applying science to military problems, understood the operation of government decision-making, was successful in influencing government decisions, proven in judging the relative value of technological proposals, and personally experienced with providing technical advice to Presidents.

Although President Truman was less likely than Roosevelt to ask for formal advice from the scientific community, Bush was called on to provide advice on an informal basis. After the first Soviet atomic explosion in 1949, President Truman was under significant pressure to take actions that would restore U.S. nuclear superiority. One such decision that rose to the Presidential level was the decision to develop an intercontinental ballistic missile. All three services sought a crash program to develop long-range ballistic missiles, and provided rationales for a costly development program. Truman was conscious that such a long-range missile was thought by many to be the stuff of science fiction, and he asked for a variety of opinions on the practicality of such missile.

Vannevar Bush was only one of many experts whose views were sought, but he devoted considerable study to the question. Bush concluded that it was very unlikely that accurate missiles could be built with a range more than about triple the range of the V-2 missiles, and that therefore it was wasteful and unnecessary to pursue an ICBM. Bush's conclusion was not based on ignorance of the technologies under development.  He looked into the potential to improve rocket engines and the practicality of multi-stage rockets. He had the security clearances that allowed him to understand that the concurrent development of hydrogen bombs would reduce the requirements for missile accuracy. But he believed that the uncertainties about the shape and gravity distribution of the earth, and other concerns about guidance and navigation, would fundamentally limit the ability to deliver a missile to a sufficiently precise target point at very long distances.

It is not clear what impact Bush's advice had on Truman's decision to downplay ICBM development during his administration. When Truman chose not to endorse any of the service programs for ICBMs, he may have simply judged that this decision could be put off for a later date.

In one sense Vannevar Bush was right in his conclusions.  It took the development of a whole range of satellite measurement techniques over the next 15 years to develop sufficient accuracy for meaningful targeting.  But in another sense, he was fundamentally wrong. Bush used his scientific expertise as the basis for an argument that the U.S. need not invest in ICBMs because they would never be practical and important.  Current technical challenges, his own experience, and his perspectives about what future governments would be willing to pursue, limited even Vannevar Bush's imagination about what technology could be created.  It turned out that the accuracy to target Moscow and Washington with the earliest hydrogen-bomb-armed ICBMs was achieved in about the same timeframe as the rest of the missile development program.

Vannevar Bush's recommendations against the development of ICBMs suggests that even the best science advisers can make an incorrect judgment about a critical technical issue important to national security. The example raises questions about how much to trust even the most well-qualified scientist as an adviser.

It would be easy to provide good explanations for why this decision is not representative of the typical role of science advice, and what unique factors in the advice or the policymaking environment mitigate the conclusion that the scientists provided bad advice. For many policymakers, however, examples like this suggest that relying on science advice is not the obvious path to better decisions.

Some policymakers also express concerns that scientists are not inherently trustworthy providers of objective scientific expertise, but are in fact just another interest group using a claim of expertise to advance their own agenda. The assumption that scientists act as just another elite interest group is at the core of this criticism of scientific expertise for policymaking in the United States. Policymakers and some political scientists suspect that scientists are just like other potential advisers. Some policymakers believe scientists to use scientific arguments primarily to buttress their personal political positions or personal self-interest. Policymakers are suspicious about claims that they cannot independently verify, but scientists claim that specialized education and experience is required to judge the facts of a scientific issue.

One of the most discussed changes in the history of science advice is the decision by President Nixon in 1973 to remove the President's Science Advisor, dissolve the President's Science Advisory Committee (PSAC), and banish formal science advice from the Executive Office of the President. President Nixon took these actions in response to his perception that former and current members of these organizations acted as explicit opponents to his policies on Vietnam and his decisions to deploy an Anti-Ballistic Missile (ABM) System and develop a supersonic commercial transport aircraft. Members of the PSAC had, in fact, written articles and provided Congressional testimony that criticized the Administration's decisions. At one point a Senator pointed out that he could not find any Presidential science adviser who was for the ABM system. President Nixon, and most leaders in his Administration, concluded that the science advice from PSAC was nothing more than political opposition.

The ABM debates of the Johnson and Nixon administration also provide evidence from within the scientific community that scientists sometimes emphasize the science that supports a position they take on other grounds. Sometimes that position reflects an ethical position, or is based on beliefs about military strategy or political realities, but not necessarily on scientific expertise. In 1969, the Operations Research Society of America (ORSA) undertook a unique effort to investigate the professionalism of expert testimony and reports developed during the ABM controversy of the 1960s. Responding to the complaints by some of its members, a panel of ORSA investigated whether science advice on ABM met the standards of the society for quality analysis and ethical reporting. In an acrimonious and still-disputed report, the panel concluded that scientists on both sides of the debate – for and against ABM deployment – consciously chose to advance arguments that they knew were incomplete or actually incorrect, and to ignore or misrepresent counter-arguments.

The ORSA report points out yet another concern policymakers have about using science expertise. There may be competing versions of the scientific facts on a policy issue. The claim that scientific expertise will make a difference in policymaking comes in large part from the assumption that there are uniquely scientific insights on some policy issues based on scientific expertise relevant to the decision. If so, many policymakers assume that reasonable scientists should come to the same conclusions about those scientific insights. But it is rare to find only one perspective by scientists on policy issues.

Often the argument among scientists is over what facts matter as much as over what the facts are, but such debates challenge the idea that there is a uniquely scientific expertise to bring to bear on a problem. The conflict among scientists over the relevant facts in a policy debate sometimes came as a surprise to early decision-makers. Realizing for apparently the first time the deep ideological divide between Edward Lawrence and Edward Teller, President Eisenhower wrote in his diary that "I learned that some of the mutual antagonisms among the scientists are so bitter as to make their working together almost an impossibility." (Herken, 2000, p. 104) Lawrence and Teller had sparred over the need for the hydrogen bomb, the practicality of ballistic missile defense, and the importance of atmospheric fallout. If two such distinguished scientists, from the same University, with similar experiences and technical expertise, could disagree over such fundamental national security issues, a policy-maker can ask if there really is a scientific expertise relevant to these questions.

A great deal of literature on science advice assumes that better government decisions would be made if more scientists were included in the decisions, and expert science advice were sought more often before decisions were made. In the United States, the effort to define and defend the role of a Presidential Science Advisor, an Office of Science & Technology Policy in the Executive Office of the President, and an Office of Technology Assessment for the Congress has filled literally hundreds of books, articles and editorials in *Science* and *Scientific American.* Such literature has grown over the years rather than receded. The change in science advice in the Executive Office of the President after the Nixon purge, and the abolishment of Congress' Office of Technology Assessment after the 1995 Republican takeover in Congress, were both a source of dismay for the American scientific community. Despite the large amount of such literature, the most recent books sound surprisingly like the earliest literature: decrying the lack of a good structure for science advice, and claiming that too little attention is paid to scientific expertise in important government decisions. A report by the National Research Council (NRC) argued that almost all current problems addressed by the State Department required the involvement of scientific expertise, and that the State Department was woefully short on such expertise. The report argued for engaging more scientists as workers in the Department, using them in broader aspects of decision-making, and appointing a science adviser to the Secretary of State (National Research Council, 1999). It is hard for some policymakers to credit such claims – scientists arguing that scientists should have more impact on the policymaking process – as anything other than an interest group staking a claim for increased power in the policymaking process.

The evidence that scientific experts can still be wrong, even on scientific issues that matter to policy, that such experts often disagree about the facts relevant to a policy decision, and that scientists sound like other interest groups seeking increased roles and power jointly lead to skepticism by policymakers about scientists as advisers. That skepticism can be present even among policymakers that simultaneously believe science itself provides significant benefits for the country, and has insights to offer that are relevant to policy problems.

**Skepticism about quality decision-making as the driving factor in policymaking**. Much of the political science literature argues that national policymaking in a democracy primarily results from the dynamic interplay of power among the key actors, instead of a search for quality decisions. Such explanations of policymaking in the United States include a variety of models for defining the balance of power in Congress (median voter models, institutional rule-making models), models of bureaucratic interactions, and interest group models such as the iron triangle explanation for stability in policymaking.

The emphasis in most political science models of policymaking is on elected policymakers as single-minded seekers of re-election, and therefore partisans for their constituent or regional interests. On the executive side, bureaucratic policymakers are viewed as primarily seeking the goals of their political principals or seeking to strengthen their organizational power and responsibilities. If any of these models of policymaking is correct, only an unusual circumstance would lead to scientific expertise playing a role in actual decision-making. Arguments about the content of policy, which is the only place that scientific expertise can play a role in policymaking, are relegated to being one of several sources for individual policymaking preferences, or cynically viewed as a tool for explaining and rationalizing decisions that actually are made on the basis of relative power. Such a perspective would suggest that a concern for the role of scientific expertise in policymaking is fundamentally misplaced.

The field of policy studies started with the assumption that most important political issues could be enhanced by the application of expertise. In many ways, the academic arguments for policy analysis parallel the scientists' argument that their expertise had been critical in the solution of national security problems in the first half of the 20th Century, but policy analysts have argued that a similar approach to policymaking would rationalize political decisions in general. This view of policy sciences was espoused by Harold Lasswell in the 1950s, and championed his book A *Pre-view of the Policy Sciences.* Lasswell argued that expertise could resolve many problems of political science by substituting empirical and quantitative research for sterile political debate. Lasswell's recipe for such an approach was to rely on policymakers for definition of the issues to be resolved, but to rely on expertise in method and content, including scientific expertise where relevant, to determine the proper solutions. But accepting the view that expertise will play such an important, and fundamentally sponsor-centric, role in policymaking is now considered as naïve as the 19th Century view of scientific objectivity and progress discussed above. Deborah Stone's *Policy Paradox* and Banfield's critique in "Policy Science and Metaphysical Madness" have made a strong case that there can never be a complete separation of "facts" from "politics." More severe criticisms by

Dryden and Lindblom challenge whether substitution of expertise for the democratic process is inherently consistent with democracy. Much practical policy analysis is still conducted under a version of Lasswell's paradigm, and such work apparently is useful to policymakers. But the majority of the political science profession gives little attention to a policy studies' definition of the role of expertise in policymaking.

A great deal of the political science literature about U.S. policymaking focuses on how Congress makes decisions, and has little room for expertise as an important element in decision-making. The most prevalent approach to explaining Congressional policy-making is focused on the self-interest of Congresspersons, and represents hypotheses and empirical research in the rational choice tradition. Most of this literature assumes that Congresspersons are single-minded seekers of re-election, although some consideration is also given to a desire for leadership and power within Congress. Note that within these traditions, the idea that elected officials are primarily trying to find the best decision for the country is considered a relatively secondary proposition in explaining their actions. Explanations focus instead on the pursuit of constituent interests, relationships to special interests, and the role of party organization and ideology. A variety of additional structural explanations for the positions taken by representatives complete the body of most political science theorizing on Congressional decision-making. The role of spatial positioning (how close the legislator is to the center of Congressional opinions on an issue); the institutional rule system in creating and controlling legislation; and the impact of divided government on policymaking have all been studied. Analyses suggest that all of these features can, under some conditions, have a significant impact on moderating the otherwise direct exercise of power to balance local interest and party power in determining policy. For most political scientists, such explanations provide a rationale for the position of individual elected representatives on any particular issue. That conclusion largely relegates attempts to determine the best solution to a political issue as merely acceptable language in which to couch explanations for votes.

In studies of the executive branch, which has, in theory, a more unitary decision-making process, the literature also focuses on forces that constrain quality decision-making rather than the content of such decisions. Such constraints may be bureaucratic and political. Bureaucratic theories of decision-making, exemplified by James Q. Wilson's classic *Bureaucracy: What Government Agencies Do and Why They Do It*, focus on the self-interest of the representatives of existing agencies as they engage in and support policymaking. Studies of bureaucratic politics assume that agencies seek to improve their future position in bureaucratic in-fighting by increasing their budget and authority, or, perhaps less cynically, that bureaucracies only tend to propose and support policies that fit with their existing capabilities and authorities. The literature suggests that the interaction of such bureaucratic perspectives, and the relative power of the institutions involved, determines much of the resulting policy. An alternative viewpoint is that politics influences executive decisions much as they do in Congress. Presidents are driven in their decisions more by the need to enhance their party's position, whether or not the President plans to stand for re-election. For such theorists, the President's campaign promises, political ideology, and the interest groups critical to his party's success are the key guides to Presidential action. New information – from the bureaucracy or independent experts – is welcomed or excluded based on its congruence with defending the political position. The most widely cited study of the Presidency, Richard Neustadt's *Presidential Power and the Modern Presidents: The Politics of Leadership from Roosevelt to Reagan*, emphasizes the constraints on Presidential power. Neustadt's most famous dictum is that the President's power is primarily the power to persuade, emphasizing the relatively small capability the President has to decide and implement a decision without buy-in by the bureaucracy and the Congress. In such a model of Presidential decision-making, the President is just one more player in the political models originally developed for explaining Congressional decisions.

It would be unreasonable to imply that policymaking research has left no role for expertise. There are two areas where the political science literature accepts a significant role, at least by implication, for expertise: agenda setting and consensus building. These will be discussed in more detail below. But it is important to recognize that these roles represent an advocacy role for experts quite different from providing an expert input to a quality decision as in the Lasswell model. It is not exaggeration to suggest that most research on policymaking leaves little room for expertise to be a critical element in policy decisions, since that research starts with skepticism about whether the search for such quality decisions is itself the dominant force in policymaking.

**Some Assumptions and a Way Forward**

The two perspectives discussed above suggest a fundamental puzzle. Scientific expertise seems inherently critical to modern policy decisions, but, despite significant efforts to improve the use of this expertise, there is still no confidence that scientific expertise is used effectively. The discussion of three types of skepticism perhaps explains the mixed reception that scientific expertise receives by policymakers, but does not completely set aside the practical experience that scientific expertise has sometimes been crucial to policymaking. It is almost fifty years since C.P. Snow, Harold Lasswell, Vannevar Bush and the early atomic scientists established the major paradigms about the role of scientific advice in policymaking. It is reasonable to review many of their basic assumptions and try to put the discussion of science expertise on a more empirical foundation.

In many ways, the question of the role for scientific expertise, and the debate implicit in the previous sections of this introduction, are versions of one of the oldest questions in western philosophy. The debate goes back to Plato and Aristotle. Plato argued that policy decisions should not be turned over to a democratic polity because the majority of the people would never have the knowledge to make the right decision. In a famous extended parable, Plato argued that such an approach to policymaking was like letting the passengers determine the path of a boat, while keeping the navigator – the one person with knowledge on how to reach the destination – tied up below decks. In contrast, Aristotle argued that the people in aggregate were better able to deal with complex problems than any expert would have the ability and range to address. In the last 2400 years, the Western perspective on the winner of this philosophical debate has changed several times but little new has been added to the fundamental dispute. It is hard to expect that anyone will develop a completely acceptable answer about whether expertise or consensus is the best way to determine policy in all cases.

Happily, the research problem about the role of scientific expertise in policy does not require the solution of the millennia-old philosophical debate. In practice, we do not require an all-or-nothing answer to the role of expertise. Examples like the creation of the atomic bomb and responding to atmospheric fallout suggest that there are situations when scientific expertise makes a difference in policymaking. It would be valuable merely to understand what conditions enable a significant role for scientific expertise in policymaking, without having to determine that such opportunities are dominant or even common. The answer to that simpler question might turn out to be related to the mechanisms of science advice, or the kind of policy problem faced by decision-makers, or some other generalizable factor. If so, knowledge of the enabling conditions should allow policymakers to make better use of scientific expertise by recognizing when it might best be sought out.

This research study makes several assumptions in order to explore the conditions under which scientific expertise has a significant impact on policymaking.

**Scientific Expertise is Real**. First, I assume that there is such a thing as scientific expertise: that scientists, engineers, and medical practitioners have an understanding about some aspects of knowledge that are unavailable to those without formal training and experience in these fields. This first assumption explicitly discards the more extreme philosophical arguments that I label anti-scientism. While it is impossible to prove that science has Platonic knowledge – necessary, certain, universal, and timeless knowledge – about nature, the existence of particular, probabilistic and contingent knowledge about nature is difficult to dispute. It is undoubtedly true that scientists involved in policy debates sometimes draw on the 19th Century image of science as a source of authority. As Shelia Jasanoff points out, "When an area of intellectual activity is tagged with the label 'science,' people who are not scientists are *de facto* barred from having any say about its substance; correspondingly to label something 'not science' is to denude it of cognitive authority (Jasanoff, 1990, p. 14)." Most scientists produce useful scientific work within their disciplines without worrying overly about the probabilistic and contingent nature of their conclusions, if they are, in fact, even concerned about such philosophical issues. Government policymakers who don't agree with a particular scientific consensus occasionally complain about rampant unjustified scientism, but it is uncommon for attacks on scientific conclusions to come primarily from a philosophical perspective. The practical utility of scientific knowledge is usually sufficient argument to the public and policymakers that scientists have some claim to expertise relevant in particular problems.

Within their particular contexts, scientists, engineers and physicians practice a form of knowledge that allows humans to successfully affect their environment. That knowledge is sufficiently different from common sense that it is only available from extensive study and practice. It is irrational to claim that the correspondence between scientific expertise and our experience of nature is a coincidence, or that the knowledge and methodology of science provides no better guide to predictions *within its area of study* than other methods of thought. By making this assumption, I do not mean to dismiss the insights from studies of sociology and philosophy of science regarding the social construction of scientific expertise. It can be important to realize that the facts presented as relevant to a policy decision are socially constructed in ways that might constrain or confuse the debate. Sometimes such constraints are justified by specialized knowledge, but the contextual and probabilistic nature of the facts must be considered.

To minimize concerns about the confidence policymakers have in the existence of scientific expertise, this research limits the use of the term "scientific expertise" to expertise in the physical and life sciences, engineering, and medicine. There is widespread acceptance in American society that persons with degrees, extensive practice, and the respect of their peers in these disciplines have knowledge about their fields that are unavailable to persons without such experiences. Practitioners in the traditional academic cluster of natural sciences and engineering are much less likely to be challenged about the reality of their expertise than experts in other fields of knowledge. Policymakers sometimes explicitly criticize psychologists, economists and political scientists about whether their knowledge can be trusted when applied to policy issues, but they rarely make a similar challenge to natural scientists and engineers. In dealing with natural scientists and engineers, policymakers are likely to start discussions by noting that they are not a scientist, and move on to ask questions about the level of scientific consensus rather than challenging the expertise, methodology, or data of the scientist. When policymakers do challenge the methodology or data of natural scientists and engineers, they are attempting to show that the individual scientist is not a good scientist, rather than challenging the existence of scientific expertise.

**Sometimes Scientific Expertise Drives Policymaking**. Second, I assume that some policy decisions are significantly affected by such scientific expertise. I have noted examples from World War II and the early Cold War that support that assumption, although it may be more difficult to find clear examples that are more recent. Despite the relevance of science, engineering and medical knowledge to a great many policy issues, I suspect that decisions that turn on scientific expertise may be few and far between. Often there is not enough scientific knowledge to resolve, or even reduce, the uncertainties in a policy issue. Even if scientific expertise is available, scientific questions may not be the most important fact in a policy decision. Other kinds of expertise and experience may play a larger role in forming a quality decision about the policy response to such issues. As suggested in the discussion of skepticism about quality decision-making as the driving factor in policymaking, many decisions may turn on power relationships and political dynamics. But I assume examples exist where scientific expertise was the most important factor in a policymaking.

This research concentrates on cases where scientific expertise was one of the most important factors in a policymaking decison.

The primary reason for not focusing on the failures is the assumption – perhaps even the high likelihood – that such failures are likely to be unique to the individual cases, and not provide enough guidance for improvement in the use of scientific expertise. There are, unfortunately, many clear examples of failures in the use of scientific expertise. Discussion of failures, or perceived failures, is the stock-in-trade for many existing books and articles about the role of science in policymaking. Some perceived failures probably reflect cases where there is simply not enough scientific knowledge to resolve the policy issue, and policymakers make their decisions on another basis. Some may reflect a dominance of value questions over scientific questions in a manner that is appropriate for elected leaders. And some clearly represent failures to use valuable information that would have been available if policymakers had understood it.

Some failures to use scientific advice seem to reflect advice by scientists about issues that go far beyond their scientific expertise. For example, President Truman decided to pursue the development of the hydrogen bomb in 1950 despite opposition from the formal scientific advisory panel within the Atomic Energy Commission. The scientists in opposition to pursuing the hydrogen bomb did not challenge the technical feasibility of developing such a weapon, but doubted the strategic and political impacts of having such a weapon would be a good thing for the country. In such a case, it is hard to argue that the failure to listen to scientists represents lack of attention to scientific expertise, unless you claim that scientists have inherent expertise in these broader matters as well.

Other failures come from the style of a policymaker who may have little interest in a system of scientific advice. Ronald Reagan's budget director, for example, told one early visitor that he wanted to minimize the role of the Office of Science and Technology Policy because "We know what we want to do and they will only give us contrary advice." (Herken, 2000, p. 200) Failures also occur when policymakers have no easy access to scientific advice, or when, like President Nixon, they come to view advice from scientists as reflective of the scientist's political allegiance rather than their scientific expertise. Each of these cases may be explained by a single dominant cause, but identifying the cause of the failure does not provide confidence that changing that factor would guarantee success.

This research does not ignore the insights from previous studies about factors that prevented scientific expertise from being significant in decisions that now appear to have been harmed by the lack of attention to scientific expertise. Some of those insights provided guidance for factors to look for in successful examples of the use of scientific expertise. But, rather than risk the discovery only of idiosyncratic explanations for each failure, this research sought out common elements from situations where scientific expertise was a significant element in determining policy.

**Looking at Presidential Decisions is a Good Way to Study the Impact of Scientific Advice**. Third, I assume that Presidential decisions are an appropriate level and unit of analysis to explore the effectiveness of scientific expertise in policymaking. Many of the examples used in this research study, both for context-setting and as detailed case studies, have been about Presidential decisions. Despite the skepticism of some political scientists, examples do exist of a President relying heavily, sometimes even predominately, on scientific advice in making a decisions.

There are several advantages to analysis of decisions at the Presidential level. Presidential decisions are more likely than most policy issues to be decided as a search for quality decisions. I assume that in most cases Presidents, despite the pressures on them, wish to find solutions to policy problems that will improve the security and welfare of the people of the United States. Whatever the pressure to ensure consensus, respond to interest groups, or to maintain a consistent ideological position, Presidents want policies that *work*.

Certainly there are many cases where the questions that require scientific expertise is  resolved before the issue rises to the Presidential level. Since the 1960s, increases in scientific expertise within the departments and agencies of the U.S. government may have reduced the number of issues that both involve scientific uncertainties and rise to the level of a Presidential decision.  But such a change in the type of issues that rise to the Presidential level, if it exists, only increases the value of studying decisions that turn on scientific expertise at the Presidential level.  Such decisions are likely those where the highest level of expertise is required and where the stakes are high enough to emphasize a desire for a quality decision.

Treating the decision as the unit of analysis allows a focus on the inputs to a particular moment in a President's assessment of an issue.  At the point where a President must commit to a budget, make a speech, or promulgate an order, it is somewhat easier to determine what factors led to the decision. Focus on Presidential decisions represents a good perspective from which to investigate the conditions under which scientific expertise had a significant impact on policymaking.

It is possible that scientific expertise could make a contribution in a more diffuse way than would be reflected in treating the unit of analysis as a decision. Scientific expertise might support the identification and definition of issues, the development of options, the framing of policy issues for resolution, and the general understanding of government priorities.  It seems highly credible that scientific expertise, provided by experts inside government and through external advisory boards, actually is part of a broad range of policymaking activities in addition to being considered at the time of a Presidential decision.  But again, the issues that rise to the level of Presidential decision-making are likely to represent the most important examples of the use of scientific expertise.

The three assumptions – that scientific expertise exists, is important to some policymaking issues, and can be studied effectively through a study of Presidential decisions provides a basis for the overarching research questions for this study.

**Under what circumstances does scientific expertise have an important role in Presidential decisions?**

**What are good examples of such decisions?**

**Are there common factors among such decisions?**

## Chapter 2. Insights from an Overview of Previous Research

Three areas of previous research suggest circumstances under which scientific expertise will have an important role in Presidential decisions. This chapter reviews previous research on presidential decision-making, on the use of expertise in setting the public policy agenda and building consensus among actors, and the literature explicitly focused on improving science advice.

The purpose of reviewing this literature is to identify factors that previous writers have judged significant in affecting Presidential decision-making. In each category of previous research, key literature is discussed and factors that might encourage the use of scientific expertise in that literature are identified. At the end of the chapter, the relatively large group of factors are organized and categorized into a list of potential variables for use in case studies.

### Presidential Decision-making Theory

Books and articles about presidential decision-making are not primarily concerned with the role of expertise. But theories of Presidential decision-making do make a case for what matters in Presidential decisions, and some of those factors can be applicable to the use of scientific expertise.

Graham Allison and Phillip Zelikow's widely cited *Essence of Decision* (1999) is the most thorough book available on the insights from political science about Presidential decision-making. This book, which has gone through two editions as theory has evolved, uses a careful analysis of events in the Cuban missile crisis to show how three different theoretical perspectives are credible, and how theoretical models explain significant, but different, aspects of Presidential decisions. Allison and Zelikow provide a strong framework for discussing the political science literature about Presidential decisions, and the theoretical chapters of the book review models and concepts in light of the variety of Presidential decisions over the last fifty years. The book's focus on national security decisions allows it to include both theoretical perspectives that scholars treat as unique to questions of national security, like international relations theory, as well as the role of rationality in decision-making, bureaucratic politics and interest group models, and psychological aspects of decision-making.

Despite its broad coverage, there is no explicit discussion in *Essence of Decision* about the role of expertise or information in Presidential decision-making. The absence is particularly surprising in light of the clear importance of intelligence expertise to the book's focus case of the Cuban missile crisis. Identifying the problem, limiting the options for response, and measuring the success of policy decisions in the Cuban missile crisis relied heavily on statements by intelligence experts that were unchallenged by the leadership during the crisis. The statements from experts were simply taken for granted as the facts of the case, with little thought as to how the President could test the reality of those facts. There is also no mention of the role of scientific expertise in Allison and Zelikow, with respect to the Cuban missile crisis (where such expertise arguably was in the background), or in the broader range of Presidential decisions covered in the theoretical discussions. But Allison & Zelikow provide a thorough review of the factors that drive Presidential decisions, from which it is possible to suggest how scientific expertise can play a role.

*Essence of Decision* categorizes the political science literature into three alternative theoretical perspectives about Presidential decision-making. The three paradigms reflect viewing Presidential decision-making as being primarily driven by (1) a rational actor making decisions, (2) organizational behavior, or (3) governmental politics.

**The rational actor paradigm.** This perspective assumes that the decision-maker calculates costs and benefits and chooses the action that maximizes their utility. In the case of Presidential decision-making, Allison and Zelikow define this model by assuming that a President seeks to maximize the national interest. Referring to the 1971 first edition of the book, Thomas Schelling said, "The rational choice movement in political science mostly extends and formalizes the rational actor model articulated in *Essence of Decision*." (Belfer Center for Science and International Affairs Press Release, 1999) Allison and Zelikow define the rational actor paradigm in very broad terms. Allison and Zelikow's version of the rational actor model includes the full range of analyses that seek to explain a Presidential decision in terms of an attempt to achieve a quality decision about some identifiable goal such as avoiding war, maintaining deterrence, or maintaining national credibility. Allison and Zelikow argue that the rational actor paradigm covers the full range of explanations of Presidential decision-making addressed in international relations theory, strategic studies, and decision analysis. Allison and Zelikow recognize the limits on rationality for the President and his advisers, and embrace a bounded rationality view of decision-making. They point out that different perspectives on the "thickness" of rational choice explanations is the reason for the range of explanations in international relations theory.

Rational explanations can be based on maximizing (1) generic state interests (security, power), (2) a state's values and identity (democratic limitations and institutions, or the Chinese view of the traditional boundaries and influence of the Chinese nation), or (3) the values of individual decision-makers (Clinton's perspective on the U.S. role in the world, or Reagan's anti-communism). Within this paradigm, explaining, predicting, and improving Presidential decisions requires that you understand the actual details of a decision, and the key factors affecting a decision. With that information, an analyst can explain why a particular course of action will achieve the best outcome possible in the situation.

**Implications for the role of scientific expertise in the rational actor model**. Even though the rational actor paradigm does not directly address scientific expertise, it suggests that scientific expertise will be important to a Presidential decision if such expertise is highly relevant to the decision. Even under assumptions of bounded rationality, Presidents will seek relevant and critical information. When the President's decision turns on scientific expertise –on the feasibility of a new weapon system, or the likelihood of a pandemic, or on whether the nuclear weapon stockpile can be adequately maintained without testing – it is more likely that a President will seek scientific expertise to resolve the question, and test the scientific expertise presented to him. Conversely, the more peripheral the scientific question, the less likely a President is to care about scientific expertise. The key factor will be the President's perception of the centrality of scientific results to his policy decision.

Another factor that often comes up in discussing the role of scientific expertise in a rational decision-making model is the level of consensus among scientists over the relevant facts and predictions. The amount of consensus, especially unexamined and unchallenged consensus, often plays a significant role in Presidential decisions. Richard Neustadt and Ernest May address the important role of such consensus in their book *Thinking in Time: The Uses of History for Decision Makers* (1986). While they strongly suggest the need to challenge consensus about the facts, analogies, and predictions in a major policy decision, they also make the point that decisions usually turn on the unexamined consensus about those things in the minds of a few key decision-makers. Neustadt and May do not address scientific expertise *per se*, but they discuss several examples where scientific consensus was important to Presidential decisions. It seems likely that the degree of consensus among scientific experts, the risk from uncertainty among scientists, and the way that consensus is understood or misunderstood by the President could be significant factors in determining whether his decision is significantly affected by scientific expertise.

**The organizational behavior paradigm**. Allison & Zelikow's second perspective on Presidential decision-making, the organizational behavior paradigm, is best summarized by the aphorism that "where you stand depends upon where you sit." Allison & Zelikow bring together the work of Wilson, Moe, and Simon, among others, to argue that many government decisions, even at the Presidential level, are determined by existing organizational capabilities and priorities. They argue that this literature reflects decisions that are made by a "logic of appropriateness" rather than the rational actor paradigm's "logic of consequences." For the rational actor paradigm the most important question is “What will happen if I decide this way?” For the organizational behavior paradigm, the most important questions are “Can we easily implement this decision?” and “What will have to change in our organization to do so?” The capabilities developed in the existing departments and agencies limit what options will be presented for Presidential decisions and how new proposals are received. In its most extreme version, the organizational behavior paradigm would argue that debate about the intended consequences of a policy decision is merely an acceptable rationale for power struggles within the bureaucracy.

**Implications for the role of scientific expertise in the organizational behavior model.** One implication of the organizational behavior paradigm is that organizations will embrace scientific expertise that buttresses the options consistent with their own missions and capabilities. That observation provides us little basis for improving the use of scientific expertise. It indicates one of the difficulties in determining the impact of scientific expertise: that there may be multiple reasons for a decision, and the apparent criticality of scientific expertise to the decision may be misleading. Such confounding factors will need to be carefully considered in analyzing cases.

An additional implication is that organizations with a scientific culture are more likely to seek, use, and invoke scientific expertise and make scientific arguments as the rationale in Presidential decisions. When NASA, the Department of Energy, or the EPA are arguing for a Presidential decision, they are likely to bring evidence from experts to support their policy prescriptions. Organizations like State and Defense, which may use scientists but were not founded on a science and research culture, are less likely to make their primary arguments on scientific grounds.

**The governmental politics paradigm**. Allison & Zelikow's third perspective on Presidential decision-making, the governmental politics paradigm, suggests that policy is heavily dependent on the personal preferences and relative power of the small group of people who determine policy. A summary for this paradigm might be that "players' preferences matter." Included in this paradigm would be the President's decision-making style: whether a President is interested in seeking consensus, encouraging conflicting analyses, following the guidance of a few key advisers independent of their expertise, or making decisions with little consultation based on his personal world-view. It also includes the type of analysis common in journalist's reports of government decisions, in which the decision is determined by the relative power and skill of particular persons within an administration. This third model, focusing on individual psychology and group processes, offers the most diverse suggestions on where to seek explanations for Presidential decisions. Building on the work of Gordon Adams, it may be easiest to break this model into three kinds of explanations: macropolitical explanations (the Administration or the President's Party goals and election promises), micropolitical explanations (the goals and beliefs of particular players in the Administration, and the need to seek agreement from key players in Congress or interest groups), and individual explanations (including psychology, ideology, and life experiences of the President and key players).

One book which argues for the importance of a President's decision-making style as the primary determinant of the use of expertise is *How Presidents Test Reality: Decisions on Vietnam 1954 and 1965*, by John Burke and Fred Greenstein (1991). Burke & Greenstein argue that a similar range of expertise about the military and political situations in Vietnam were available to Presidents Eisenhower and Johnson when they were faced with the potential fall of a friendly government there. In both cases, some important foreign countries, the more hawkish members of Congressional leadership, and key actors in the Departments of Defense and State sought significant U.S. military intervention. Burke & Greenstein argue that the primary difference in the decision was not due to the differing situations, but to the presence of a structured form of Presidential advising in the Eisenhower Administration and the President's inherent ease with hearing a variety of conflicting expert advice before making a decision. Johnson's more informal system of decision-making, which often included only a subset of persons the President trusted, is judged to have made it easier for President Johnson to discount the long-range problems that a major ground commitment in Vietnam would eventually entail.

**Implications for the role of scientific expertise in the government politics model.** The governmental politics paradigm provides little in the way of guidance about the role of scientific expertise in Presidential decisions. Scientists and scientific issues never represent significant interest groups, and rarely feature in a political party's election promises. Presidents themselves are rarely trained in science or engineering, and often feel somewhat uncomfortable with scientific methods and modes of explanation. Two Presidents, Herbert Hoover and Jimmy Carter, were trained as engineers and practical working experience in engineering before entering business and politics. Some might argue that the historical assessment of these Presidencies does not make a strong case for the value of having a President with technical background.

If the President's style of decision-making is key to the potential use of expertise, then setting up clear mechanisms for scientific advice can improve the use of scientific expertise in those decisions where science is most relevant. While it is not possible to change the style of a President who is skeptical of advice or punishes dissent, Presidents who do not normally think of seeking scientific advice might be helped by a structured system of advice. Such a system might be the kind of broad staff arrangements used by Eisenhower, in which any type of expertise relevant to a decision was sought out and addressed in the lead-up to a Presidential decision, or might be a specific mechanism for science advice to the President.

One issue often raised in discussions of science advice fits well within this paradigm. In many cases, the use of scientific expertise in a Presidential decision seems to depend on having a science adviser that the President already knows well and trusts. It may well be that the use of scientific expertise depends on relatively random factors about the personal relationship between a President and key advisers with scientific expertise.

Which of these three paradigms you believe is dominant in Presidential decision-making has a major effect on the role you might imagine for scientific expertise. Assuming that the Presidential decision turns on issues where science might provide meaningful insight, the rational actor paradigm would argue that the best scientific expertise would be brought into the decision-making process. Such a conclusion is less clear for the other paradigms, where expertise and information are used more to rationalize decisions primarily made on other grounds. In fact, the conditions under which scientific expertise is a significant factor in a Presidential decision may be limited to conditions when the organizational behavior and governmental politics paradigms are not dominant.

**Alexander George's model**. One book which explicitly addresses the role of expertise in Presidential decisions in, *Presidential Decisionmaking in Foreign Policy: The Effective use of Information and Advice* by Alexander George (1980). The book attempts to understand how expertise of many kinds can be used to improve foreign policy decisions, although scientific expertise is not explicitly addressed. George's work is firmly grounded in the bounded rationality paradigm, and provides a way to think about how organizational behavior and governmental politics may constrain an otherwise rational decision-making process. George has suggested an integrated model for Presidential decision-making that explicitly accepts that a president has other constraints that limit what he calls a quality decision. George defines a quality decision as one in which "the president correctly weighs the national interest in a particular situation and chooses a policy or an option that is most likely to achieve national interest at acceptable cost and risk." (George, 1980, p. 3) He then argues that the best way to understand actual decision-making is to recognize that there are two major constraints on the attempt to make quality decisions. Those constraints are the need for acceptability by those who must ratify or implement the decision, and the limits on time and other resources in making a decision. George argues that, at least for decisions on national security and foreign policy, Presidents will seek the best decision possible within the resource constraints and the requirements for building consensus. Therefore, George argues, advice will be accepted if it is clearly relevant, easily available and or helps build a consensus. He recommends that future Presidents should foster a competitive approach to policy analysis, with a focus on testing assumptions and options by exposing them to a variety of experts not involved in implementation of the policy. He further recommends that such work be done continuously as problems and policies are raised at lower levels of the government, since he believes that only the expertise easily available at the time of a decision will be used.

**Implications for the role of scientific expertise in George's work**. One place where conditions that focus on a quality decision may dominate is in Presidential decisions about national security and foreign policy. As such, it may be that decisions about national security are the ones where a President would be most open to relevant scientific expertise. George's analysis suggests that Presidents will seek all relevant advice, within his defined constraints, for such decisions. Although organizational and political factors can sometimes be in play even in such decisions, other political scientists also assume that decisions about national security and foreign policy are different from other aspects of American politics. For example, Lowi's taxonomy about policies eventually excluded national security from his analysis of how policy choices can determine the politics of an issue. In his first article about the subject, he thought that such decisions might represent a type of policy that required rational decision-making. Most analyses of Congressional activities exclude national security and foreign policy decisions from their data. Analysts argue both that such decisions are primarily a Presidential responsibility, and also express doubt that concepts such as logrolling and interest group politics are dominant in national security decisions. Analysts intuitively suspect that the stakes are sufficiently high in national security decisions to suspend many of the other dynamics of policy-making. Policy about the physical security of the nation from attack is usually judged by whether it is likely to work, above all other considerations. The criticality of decisions about the safety and security of the nation may be a reason to seek the best expertise, including scientific expertise when it is applicable.

George's model suggests that scientific expertise is most likely to be used if it is easily available to the President at the time of the decision. Respected studies done in advance and easily available to the President meet that requirement. Easy access to the President by a senior science adviser or anyone he trusts as a source of scientific expertise would also allow the President to get quick input to a decision.

The model also suggests that science advice can be accepted or rejected based on whether it contributes to forming a consensus among those who must be involved in making or implementing the decision. Scientific expertise cannot be considered in isolation from the implications of the policy that it would recommend. As George emphasizes, this is a mixed blessing for the use of expertise. The best advice may be ignored because it is inconsistent with implementation. On the other hand, expertise can be used as a tool to build consensus about implementation if the case is strong enough.

Finally, George makes an argument for the importance of seeking the input of experts not involved in making or implementing the decision. Seeking such expertise provides a balance for the normal institutional biases of implementing departments and agencies, and for the potential single-mindedness of policy advocates. Such an argument applies to including scientific experts when the decision involves scientific questions. George is a strong advocate for structured mechanisms for including expertise in decision-making.

**Expertise as a Tool for Policy Change**

Despite the general absence of discussions about expertise in modern works on the policymaking process, there are two areas where the political science literature accepts a significant role, at least by implication, for expertise in agenda setting and consensus building. This section will discuss four theoretical perspectives – from Kingdon, Baumgartner and Jones, Sabatier, and Krehbiel – that suggest expertise can play a role in policy change.

John Kingdon's work, documented in evolving editions of *Agendas, Alternatives and Public Policies* (1984), has developed strong evidence for his argument that the agenda-setting process is the intersection of the political need to define problems that need solving during election cycles with the policy proposals made by content experts he calls policy entrepreneurs. In Kingdon's model, non-expert policymakers seek evidence of problems that their opponents have not addressed, and for solutions that can be presented as new initiatives to resolve such problems. A major insight from Kingdon is that elections matter in setting the policy agenda. Politicians who are elected on the basis of a problem they raised in their election campaign are likely to seek expertise in solving that problem. Kingdon's model has a strong role for experts, potentially including scientists, in the policy-making process. He believes that persons who develop expertise on particular policy issues are the source of new policy options. Expertise on the details of a policy proposal is the key contribution of a policy entrepreneur.

Kingdon provides a role for expertise, but also leaves much room for a credible critique of the idea that policymakers seek solutions to problems from the best and most objective information. The advocacy role of a policy entrepreneur is quite different from the role of an independent expert providing a review of analysis in an attempt at quality decision-making, as in George's model. Kingdon argues that policy entrepreneurs are committed to their policy prescription – whether it is a key decision, a program to develop some technology, or a program of research – and try to move it forward by tying it to different issues as they rise in public discussion.

Scientific expertise has certainly been used in a manner very like Kingdon describes. In the early 1950s, some scientists began to believe that the continued development of nuclear weapons was likely to end in nuclear Armageddon. These scientists formed the core of the original Federation of Atomic Scientists. In collaboration with other non-scientific activists, these scientists have sought a comprehensive ban on nuclear testing as a key step towards ending the development and deployment of such weapons. Over the last five decades, they have argued for a comprehensive test ban as the answer to at least five problems: the Russian development of nuclear weapons (in order to halt Russia's weapons program at a primitive level), the health dangers from atmospheric fallout (to prevent secondary effects on the world's public), maintaining a stable balance of power with the Soviet Union (avoiding technological surprise), developing a dialogue with Soviet technical leadership (by addressing an area where the U.S. and U.S.S.R could speak as equals at low risk), and minimizing the proliferation of nuclear weapons to countries that do not already have them. In some cases, the same scientists pursuing this policy today were the ones who proposed a comprehensive test ban in the 1950s. These scientists have developed significant expertise in nuclear testing and created the discipline of nuclear test detection for the verification of any test ban. They have clearly used their expertise on these issues to move a comprehensive test ban onto the agenda whenever a related problem is raised, rather than to provide an objective evaluation of the best answer to each new policy problem.

The body of work on agenda setting by Baumgartner and Jones is another mainstream theoretical construct that has a place for expertise to play a role. Baumgartner and Jones (1993) argue that new issues reach the public agenda by a response to outside events, the demands of new stakeholders, creation of new technological options, or new perceptions of urgency within the political process. Their analysis is not inconsistent with Kingdon, but put more emphasis on the public concerns than the political needs of politicians. Baumgartner and Jones believe that much of American policymaking is incremental, but they are particularly interested in periods of rapid change that occur when public attention becomes focused on an issue. Congress is likely to act during such waves of mobilization, which Baumgartner and Jones refer to as Downsian waves or Schattsneider waves. Downsian waves are periods of policymaking enthusiasm about a new technology or opportunity. Schattsneider waves are periods of challenge to existing policy and institutions driven by questions about the safety or correctness of previous decisions.

Baumgartner and Jones see external changes as welcome opportunities to introduce previously intractable problems to the policymaking process. They believe that the most important changes occur when an external opportunity or problem becomes evident to the public at large, often involving scientific research or technological developments. Their primary example of these mechanisms was the nuclear power industry. Enthusiasm for nuclear power in the 1950s led to creation of a policy community focused on the widespread adoption of nuclear power plants and an evolutionary improvement in their design and performance. One of the key insights of Baumgartner and Jones was that the key outcome of such a period of policymaking is the creation of institutions that carry on the policy decisions long after the issues have left the public agenda. In the case of nuclear power, the Atomic Energy Commission, the Joint Atomic Energy Committee in Congress, and certain industry associations were the product of policy decisions and legislation during the period of enthusiasm for nuclear power. Baumgartner and Jones argue that there can also be a return of a policy area to the public agenda (Schattsneider waves) enabled by challenges to the correctness of the existing status quo. They returned to the nuclear power example to show that questions raised about the safety of nuclear power plants in the 1970s led to a new set of policies, redefinition of popular assumptions, and the creation of new institutions such as the Nuclear Regulatory Commission (intended to regulate nuclear power plants without having a simultaneous mission to promote them).

Baumgartner and Jones imply that scientific expertise can play several roles in the critical process of changing the policy consensus. Scientific experts provide the basis for credible arguments that a new opportunity exists before it has proven itself. Most of the basis for policy action in Downsian waves depends on the testimony of scientific experts about the potential of a new technology or the scale of a problem that needs to be fixed. In Schattsneider waves, scientific expertise can provide a basis for challenges to the status quo in existing institutions. Only respected scientific expertise, presented in a way that can stand up to the scientific arguments within the existing policy community, stands a chance of challenging the status quo. In most cases, scientific expertise is also critical to defining the kind of institutions that will implement the policy direction in response to either intense period of policy-making. Baumgartner and Jones make the point that external scientific expertise is usually critical to Downsian waves of enthusiasm, and that scientific experts from within existing departments and agencies are the most credible critics for building a Schattsneider wave.

Another role for expertise in policymaking is in providing a basis for consensus solutions on issues that have otherwise stalled in hardened partisan positions. Paul Sabatier (1993) has made a study of the ways that policy change occurs in Congress. Much policy is perpetually hostage to fixed positions by existing members, and changes only through the replacement of members by policymakers with different preferences. Over long periods in Congress, Sabatier was able to find examples of such shifts in preference without a change in key membership, party leadership, or party control of Congress. He explains such changes with a theory of policy-oriented learning. Sabatier emphasizes that policymakers are unlikely to change what he calls their deep or core beliefs, but they are open to changes about the logical and causal relationships between their core beliefs and their policy preferences. In arguing that new information can be accepted about how a policy will actually work, he finds a role for expertise. When expertise can demonstrate that an accepted goal, such as countering terrorism or reducing the health risk to Americans, can be better achieved by a policy that was once opposed, the presentation of this as new information based on research allows the debate to move forward.  Sabatier concludes that such movement required credible information that could be presented as impartial expertise. He also believed that such institutional learning required the advocacy of Congressional members who put progress above maintaining their partisan position.  Sabatier also concludes that such institutional learning requires a long period to occur.  He judges that a minimum of ten years is required for such learning, because members need to build trust with one another, develop a belief that the normal political process will not likely yield to their policy preferences, and use the new knowledge to reframe the debate.

In his book *Information and Legislative Organization* (1991), Keith Krehbiel argues that the primary reason for the Congressional committee process is to allow committee members to develop expertise in particular areas.  He believes that other members defer to that expertise in developing legislation under most circumstances.  In that context, the provision of scientific expertise to the correct members of Congress could be a very powerful policymaking tool. He makes the point that expertise is developed and used as a tool to ensure that all decisions are not merely the result of counting votes.  The development of a new consensus about policy is enabled by the credibility of expertise about what policy prescription will work best.

In many ways, these four theorists suggest a very strong role for expertise in the policymaking process: expertise can be the primary tool for initiating important policy changes. Kingdon, Baumgartner and Jones see expertise being used to place new items on the policy agenda, while Sabatier and Krehbiel see expertise being used to develop a new consensus on policy issues can be developed. All accept that most policymaking is incremental, involving slow changes in government practice, but the existence of discontinuous policy changes are tightly coupled to claims of new expert information. But the exceptions to incremental policymaking are often the most important policy decisions. As Baumgartner and Jones argue, such discontinuous changes in policy establish the institutional framework for decades of incremental policymaking.

For all four theorists, invoking credible independent expertise is viewed as one mechanism for initiating a new policy discussion. A new initiative in government action begins with policymakers arguing that a new option is possible or a new problem is now critical. Reframing and challenging of an old policy can only begin when credible expertise is available to support arguments that the old way is not working. For Kingdon, such policy initiatives even explain policy change that occurs through the electoral process, since he counts on subject matter experts to propose the link of problem and policy through which a politician can win an election.

**Implications for the role of scientific expertise from the literature on expertise as a tool for policy change**. The key to all of these perspectives on the role of expertise is that expertise – sometimes explicitly scientific expertise – is a powerful force in policymaking when it is used as advocacy for a policy. Kingdon, Baumgartner and Jones, Sabatier, and Krehbiel all make a case for expertise as a tool for policy change when it is explicitly used to argue that policy needs to be changed. This role for expertise is significantly different from the role envisioned in the rational choice model, and acknowledges that scientific expertise can be allied with a policy advocate, an interest group, or even a political position. It need not be as political as Kingdon's perspective, since the scientific expertise might be merely encouraging the government support of some new opportunity that both parties will want to be associated with. In the early 1990s, Congress was active in a bipartisan manner to craft legislation that made the expansion of Internet business opportunities possible. And it is not clear that advocacy implies somehow weakening the quality of the science involved; if a scientist believes that his evidence clearly supports a particular policy, there is nothing inherently unethical about saying so. But the key to all of these perspectives is the role of scientific expertise as a tool for policy advocacy, rather than as a tool for evaluating policy options.

**Literature on Recommendations to Improve Science Advice**

This section uses four works to represent the range of recommendations about effective science advice. Gregg Herken's *Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI* (2000) not only focuses specifically on science advice to the President, but also reflects the conclusions of most writings about the requirements for good science advice. C.P. Snow's classic *Science and Government* (1961) offers some slightly different conclusions, and it is also focused on providing science advice to his country's chief executive (the British Prime Minister). Shelia Jasanoff's *The Fifth Branch: Science Advisers as Policymakers* (1990) is focused on advisory committees in the Environmental Protection Agency and the Food & Drug Administration rather than explicitly on Presidential advice. But her study provides good analysis of how science advice is used by administration officials to develop policy. Finally, Bruce Bimber's *The Politics of Expertise in Congress: The Rise and Fall of the Office of Technology Assessment* (1996), chronicles the history of the 20-year experiment in providing non-partisan technical analysis for Congressional decision-making. Bimber's book offers an additional model for science advice, even if not focused on advice to Presidents. As in the previous sections of this chapter, a discussion of the implications of each for the role of scientific expertise in Presidential decisions will follow the review of the books.

**Herken**. Gregg Herken's *Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI* is a thorough historical review of Presidential science advice. It also captures the conclusions and recommendations of much of the science advice literature. Wolfgang Panofsky's review of the book in *Physics Today* summarizes a generation of scientific opinion:

> One strength of the work is the thoroughness in tracing the stages at which science advice has influenced momentous decisions. Another is how it delineates the gradual erosion in the impact of science advice…. But possibly most important is the lesson that whatever the formal organization of the science advice at the Presidential level, its success ultimately rests on the "chemistry'' between the President and the adviser. (Panofsky, 2002)

Herken's book is primarily a work of history. He devotes about a quarter of the book to role of scientists in creating and implementing the Manhattan project and immediate post-war advice about nuclear weapons. The second quarter of the book addresses science advice in the Eisenhower Administration, which has come to be seen as a golden age for scientific advice to the President, and a little less than half of the remainder covers science advice to Presidents from Kennedy through Reagan. The focus of the book is primarily on the formal science advisor to the President, when there has been one, although he also addresses other sources of science advice to the President.

Herken is writing firmly within the tradition of most work about science advice. Some the primary points in Herken's book are very representative of that literature.

- Many mistakes by policymakers reflect a lack of scientific expertise by the decision makers and a failure to seek out that expertise when needed.
- Most policy issues in the modern world involve significant components of science, technology and health, and therefore scientific experts should be involved in most policy decisions.
- On policy subjects that involve science, engineering and medicine, only those with appropriate scientific expertise are competent to judge the facts of the issue;
- Decision-makers should seek the best experts available on the particular policy issue, and should particularly seek outside expertise in order to ensure freedom from organizational bias.
- Scientific advice should be provided directly to the most important decision maker, lest the scientific conclusions be distorted when combined with other aspects of the problem.
- A major role for science advisers is to "speak truth to power" when the facts indicate that a policy option will not work, or will not meet the promise claimed for it.

There is probably no single issue about science advice on which more has been written than the need for better science advice to the President, reflecting the perspective that scientific advice should be provided directly to the most important decision-maker. Probably no issue has so united scientists like their desire to see the re-creation of a President's Science Adviser after President Nixon abolished the post. Every President since Nixon has selected someone to head the White House Office of Science and Technology Policy (OSTP), usually designating that person as a Counselor or Adviser to the President. Presidents, and other policymakers, often express agreement with most or all of the six observations above when installing their choice to lead OSTP, and when speaking to scientific groups. It is clear that many in the scientific community see the

President's Science Adviser and the Office of Science and Technology Policy as their voice and representative in the councils of power. When a President's Science Adviser supports a Presidential policy that is unpopular with scientists – as when George Keyworth supported President Reagan's Strategic Defense Initiative – scientists not only pillory the Adviser, but they see this as a failure of science advice.

In his final chapter, "Speaking the Truth to Power: The Future of Presidential Science Advice," Herken concludes that the foremost requirement for better science advice is that "the President's Science Adviser and OSTP should reassert for themselves a significant role in advising on scientific matters affecting the nation's security, broadly defined." (Herken, 2000, p. 222) Herken argues that science advice will have the greatest effect when a single scientific leader acts as an arbitrator or referee in disputes over scientific aspects of policy. Such a leader "must be extraordinarily competent both technically, in order to comprehend the major programs and integrate them in his mind, and administratively, in order to avoid distraction by seductive details or special pleaders." (Herken, 2000, p. 223) And Herken notes that it is critical that the Adviser enjoys the President's confidence. In other words, the effective use of science advice, in this model, depends upon getting the right person next to the President, and giving him the power to arbitrate scientific debate and help the President understand how the scientific facts affect Presidential decisions. Herken argues that creating the right mechanism for science advice to the President consists of putting the right person in place with the right level of authority.

Herken is mildly critical of the proliferation of science advisers and expert committees within the government departments and agencies. He believes that these spreading efforts at science advice dilute the impact of scientific expertise, and fears that such bodies may become captive to the organizations that sponsor them. He argues that a strong Presidential Science Adviser, combined with mechanisms for coordination among the scientific elements spread throughout the bureaucracy, can work effectively. But he feels that a strong Science Advisor in the White House is key, both to championing good ideas that do not have a bureaucratic home and to providing an independent opinion about ideas that do.

Herken none-the-less suggests that the task of reviewing the evidence behind controversial questions like climate change should be assigned to "an external blue-ribbon committee … composed of technical experts rather than special pleaders chosen for the sake of political balance." (Herken, 2000, p. 222) The idea that a committee of outside experts should review important government decisions is hardly controversial. Herken concludes that such a committee should be composed of the best possible technical experts on the issue of concern, chosen for their expertise alone. He suggests that the experts should be objective and have as little stake as possible in the issue, other than to ensure that the scientific facts are properly presented. Herken argues that such committees will relieve the President's Science Adviser from having to conduct the detailed analysis on each issue. He apparently believes that a strong Presidential Science Adviser, acting as the arbitrator of all disputes over science, would always agree with the results of such a well-chosen committee.

**Implications for the role of scientific expertise in Herken's work**. Herken's self-identified primary recommendation is that there needs to be a single strong science advisor acting as an arbitrator or referee in disputes over scientific aspects of policy.

Herken believes there should be a senior adviser on science and technology in the Executive Office of the President, with the authority to review the scientific work done in the executive branch and make a final judgment on the merits of the scientific position. He believes that person should have well-recognized credentials as an academic scientist, and should also be picked to have the trust of and easy access to the President. Since he refers to this "foremost requirement" as the need to reassert this role, it is likely that he envisions a return to a science advisor relationship like James Killian enjoyed in the Eisenhower administration. Herken believes that scientific expertise made a difference at that time, and that establishing similar conditions will lead to better use of scientific expertise, and thereby better decisions overall.

Herken argues that the scientific advice on controversial questions should be given to a committee formed of scientific experts. Such experts should be objective and have as little stake as possible in the issue, other than to ensure that the scientific facts are properly presented. They should be chosen for the scientific expertise on the issue

Herken clearly believes that the most important role for the Presidential science adviser is to "speak truth to power," that is, to tell Presidents when some difficult problem must be addressed or to tell them when some proposed technical program or policy will not work.

Herken strongly argues that the role for scientific advice is most important in dealing with national security issues, broadly defined so that national security would include health and environmental issues with major consequences. Herken explicitly emphasizes that questions like what scientific projects to fund and how to organize research are more the responsibility of line organizations like the National Science Foundation.

Herken argues senior scientists must give science advice directly to the President. He feels that scientific advice can easily be garbled, or even be twisted to say things the scientists would not support, if it were passed through other senior officials.

**Snow**. C.P. Snow's *Science and Government* is in many ways a challenge to the more common conclusion that science advice requires a strong arbitrator or referee in disputes over scientific aspects of policy. Snow's primary evidence for the role of science advice is an extended comparison of the advice to the Prime Minister during World War II by two senior British scientists, Henry Tizard and F. A. Lindemann. Snow believes that Tizard's advice on radar development and the development and use of air power saved the United Kingdom from defeat. On the other hand, he believes that Lindemann's later advice to the Prime Minister wasted resources and delayed the end of the war through a single-minded commitment to strategic bombing. In Snow's perspective, Lindemann's advice was not based in good scientific logic and his recommendations seemed impervious to the effect of new information. But it is hard to be sure that such a difference between the advisers was clear at the time or discernable by the Prime Minister. To an outsider Tizard and Lindeman's qualifications seem similar. Both were well respected as academic scientists and had long worked with defense groups on the application of technology to warfare. And both were well placed to influence the Prime Minister's decisions.

Snow concludes that there are several lessons we can draw about what kind of scientists in government we do not want to have: incompetent scientists or ones with a narrow specialty. He also argues that policymakers should be on guard against ones who are fascinated by the latest gadgets and prone to single-minded commitments. But he argues that it is difficult to make conclusions about the right kind to have. One of his major observations is that, while the country may owe a debt of gratitude to the advice of such a scientist as Henry Tizard or Vannevar Bush, "on the whole, I am inclined to believe that the obvious dangers outweigh the vestigial possibility of good … We ought not to give any single scientist the powers of choice that Lindemann had." (Snow, 1961, p. 68)

Snow is much more sanguine about the possibilities for the expert committee. "[Such a] Committee is, in the right conditions, as sharp a tool for doing business as the government can find." (Snow, 1961, p. 74) Such a committee avoids the need to find a singular individual that can combine broad technical expertise together with unusual foresight and ability to communicate with leaders. Use of a committee of experts provides room for communicating the uncertainty about a scientific conclusion while still ensuring that the scientific expertise is made explicit to the decision-makers. Snow argues that such committees should be focused on a clear objective, placed so that the small group of decision-makers will hear it, and have the power of inspection and follow-up.

Snow believes that the heart of the problem with using scientific expertise was that the most important government decisions are taken in small secret councils, among persons who are delegated to make such decisions but have very little understanding of modern science. He points out that, while military matters may be the most important of such issues, "the same reflections would apply to a whole assembly of decisions … For example, some of the most important choices about a nations physical health are made, or not made, by a handful of men … who normally are not able to comprehend the argument in depth." (Snow, 1961, p. 2) Snow's ability to live on both sides of what he famously described as "the two cultures" of science and the humanities led him to believe that non-scientific leaders were likely to underestimate the number of decisions that require scientific expertise to comprehend the argument in depth. He fundamentally argues that science needs channels for communication into the councils of leadership. Snow judges that a primary part of the problem with science advice is the lack of communication between scientists and non-scientists, and that the increasingly specialized language of science made communication more difficult.

Snow is probably the most explicit advocate for the importance of scientists within the government. Snow argues, "If we had scientists of any sort diffused through government, the number of [such] people helping to influence secret choices is bound to increase." (Snow, 1961, p. 81) He also believed that scientists in government would increase the general understanding of scientific knowledge, and encourage scientific approaches to policy analysis when that was appropriate.

**Implications for the role of scientific expertise in Snow's work**. Snow recommends recourse to a committee of experts. He expects the experts to primarily consist of technical specialists about the issue in which a decision will be required. But Snow also imagines these committees spending a relatively long time together on a range of topics of which the current decision is but an example. In contrast to Herken, Snow does not expect committees of experts to be assembled for each controversial issue. He expects advisory committees to be relatively small standing committees, focused on a broad area of defense policy like air defense or communicable diseases, which are then asked to address particular questions. He further argues that such committees must be placed so that their advice will be given directly to decision-makers. The placement would ensure that their advice would be provided clearly, since Snow was concerned about the potential for miscommunication of scientific expertise, and would also provide sufficient clout to ensure access to the various organs of government where scientific work was underway.

Snow also believes that putting scientists into the government is an important tool for science advice. He is hopeful that the addition of natural scientists and engineers to government departments and agencies will reduce the requirement for outside science advice. As persons with scientific training have become more common in the departments and agencies of the U.S. government, it may become less critical to have outside committees of experts directly advising the President.

**Jasanoff**. In her book *The Fifth Branch: Science Advisers as Policymakers*, Sheila Jasanoff explains some of the mechanisms through which scientific expertise helps to form consensus. Jasanoff studied the role of scientific expertise in environmental policy and food safety. Her work shows how expert panels – the most common tool for providing scientific expertise to policy decisions – must develop and use a special set of skills to define science that is good enough for policy. She argues that science advice can never be an independent evaluation of technical feasibility, as envisioned in Crichton and Mooney's recommendations. Policy questions are rarely put in terms that science can explore directly, nor does the existing science usually provide a clear guide to the policy that should be chosen. She argues that scientific expertise can best inform policy when the outside experts work closely with the government bureaucrats who will define, defend and implement a policy.

Jasanoff's research is consciously on guard against the technocratic simplifications in much of the science advice literature, and seriously considers the possibility that scientists are merely asserting authority on issues better resolved through political debate. None-the-less, she concludes that the use of scientific expertise is important and useful in the shaping of public policy that turns on scientific uncertainties. She concludes that science advice need not challenge democratic ideals, as some fear from the kind of scientific arbiter envisioned by Herken. Jasanoff's conclusions in *The Fifth Branch* are supportive of the value of scientific expertise, but are different from Herken in emphasis.

> What emerges from a successful recourse to scientific advice, then, is a very special kind of construct: one that many, perhaps most, observers accept as science, although it both shapes and is shaped by policy. That such constructs sometimes break down under political pressure is hardly surprising. Their frequent durability is the greater puzzle, for they are founded neither on testable, objective truths about nature, as presupposed by the technocratic model of legitimization, nor on the kind of broadly participative politics envisioned by liberal democratic theory … In this effort, agencies and experts alike should renounce the naïve vision of neutral advisory bodies "speaking truth to power," for in regulatory science … there can be no perfect objectively verifiable truth. The most one can hope for is a serviceable truth: a state of knowledge that satisfies the test of scientific acceptability and supports reasoned decision-making, but also assures those exposed to risk that their interests have not been sacrificed on the altar of an impossible scientific certainty. (Jasanoff, 1990, p. 234, 250)

**Implications for the role of scientific expertise in Jasanoff's work**. Jasanoff's research supports the premise that scientific advisory committees are useful. But her conclusions about the kinds of scientific participants are different from the literature reflected in Herken. Jasanoff believes that negotiation is required between advisory scientists and government officials about the questions to answer, the kind of data to be used, the collection and meaning of data, the appropriate models, and the types of policy options that can be effective. Accordingly, Jasanoff would not insist on the committees being made up of the most knowledgeable scientists on each issue. She argues that the more narrow the specialization of the scientist, the less likely that the scientist can contribute to the interdisciplinary and policy-oriented work of an advisory group. She would seek experts who are known for synthesizing knowledge from several fields as well as having the respect of their peers.

Jasanoff also argues that scientific expertise will affect decisions most if it is provided by groups of outside experts who take a long-term commitment for interaction with their government counterparts. Her conclusion on the need to seek such advice from standing advisory boards and committees is similar to Snow's perspective on such committees. In her view, long-term experience in giving science advice itself is the best way to develop the key skills for bringing scientific expertise to a critical decision.

**Bimber**. In his book *The Politics of Expertise in Congress: The Rise and Fall of the Office of Technology Assessment*, Bruce Bimber chronicles the 20-year history of an attempt to provide non-partisan technical analysis for Congressional decision-making. The Office of Technology Assessment (OTA) was created in 1973, after several years of arguments about Congressional requirements for science advice mechanisms to parallel the President's Science Adviser and the PSAC. Ironically, the OTA was created in the same year that President Nixon abolished those mechanisms for advice to the President.

OTA was an independent agency of the Congress like the Government Accountability Office, the Congressional Budget Office, and the Congressional Research Service. OTA was often under suspicion by the Republican minority in Congress of being a tool for liberal democrats to produce analyses that would criticize Republican

Presidential initiatives under the guise of providing scientific advice. In response to this concern, OTA developed very unique approaches to providing science advice. OTA accepted tasking from either the chairman or ranking member of any committee of Congress. As requests arrived, a staff member was assigned to the request, and they worked with relevant members of Congress and leading staff to further define the study. After a working terms-of-reference was established, the OTA staffer would assemble a study group of experts both in and out of government, with the intention of having the most knowledgeable technical experts on the study. In addition to a manageable-sized study group of about a dozen experts, the OTA staffer would also line up a larger body of consultants to the study who were experts on narrower aspects of the problem.

The most unusual aspect of the OTA approach to scientific advice was that OTA had a policy against making policy recommendations. OTA leadership believed this lack of recommendations was key to maintaining bipartisan support for the organization. Bimber points out that all independent Congressional agencies must develop unique mechanisms to repeatedly demonstrate their non-partisanship. OTA directors also came to see the commitment to avoiding recommendations as a positive strength. OTA came to view its role as explaining the facts of an issue, and expecting that to improve debate among members. The ability to eschew recommendations encouraged development of relatively strong conclusions when consensus could be reached among the scientific experts, and made it easy to include minority dissents or concerns about the uncertainty of data on an issue.

OTA was eventually disbanded as part of the Republican take-over of Congress in 1995. While OTA still remained under suspicion by some Republican members in 1995, the primary reason for disbanding the organization seemed to be Republican zeal to demonstrate that they were willing to reduce the institutions of government. While the new Republican majority never moved far on their stated intention to dissolve some major executive departments and agencies (the Department of Education and the Environmental Protection Agency were reported targets for the new Republican majority), they could zero-out a Congressional agency using only their majority votes. This symbolic move ended the Congressional experiment with a formal mechanism for technology advice. OTA studies were generally held in high esteem by the scientific community, by many members of Congress, and in many cases by the general public. OTA reports are still widely cited today.

**Implications for the role of scientific expertise in Bimber's work**. Bimber makes a case for using scientific expertise through a committee selected for their technical expertise. The OTA experience demonstrates that such a mechanism, if given enough time, can be an effective mechanism for providing science advice.

The most unique aspect of the OTA experience is the provision of advice without a policy recommendation. The OTA experience shows that communicating science may be sufficient. Providing information allows each side in a political debate to make use of the points that support their position, but such an analysis can set the boundaries on what is the current level of knowledge.

**Factors that May Determine When Scientific Expertise is Used**

It is clear that there is not a well-developed and accepted theory on the role of scientific expertise in Presidential decision-making. There is a need for middle-level theory building on this topic. If research could determine the mechanisms through which scientific expertise has been effectively used in Presidential decisions, the insights could be used both to enhance policymaking where scientific expertise is relevant, and possibly to begin a broader explanation of the role of expertise in policymaking more generally.

In the effort to determine the circumstances under which science expertise has a significant impact on Presidential decisions, previous research provides either too many factors to be significant or no clear guidance at all. In addition, there are suspicions by some of the researchers that idiosyncratic factors, like interpersonal chemistry, are the most important in determining whether scientific expertise is even heard.

As an exploratory study, this research identified and categorized factors that have been suggested as important factors whether scientific expertise will influence Presidential decisions. At this point in developing mechanisms for when and how scientific expertise is used, it is more reasonable to identify factors – potential variables – that the literature suggests might be important. This study took those potential variables and operationalized them as variables to look for in the review of good case studies where a President relied on scientific advice.

At some future stage, such factors might become variables suitable for testing a theory about the relative strength of each on the utility of scientific expertise in a more statistical study. This study's research design merely explores whether some of these factors can be excluded from significant examples where scientific expertise makes a difference.

The discussion above should indicate that the list of potential variables could be a very long list. But some of the potential variables are suggested by more than one theoretical perspective. For example, the idea that it is important to use outside experts to encourage quality decisions occurs in both the Presidential decision-making literature and the writings on science advice. Some other factors could be combined. For example, George suggests that the need to form policy consensus is a limitation on the search for quality decisions, and Sabatier suggests that expertise is a key element in allowing such a consensus to form.

To provide a systematic list that can be used to investigate relevant cases, I have organized the potential variables that might determine when scientific expertise is used into a taxonomy shown in Table 2-1. The potential variables can be considered as falling into four categories. I argue that the literature can be summarized as suggesting that scientific expertise may be more likely to be used in a Presidential decision based on the presence or absence of these factors.

- Type of Decision

  1. High Scientificity (scientific questions are the issue)
  2. National Security Issues
  3. Based on Wide Scientific Consensus
  4. Led by an Agency with Scientific Culture

- Type of Expertise

  1. Experts from Outside Government
  2. Experts Other than the Advocates
  3. Best Expertise on the Issue
  4. Experience with Science Advice

- Role of Scientists in the Policymaking Process

- Advisory Mechanism

  1. Single Strong Adviser
  2. Policy Advocate
  3. Committee Created for this Decision
  4. Committee of Standing Advisory Body
  5. Reports on Issue Prepared in Advance of Decision
  6. Direct Report to President
  7. Communication (without a policy recommendation)

**Table 2- 1 Potential Variables on When Scientific Expertise is Used in Decisions**

I have identified six factors about the decision that may be important to whether (1) type of decision, (2) the type of expertise available, or (3) the advisory mechanism that is used. Research may indicate that some combination of those factors is important, as neither the categories nor the potential variables are mutually exclusive.

**Type of Decision.** The most important factor determining whether a President is open to scientific advice may be the type of policy issue he is facing or the nature of the decision. If the type of decision is the critical factor, we could identify the decisions where it would be valuable, or even necessary, for a President to seek scientific expertise before making a decision.

The first three of these factors are implied by from rational actor paradigm with a focus on a President seeking quality decisions. The first potential variable is the degree to which a decision actually turns on a scientific question. I call this factor "scientificity." It seems reasonable that the President is more likely to seek and use scientific expertise if the decision clearly turns on a question that is fundamentally scientific, like how well a proposed weapon system will work, or the likely spread of a new disease.

"Scientificity" is the characteristic of decisions most closely associated with the legitimacy of the argument that scientific expertise is required in policy decisions. Herken, Jasanoff, and Snow would all take as a given that such issues are the ones where a decision-maker is most likely to turn to scientific expertise. Allison & Zelikow would argue that a rational actor would seek the most relevant advice. When the question under consideration is fundamentally a prediction about the likelihood of some future event or the performance of some as-yet-unproven device, natural scientists and engineers have a special competence to bring to the decision. As J. Robert Oppenheimer said about the decision to drop the atomic bomb, "we, as scientific men, have no proprietary rights … no claim to special competence in solving the political, social, and military problems which are presented by the advent of atomic bombs." (Herken, 2000, p. 26) In contrast, a case can be made that scientific experts are the best-informed persons to make predictions about the potential of scientific and technical issues, such as whether such a bomb could be made, or how powerful it would be once developed.

For example, the relationship between smoking and cancer as argued in the 1960s represented a policy issue with high scientificity, as Administrations struggled with the question of how much of a connection was clear in the mounting evidence.

A question with high scientificity need not imply that there is no scientific consensus. For example, President Truman's decision to pursue development of the hydrogen bomb clearly turned on whether it was feasible to develop such a weapon and whether it would have the thousand-fold increase in explosive power predicted for the weapon. By the time Truman made his decision, however, there was no disagreement between the scientists on whether such a bomb could be built, only on whether it was a good thing to do so from strategic and moral perspectives.

In contrast, a decision might involve science but have a low scientificity. Consider the decision in the Reagan Administration to negotiate and sign an arms control treaty that banned all intermediate range ballistic missiles. Many scientists and engineers were involved in negotiating details of the treaty, and the resulting Treaty on Intermediate Nuclear Forces (the INF Treaty) was widely praised by scientific societies. But there were no technical issues in the decision to pursue the treaty. No one doubted our ability to destroy the missiles, and verification of the treaty relied on observation of the destruction by on-site inspectors rather than complex technical methods. Arguments about the Treaty before its signature and ratification turned on strategic and military issues of whether the U.S. was better off with this class of missiles completely missing from both countries' inventories, or available to both countries. President Reagan's decision to seek the INF Treaty was a low scientificity decision, despite the large role of scientists in the debate. This research addresses, among the other factors, whether scientific expertise is used in cases where the scientificity of the decision is high.

The second potential variable is whether the decision is about national security, at least if that factor is defined as traditional national security and foreign policy matters. Herken argues that this is the area where scientific expertise is most important. The political science literature seems to accept that the President is most likely to seek and use appropriate expertise if the decision is critical to national security. Decisions that affect national survival or vital national interests, which might also include decisions about potential pandemics or environmental catastrophes, are less likely to be driven by political trades.

It may be that national security decisions are well represented in cases where the President seeks and uses scientific expertise. For example, the decisions in the Truman and Eisenhower administration about the relative priority to give development of an ICBM seemed to be heavily weighted by the judgment of scientific experts on the feasibility of such a system. The political and military implications of ICBMs were well understood. If they could be built, ICBMs would be extremely important weapons to have. Seeking scientific expertise seemed more important for such a decision.

A third factor is the level of consensus about the issue. The President is more likely to use scientific expertise when there is a strong scientific consensus about the facts of the issue. Consensus is relative concept, since there is rarely an important issue where there are not some contrarians even among mainstream scientists. But there are cases of widespread consensus among the scientific community about the facts relevant to a policy issue. For example, a consensus developed on the long-range transport of radioactive fallout. Even in the controversy of development of the hydrogen bomb, the scientists agreed on the likelihood that such a weapon could be developed. Scientific consensus is a concept with mixed applicability to using scientific expertise effectively; the most knowledgeable scientists may actually know more than is reflected in the consensus of all scientists. For example, when President Carter announced the stealth bomber program, many scientists and engineers challenged the idea that a low-observable bomber could be developed. Such technical experts were unaware of a decade of secret work that had tested and addressed the problems with such technology. None-the-less the question of whether a President is more influenced when scientists seem to be in agreement is worth exploring.

The fourth factor is whether the decision is led by an organization that has a strong scientific culture. The organizational behavior paradigm suggests that a Presidential decision is likely to turn on questions of scientific expertise when the decision is important to a department or agency with a strong scientific culture. Such an organization will make their policy arguments in scientific terms. Organizations like NASA and the Department of Energy clearly represent examples of strong scientific cultures. Decisions involving those agencies might naturally involve arguments about scientific expertise. Decisions that are brought to the President by those agencies would invariably be described in terms of scientific analysis, and other agencies would need to address the credibility of the scientific expertise in the agencies.

**Type of Expertise**. Five factors in the type of expertise available when a Presidential decision is made could be important to whether scientific expertise will have a significant effect.

Whether outside expertise is used, in contrast to relying only scientists in government employ, may be an important factor. Both Herken and Jasanoff argue that it is important for experts to come from outside the government. To ensure that scientific advice is not skewed by internal bureaucratic preference for particular decisions, external expertise is preferable. Outside expertise has been important in some scientific inputs to Presidential decisions. The out-of-government status of the FDA's Cardio-Renal Committee allowed them to step outside existing regulation to propose a new look a the full range of such drugs. Independence of scientists on the President's Science Advisory Committee allowed them to make proposals not even considered by the bureaucracy, and also made them free to criticize President Nixon's preferred approach to ABM deployment.

A related, but not identical, potential variable is the seeking of expertise not involved in the advocacy of a policy solution. The advocates for a particular government action may be inside or outside the government. Most discussion of the potential role for scientific expertise suggests that scientific expertise is particularly important when advocates may misstate the technical issues in ways that favor their preferred solution. C.P. Snow warned against the abundant enthusiasm for a particular solution even among science advisers, and argued that Lindemann's belief in strategic bombing was unchanging in the face of growing evidence. When President Reagan announced an effort on hypersonic transport in his 1987 state-of-the-union speech, he was apparently unaware that experienced scientists viewed this technology as not yet ready for practical application. Reagan had instead relied on advice from advocates of such a program.

There are also three perspectives on the most important characteristics of the outside experts who are consulted. Most of the science advice literature suggests that the best expertise on the issue of concern should be sought. If a particular decision or issue with a technical element is becoming important, Herken suggests the creation of a blue-ribbon panel of academic and industrial experts with experience most relevant to the issue. The National Academy operates on a similar approach, making up each research panel from among its members who have relevant expertise. OTA believed strongly in seeking a panel of the most qualified persons for each study, even if these experts had never been previously involved in a policy-making study.

In contrast, Shelia Jasanoff suggests that this is the wrong perspective. She suspects that scientists will do the best job of providing advice if they have long-term experience with providing policy advice. She argues that giving advice on government decisions is itself a skill that requires development, and so important decisions should use advisers with such experience. Some of the most famous examples of scientists making a difference were from persons with long experience in providing expert advice. The JASON, a group of outside experts that provide advice to the government on a wide variety of national security problems, largely exists as a mechanism to introduce proven academic experts to the issues that matter in government, with the expectation that such experience will make them effective when an issue involving their primary expertise is raised. The impact of key advisers like Killian and Vannevar Bush over a long period of time and multiple administrations suggests that experience in advice makes a scientist more valuable to the government.

**Advisory Mechanism**. Probably the most common factors addressed in the science advice literature are the need for a proper mechanism for science advice. If the mechanism is the most important factor, it should be easy to improve science advice. But there are conflicting perspectives about the best mechanism to use, and it is unclear which of the proposed mechanisms have led to a better understanding by the President of scientific aspects of a decision.

Much of the literature argues that a single strong Presidential Science Adviser would make the most difference, by identifying issues that require scientific expertise and arbitrating debate within the government about such issues. Herken is a clear advocate for such a strong science adviser. He believes that a single arbiter is necessary, lest scientific expertise be lost in conflicting claims by the bureaucracy, and he questions whether the proliferation of science advice in departments and agencies represents a weakening of the impact of scientific expertise. Without such an arbiter role, it may still be important to have a single advocate for scientific expertise in the Executive Office of the President. When James Killian acted as the first Presidential Science Adviser, he felt that his greatest value was in the right to attend cabinet and NSC meetings as a backbencher, since his mere participation ensured that bad science would not become a basis for bad decisions.

The primary implication of the political science literature on expertise as a tool for policy change is that scientific expertise can make an impact when the scientists act as policy advocates. When a scientist takes the step away from presenting his analysis as an objective evaluator of other proposals, it is difficult to argue for the strong arbitration role Herken wants to establish. But Kingdon would argue that such an expert takes a major step forward in effectiveness. By showing the relationship between a public problem and a technical solution, the advocate fills a critical need in the policy process. Baumgartner and Jones believe that experts should bring forward the need for policy changes that will enable a technical opportunity or correct a problem that is most clear to the relevant expert. It is therefore interesting to see if cases where scientific expertise is most effective involve scientists acting as advocates versus acting as evaluators.

A third mechanism is the use of a special committee of experts to evaluate and present the scientific facts relevant to a policy decision, especially if the decision itself is controversial. Herken reflects a widespread scientific perspective that a President would be well served by creating a blue-ribbon committee of outside experts to address particular problems. Herken argues that such committees are the best mechanism to develop independent science advice, even though he believes that a strong science adviser should have the final word. Such committees might be useful whether or not there is a strong a Presidential adviser. A committee formed of the best scientific experts on a topic with relevance to current policy seems inherently appealing as a mechanism of science advice. Using such as special-purpose committee could be done whether or not the best experts are assigned or persons with experience in science advice were preferred, as discussed under type of expertise above.

In contrast, Jasanoff makes a case that standing committees or committees formed from standing advisory bodies are better choices for creating science-for-policy than identifying a new group of scientific experts for each decision. Only such standing bodies have the opportunity to develop recommendations in collaboration with government implementers, and are likely to have a long-term history on a problem that may extend beyond the knowledge of any of the decision-makers. The proliferation of scientific advisory bodies reflects a belief in this perspective. It will be valuable to see if the President finds the deliberations of such standing committees more useful than committees brought into being to answer a particular question.

An additional mechanism for science advice is written reports, prepared in expectation that some upcoming decision requires a strong scientific grounding. OTA reports represent an extreme example of this approach, since the reports were usually viewed as the definitive work on their subject. OTA analysts were often unwilling to provide personal summaries of the work, since the study represented careful balancing of expert opinion. President Lincoln, after all, established the National Academies primarily in order to have easy access to expertise in the natural sciences, medicine and engineering. The modern invention of think tanks almost ensures that almost any question requiring scientific expertise will have been explored before a decision reaches the President's desk. While such an approach to scientific expertise does not allow the President to interact easily with the report's authors, it is sometimes possible to form a more definitive picture of scientific knowledge on a subject with a detailed report developed over months.

Another recommendation in the science advice literature is that scientific expertise, however arrived at, should be given to the President directly, to avoid deliberate or accidental confusion of critical details about the scientific expertise. Scientific expertise communicated directly to the President can more easily include clear information about the uncertainties in the scientific conclusions and the potential risks on both sides of that uncertainty. One of the strengths of the President's Science Advisory Committee (PSAC) was that it involved regular meetings directly with the President. In such meetings, the President could be ask questions and develop an opinion about the credibility of the PSAC proposals.

Finally, it is possible that scientific expertise communicated without policy recommendations may be effective at clarifying the role of scientific expertise. C.P. Snow was a strong advocate that communication about scientific expertise, rather than advice, was the most effective way for scientists to participate in policy decisions. Shelia Jasanoff's work supports the concept of stepping away from pronouncements and towards a meaningful discussion about the results of science. OTA was the most extreme advocate of this approach, arguing that eschewing policy recommendations allowed the expert panels to do a much better job of highlighting those areas of relative certainty that could be taken as the facts of an issue.

It isn't clear that this list of potential variables is exhaustive. Future research into successful examples of scientific expertise having a significant effect on Presidential decisions may discover that only some of these potential variables are present, or none of them. But this taxonomy of potential variables provides a good summary of the research to date about the likely factors that make a President open to seeking and using scientific expertise.

**Confounding Factors**

In addition to the potential variables identified from the literature, there are several factors that make it more difficult to determine whether scientific expertise is an important factor in Presidential decisions. Such factors have the potential to provide alternate explanations for what appear to be cases where scientific expertise made a difference. Quantitative analysis would treat these factors as control variables. This research considered these factors through case selection and in the analysis of each case.

The confounding factors identified from the literature are:

1. macropolitical factors that encourage the same recommendation as scientists;
2. micropolitical factors that encourage the same recommendation as scientists;
3. a major bureaucratic stake in the same recommendation as scientists;
4. a Presidential decision making style that seeks systematic analysis and debate; and
5. a close personal relationship between the President and a major scientist involved in the decision.

The presence of any of these five factors does not exclude the potential for scientific expertise to be the most important input to a Presidential decision, but each of them introduces complications to isolating the role of scientific expertise.

The first three of these confounding factors reflect the concerns described in Chapter 1 as skepticism about quality decision-making as the driving factor in policymaking. The last two confounding factors are less open to the charge of scientific expertise being irrelevant, but reflect relatively idiosyncratic explanations that would be very hard to generalize. Those last two factors imply that the personal style and friendships of the President may be more critical than the type of decision, the type of expertise, or the advisory mechanism. The policy implication of such a conclusion is problematic; there is little that policy advisers can do to change the personality and friendships of a President.

Macropolitical factors include the President's stated positions and ideology, campaign promises, or the major explicit positions of the President's party. The Reagan Administration would naturally choose deregulation policies or propose a new weapon system, and scientific advice that coincides with such a decision might be only a supporting rationale rather than a critical input. Similarly, the Clinton Administration sought to demonstrate that an industrial policy could improve America's competitive position, and would be expected to embrace scientific results that showed a major impact from such directed investment. Otherwise good cases of the impact of scientific expertise will always be suspect when the decisions coincides with major initiatives of each Administration.

Micropolitical factors are the range of deals and compromises necessary to gain the support of members of Congress, key interest groups, and the departments and agencies that must implement a decision. If a decision looks as much like logrolling, or is influenced by an interest group that was a major campaign contributor, it will be harder to argue that scientific expertise played a major role in the decision. For example, it is hard to argue that the decision by the Nixon Administration to pursue the space shuttle was driven by scientific expertise. President Nixon was not a strong advocate of human space exploration (which would be a macropolitical explanation), but the decision was probably driven by political calculations related to President Nixon's re-election campaign. The President became convinced that the loss of jobs in California from the end of Project Apollo would work against him in his home state, and that the space shuttle project would most easily meet the needs of the California aerospace industry.

A major bureaucratic stake in the same recommendation made by scientific experts also makes it difficult to demonstrate the role of scientific expertise, especially if there is only a single department or agency that has a major stake in the decision. Organizational behavior explanations may provide sufficient explanation for many decisions, even if scientists feel that their inputs were critical to a Presidential decision. If there are competing bureaucratic equities, and scientific expertise is used for support by one or more sides in such a debate, this factor may be less confounding. But any analysis of decisions must consider the power of bureaucratic advocates as a potential driving factor in a decision that otherwise would be explained by the role of scientific expertise.

It is usually a good thing for the use of expertise when the President has a structured approach to decision-making, and bases his decisions on analysis. Alexander George encourages this approach to decision-making. Most policy analysts recommend it. Burke & Greenstein argue that this was the main difference between good decisions and bad ones on U.S. intervention in Vietnam. But the relative presence or absence of such a decision-making style does complicate the assessment of the role of scientific expertise. If a President seeks all information on every decision, is there really a need for external scientists to be sought out for a decision? In a strong example of such a decision-making system, the scientific facts are likely to be well-merged with the political, social an economic factors necessary for a decision, and the unique role of scientific expertise will be hard to discern.

Finally, the scientific advice literature epitomized by Herken suggests that whether a President uses scientific expertise is often determined by the President's relationship with a key scientist. This observation is often presented as a disappointment: if only Presidents were more open to the importance of scientific expertise, it would be less important that there be a strong personal relationship. That perspective is what makes the presence of such a strong personal relationship, even if it applies only to a single decision, a confounding factor. If the trust of a President for a single adviser is the most critical factor, the explanation for the President's decision seems to fit into Allison and Zelikow's governmental politics paradigm. The preferences and interests of key players may be a sufficient explanation for such Presidential decisions, rather than assigning any explanatory power to the arguments from scientific expertise.

The next chapter will address how case studies were identified and used in this study to explore the possibility that the potential variables explain the role of scientific expertise in Presidential decisions, and provide some guidance on which potential variables are most likely to repay future research.

## Chapter 3. Methodology

### Introduction

This chapter describes the methodology used to address the research questions identified in Section 1. The methodology consists of three parts, which were conducted in order:

- *Case Identification:* a systematic approach to defining cases where scientific expertise made an impact on Presidential decision-making;
- *Case Selection* in which specific cases were chosen for further work; and
- *Case Analysis*, including the detailed review of selected cases for the presence of factors identified as potentially important for the success in science advice.

Case identification is important to this research because of the opinion expressed in some of the literature that scientific expertise never makes a real difference to Presidential decisions. The primary purpose of the case identification is to provide a basis for identifying good cases where scientific expertise made a difference, and to create a list of such cases from the more recent Presidential Administrations. Case identification is described first.

Another purpose for case identification was to provide a set of cases from which a selection of three cases can be made to explore the impact of the potential variables identified from the literature in Chapter 2. Case selection is described in the second section of this chapter.

Once the three cases were selected, the case analysis part of the research provided a structured approach to establishing the presence and impact of the factors identified in the literature review, which will be treated as variables for case analysis. The methodology used for case analysis is described in the final section of the chapter. The case analysis methodology provides an operational definition for each of the 16 variables and also defines some tools that were used to analyze the structure of each Presidential decision.

**Research Approach**

The objective of this research is to determine the conditions under which scientific expertise is significant to Presidential decisions. The research question, and two important subsidiary questions are:

- **Under what circumstances does science expertise have a significant impact on Presidential decisions?**
- **What are good examples where scientific expertise had such an impact?**
- **Are the factors discussed in the literature important to the impact of scientific expertise?**

This research project is intended to contribute to theory building about the role of expertise, particularly scientific expertise, in policymaking. This is an early step in research about the role of scientific expertise in policymaking, reflecting the largely anecdotal nature of much previous writing on the role of scientific expertise. Although the work addressed the factors suggested in the science advice literature, the understanding of the role of expertise is far too primitive make a comprehensive test of the importance of those factors. It is hoped that future work can use this research as a foundation for an increasingly empirical study of the role of expertise.

This research was pursued through exploration of selected cases where scientific expertise had a significant effect on a Presidential decision, analysis of the factors that led to that effect in each case, and comparison of common factors among different cases. The case study is the appropriate methodology for pursuing these research questions. Robert Yin argues that case studies are the best methodology for studying questions that are primarily about how and why a phenomenon occurs (Yin, 2003, p. 5-7). Such how and why questions are the heart of this research. The conditions and circumstances under which scientific expertise is actually used by a President will be determined by determining which of the variables actually occur in important cases. Yin says to "use the case study method because you deliberately wanted to cover contextual conditions – believing that they might be highly pertinent to your phenomenon of study." (Yin, 2003, p. 13) These research questions are best explored with in-depth case study research, since the exploration of alternative explanations require a review of the rich context of actual cases. The importance of expertise can only be determined in exploring alternative explanations for Presidential decisions in the full context of the events of the time.

In contrast, the state of theory and data about the role of scientific expertise in policymaking does not yet allow formal model-building or statistical analyses. By conducting a study using case studies to establish how and why expertise can contribute to a Presidential decision, this study hopes to lay the groundwork for future studies that might use those methodologies.

<u>*Unit of Analysis and Other Research Constraints*</u>**.** The unit of analysis for this research is the Presidential decision. If a President has to make several decisions about a

particular policy issue each decision is a potential case for research. A presidential decision, for the purposes of this research, is defined as a single moment in time when a President provides direction about an issue to the primary actors under his control. It should be identified with a specific date, after which the executive branch participants will change the actions and issues in response to the decision.

A single case, therefore, is a single Presidential decision and the information and events that contributed to that decision from the point the President became involved in the decision. Yin points out that a danger of using a decision as a unit of analysis is the potential fuzziness of the timeframe of interest, since in theory years of history might influence the decision. For this research, each case was clearly defined as having a specific beginning, either the time the President first became aware of the issue or a previous Presidential decision that set the context for the decision of interest in the case.

A case should be a single Presidential decision in which scientific expertise made a significant impact. Case identification, discussed below, provides a structured approach to identifying cases that turn on scientific expertise.

The Presidential Administrations considered for cases were restricted to the five Presidents from Gerald Ford to William Clinton. In theory, the research could be directed to the decision of any President since Abraham Lincoln established the National Academy of Science to advise the executive branch on scientific matters. But there are three reasons to limit this research to those five administrations: (1) to analyze cases relevant to the current environment in which science advice interacts with policy-making today, (2) to address a more modern set of cases than the 1940-1968 period often considered a golden age of science advice to the President, and (2) to deliberately leave for later research the Administration of George W. Bush.

The organization and role of science advice to the President changed so dramatically during the Nixon administration that it represents a turning point in the role of scientific expertise. From the Eisenhower Administration through 1973, formal Presidential decisions had usually involved participation by a strong Presidential Science Advisor, backed up by a formal President's Science Advisory Committee with direct access to the President. President Nixon became convinced that this system represented inviting proven enemies of his policies to sit on his counsels, and he abolished the science advice structure. Although every President since Nixon has appointed a Science Adviser, the current system has never restored the strong role and regular access that scientist had in the Eisenhower, Kennedy, Johnson and early Nixon Administrations. The factors affecting the use of scientific expertise may be different in a world without such mechanisms. Research which improves the understanding of the role and mechanisms of scientific expertise in a post-Nixon environment is much more relevant to current policymaking problems.

No decisions during the Administration of George W. Bush were addressed, since it would be almost impossible to get detailed information on the decision-making process of such a recent President, especially since the role of scientific expertise in that Administration became an issue of controversy. I hope that the systematic approach to studying the impact of scientific expertise on modern Presidential administrations may provide some guidance to future research on whether the presidency of George W. Bush was in fact different in its treatment of science than other modern administrations.

**Case Identification**

The cases analyzed in this project should be good examples of science having an impact on Presidential decisions, and should not be selected because they illustrate the factors identified from previous research. Previous writing about the role of scientific expertise, in some cases, seems to select example cases primarily as tools to demonstrate the importance of some particular factor, such as the need for a strong Presidential Science Advisor. Three approaches were used to identify cases, and the identification methodology was intended to provide some protection against such a bias.

Identifying Presidential decisions where scientific expertise had a critical influence is not an easy task. The moment of decision is hard to pin down, since issues evolve for some time before and after a President is engaged. As the policy literature makes clear, most decisions turn on a variety of inputs, not just, or even mainly, questions that can be resolved by expertise.

Identifying decisions where scientific expertise played a critical role therefore requires research. The research has been conducted in three ways: canvassing the opinion of scientific experts who have been involved in policy advice, a review of memoirs from the five administrations, and an assessment of cases mentioned in the science advice literature.

Living former Presidential Science Advisers, and some science advisers to other senior government officials, were invited to suggest such cases. They were asked to identify examples of Presidential decisions, occurring after the Nixon administration but before the administration of George W. Bush, where they believe scientific expertise had a significant impact on the Presidential decision. An example letter to these experts in given in Appendix 1. While all of the respondents emphasized the difficulty of separating the role of science from other factors, a few of them were willing to suggest examples.

The process of reviewing memoirs began with identification of the major events and issues for each administration from a chronology developed by each Presidential Library. This list was screened for issues where science might have mattered. Then the memoirs of the Presidents, their national security advisers, and their science advisers were reviewed for assessment of these issues. The memoirs were reviewed to determine when the President was actually asked to make a decision and what factors were remembered as being important to that decision. The focus of the memoir review was assessing the impact of scientific and technical arguments on the decision that the President made for each of these issues. If one of these three participants considered scientific expertise critical to an identifiable Presidential decision, it was added to the list. While this technique undoubtedly misses many issues on which a President was influenced by scientific expertise, the approach was considered likely to discover examples where the scientific factors remain important in the memory of participants.

Some elements of the second approach were begun before the response of science advisers was available, and limited results from that work is discussed under case evaluation. While the response of science advisers was used as the case identification mechanism in this study, the second approach seems likely to provide a richer set of cases, albeit one that involves more subjectivity by the researcher in their selection as good cases.

The list created by these techniques is still vulnerable to challenges by skeptics that scientific expertise may not be critical, and that the experts canvassed, participants studied, and previous research reviewed miss alternative explanations. None-the-less, this list was used as the initial identification of cases for the relevant administration. The process of case selection then clarified the relative strength of the claim that these cases are best explained as Presidential decisions where science advice made a difference.

**Case Selection**

For this research, case selection consisted of a review of the cases identified in the first phase, and the selection of three cases for detailed analysis. Case selection is potentially the most important step in the case study process, since the goal of this research study was to begin the process of tentatively identifying and excluding some of the variables derived from the literature.

There was only one criterion for case selection: confidence that a case represents a clear example where scientific expertise was critical to a President's decision. In order to address cases where the impact of scientific expertise is least ambiguous, the case selection approach was intended to reduce the concern for the confounding factors identified in the literature. Priority was given to selecting cases where confounding factors are much less probable explanations for the President's decision.

The list of Presidential decisions developed in the first phase of research was reviewed to prioritize cases where it is most clear that scientific expertise was critical to the President's decision. In some cases, the suggested Presidential issue in which Science played a key part was broken into multiple decisions, since the unit of analysis is the Presidential decision (not the total range of actions a President may take on an issue).

The cases considered were assessed for the ease of excluding the most challenging of the confounding factors discussed in the policy literature. In particular, the goal was to select cases with the least suspicion that the President would have made the same decision even if no scientific expertise had been brought to bear on the problem. If scientific expertise does indeed have a major impact on Presidential decisions, there should be at least three good examples of Presidential decisions where it is relatively clear that technical evidence trumped decision-making based on organizational behavior, governmental politics, interest groups and other explanations that fall outside of what George called "the search for quality decisions."

For this study, cases were selected where the Presidential decision seems at variance to the ideological preferences of the President. Analyzing such a case provides a good example of how scientific expertise can have a major impact. In contrast, analyzing the science advice supporting the Reagan decision to deploy a new ICBM (the MX debate over the missile that would eventually be called "Peacekeeper") would be less revealing about the role of scientific expertise. Deployment of a new ICBM was a Reagan campaign promise, was consistent with the Administration push for technical improvements in weapons systems across-the-board, and was supported by his Congressional allies and the interest groups that supported him.

It would be desirable to minimize all the confounding factors identified in the literature. Cases should provide counter-examples to the argument that the need to reach accommodation with Congress, implementing organizations, or outside interest groups was the primary basis for a Presidential decision that is viewed as an example for the impact of scientific expertise. The literature review identified two confounding factors:

- micropolitical factors that encourage the same recommendation as scientists; and
- a major bureaucratic stake in the same recommendation as scientists.

Both of these factors undoubtedly influence many decisions. In the most extreme skepticism about quality decision-making as the driving factor in policymaking, such explanations are considered sufficient and leave little room for scientific expertise to play a major role.

It would be impossible to find examples where these factors can be completely excluded. In important decisions, there are always advocates for at least two contrasting positions. Therefore use of this selection criterion was focused on analyzing the role of scientific expertise in leading the President to support one position over the other one. Since the cases selected were already Presidential decisions where the President is choosing something different than his expressed ideological position, the task is to consider whether the President is primarily driven by a belief that the scientific evidence is determinant, versus his concern to strike a deal with a key interest group. Such a judgment during case selection was later put to the test during case analysis.

When this research began, it seemed desirable to explore little-studied cases where information can be gleaned only from interviews and archives, rather than from the secondary literature. Such cases would contribute to the literature by bringing important cases to wider attention. Some lesser-known Presidential decisions might provide clearer evidence of the way Presidents weigh and use scientific expertise than large policy decisions that are influenced by many confounding variables and conflicting goals. But it was equally important to consider the availability of data. This research is an early step in research on the role of scientific expertise, and the cases selected are hopefully only the first to be studied in this way. If this research suggests variables that might lead to generalizable theory about the use of scientific expertise, there will be opportunities to explore cases that are more difficult to study. Therefore, the study focused on well-known cases where Presidential decisions were influenced by scientific expertise, but looked at them in the context of what factors led to the President's use of such expertise.

**Case Analysis**

The primary goal of this research was to determine if some of the factors suggested by the science advice literature – the variables identified in Table 3-1 – are critical to a President accepting and using scientific expertise[1] in making decisions. Archival research and interviews were used to understand the details of the selected cases. Many perspectives on Presidential decisions are captured in memoirs, concurrent journalism, and in the minds of participants who can be interviewed.

Once the cases were selected, the next step for each case was a review of primary and secondary sources about the decision, in order to create a strong understanding of the case. Review of documentation was intended to clarify the timing of the Presidential decision, the supporting issues he considered critical, the questions that the President asked, the experts on which he relied, and the role played by these experts.

When research was complete on each case study, a narrative discussion of the case was provided as background, and critical factors were identified using structured timelines, a decomposition of the questions important to the President, and two tables of key advisers for the decision. These three tools (timelines, decomposition and adviser tables) represent an abstraction of the evidence in each case to capture the information needed to determine to the relative importance of each of the variables on the President's decision.

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[1] This research limits the use of the term "scientific expertise" to expertise in the physical and life sciences, engineering, and medicine. Persons with degrees, extensive practice, and the respect of their peers in these disciplines will be called scientific experts and are assumed to have scientific expertise.

- Advisory Mechanism

  A1. Single Strong Adviser
  A2. Policy Advocate
  A3. Committee Created for this Decision
  A4. Committee of Standing Advisory Body
  A5. Reports on Issue Prepared in Advance of Decision
  A6. Direct Report to President
  A7. Communication (without a policy recommendation)

- Role of Scientists in the Decision (R1)

- Type of Expertise

  E1. Experts from Outside Government
  E2. Experts Other than the Advocates
  E3. Best Expertise on the Issue
  E4. Experience with Science Advice

- Type of Decision

  D1. High Scientificity (scientific questions are the issue)
  D2. National Security Issues
  D3. Based on Wide Scientific Consensus
  D4. Led by an Agency with Scientific Culture

**Table 3- 1 Variables Assessed for Each Case Study**

With those tools in-hand, an assessment was made of the relevance of each the potential variables for each case. For this latter analysis, the factors identified from previous research were treated as variables, despite the preliminary nature of this research. The criteria for assessment for each variable are presented later in this chapter. The operationalization of the potential variables is critical to using case studies such as these to draw causal inferences (Yin, 2002, p. 30), and this chapter provides explicit criteria for judging the presence or strength of each variable.

It is unlikely that this research project can provide confidence that one of these sixteen factors alone is critical to the effective use of scientific expertise in Presidential decisions. But it is reasonable to argue that the absence of a factor excludes the possibility that the factor is *required* in order for scientific expertise to be used. If one concedes first that the cases studied are good examples of the use of scientific expertise in Presidential decision-making, the absence of factors from a case will be a very interesting result. The analysis of each case focuses on looking for such conditions whenever possible.

The remainder of this chapter consists of a discussion of the key diagrams and tables that were drawn for each case, and the operationalization of each of the potential variables in Table 3-1. The intent of this section is to provide sufficient detail on how each potential variable was assessed, and thereby to ensure that researchers have transparency into how the assessments were conducted for each variable. There will always be some subjectivity in the evaluation of variables in such a preliminary study, and the explicit operationalization is intended to give other researchers the opportunity to critique the choices made in this study based on a common understanding of the criteria used. On the other hand, if the methodological choices prove valuable in the cases studied, the operationalization should allow other researchers to use this approach in other case studies of the use of expertise.

In order to make the discussion concrete, the descriptions below use an example. The example will be President Roosevelt's decision to "expedite to the fullest extent" the research on the potential for a uranium bomb that could be used in the expected war with the Nazis. This is not a case studied in detail for this research project, and does not fit the selection criteria described above. But is makes a good illustrative example. The decisions made by Roosevelt about the atomic bomb are widely cited as examples of Presidential decisions where scientific expertise made a difference (Herken, 2000, p. 3-94). The story of Roosevelt's decisions about the atomic bomb project is sufficiently well known to be used as an illustration without a lot of narrative description. But the example also clarifies the complexity of the interaction of scientific expertise with Presidential decisions, and illustrates how this research approach consciously chooses elements of the complex story that are most relevant to the research questions. In fact, the example should make clear that the popular image of Roosevelt and the atomic bomb project – that Albert Einstein wrote a letter telling President Roosevelt that he needed to start an atomic bomb project, the President relied on that advice to order the Manhattan Project into existence, and the project then moved forward as a technically-driven effort without further political decisions – is itself a myth about the role of scientific advice. However, this paper makes no attempt to break new ground about President Roosevelt's decision. In fact, the material presented here relies heavily on the official history of the

Manhattan Project (Hewlett and Anderson, 1962). The example is used for illustrative purposes only.

**Presidential Decision Timelines.** A key tool for abstracting each case is a set of simplified timelines showing the dates when a President was personally involved in the decisions, and the relationship of those dates to other information that is relevant to the analysis of the variables. The timelines identify a few key events that frame the entire issue, and address the information relevant to the variables under study. Identifying these key events was a tool for focusing attention on what the President knew and asked at key points. This approach to abstracting the case was developed as a tool in this study. Although most case studies use a timeline, the new approach used here was to use when the President was involved, and what data was relevant to the variables evaluations, to structure the timeline, ensure that the focus of analysis was on the 16 variables, and that the timeframe for evaluating the variables was made very explicit.

There are three timelines presented for each case: a "Presidential Context Timeline" and two "Decision Analysis Timelines" (one for the President and one from the perspective of the scientific experts).

***Presidential Context Timeline***. The first of these tools is a single timeline showing the initial and final events that define the overall issue at hand, and identifying the Presidential decisions that occur between those events. The purpose of the Presidential Context Timeline is to make clear what time period will be studied within as the case of interest, and to provide a context for that time period within the broader policy issue.

For any policy issue that rises to the Presidential level, it is likely that a President will make multiple decisions spread over time. The Presidential Context Timeline shows all of those decisions, and marks graphically the time period that will be studied for the chosen case. This tool is designed to provide the explicit clarity on the time boundaries for the case selected, a necessity if the research is to use the decision as the unit of analysis (Yin, 2002, p. 26). The Presidential Context Timeline bounds the scope of the detailed research and case analysis. The Presidential Context Timeline makes clear that each Presidential decision would be a separate case, and establishes the boundary between the case under study and the temporal context.

Key elements of the graphic are illustrated in Figure 3-1 using the example of the atomic bomb decisions of President Roosevelt. The timeline is defined itself by two events (not Presidential decisions) at the start and end of the graphic. The timeline shows every Presidential decision during the time period between those two events. A dashed box on the timeline then identifies the exact period that will be studied in the case, which will always be the period between two Presidential decisions. This approach is used to make very clear the timeframe of the decision analysis. While work before that period will be part of the context, this research assumes that the variables should be analyzed for how they occur during the period leading up to a Presidential decision.

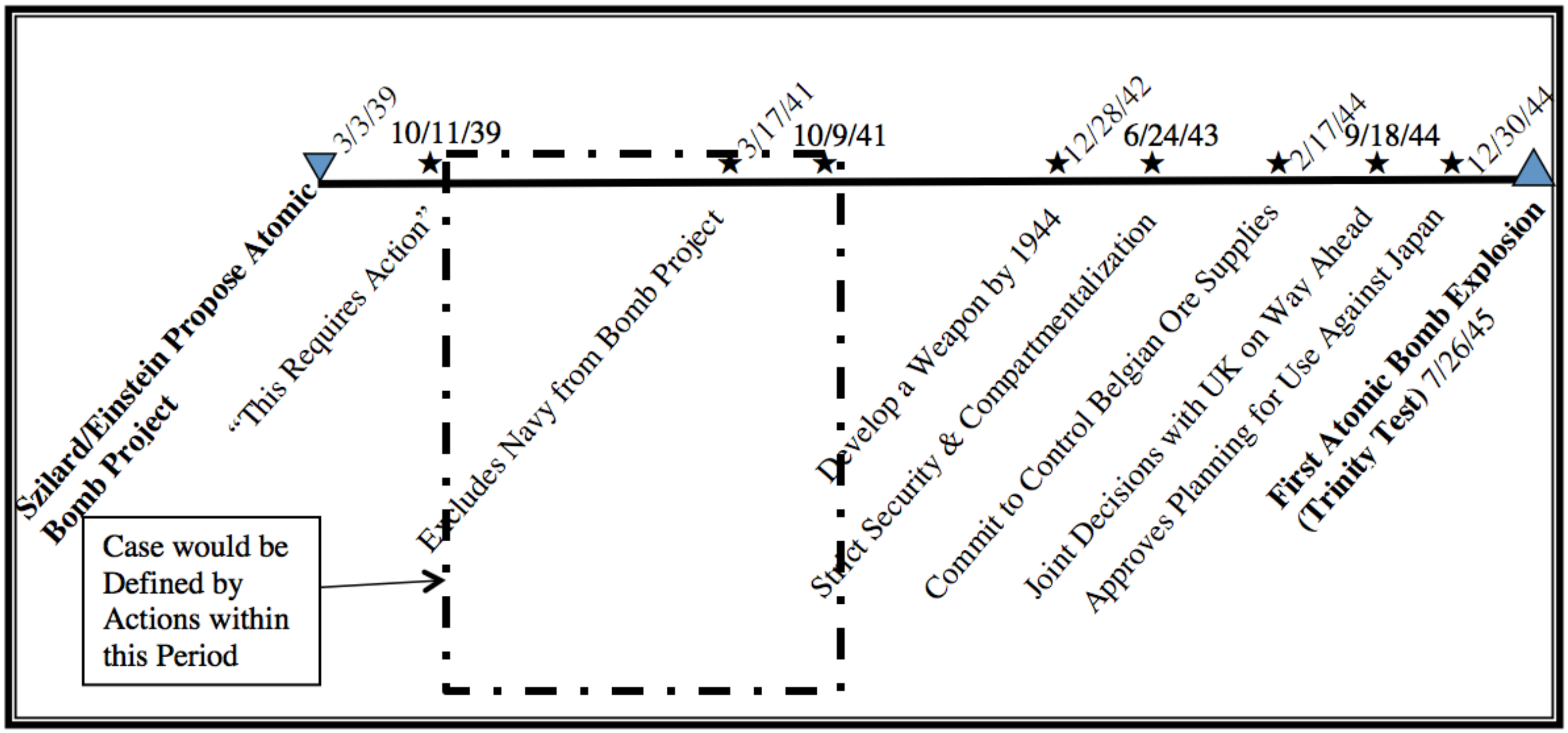


**Figure 3- 1 Example Presidential Context Timeline (Roosevelt Decision)**
**(★denotes Presidential Decision)**

In this example, the defining events begin with Leo Szilard's efforts beginning in 1939 to create government interest in an atomic bomb project, and end with the first successful detonation of an atomic bomb in July 1945. The remainder of the events shown on graphic is the complete set of Presidential decisions on this issue. In this case, there were eight times when President Roosevelt gave personal direction to the projects underway. These eight Presidential decisions are placed along the arrow of time that runs from the top to the bottom of the graphic, and are space proportional to the time that passes between them. Note that, in contrast to the myth that President Roosevelt approved this project and then let it run, he created several milestones about whether the project should continue and at what scale.

As shown in Chapter 4, some of the cases selected for this research also have this feature of multiple Presidential decisions about an issue.

The other important element of the Presidential Context Timeline is the dashed box that defines the timeframe of the case of interest, and ties it to a single Presidential decision at the bottom of that box. As I use this illustrative example throughout the rest of Chapter 3, discussion will focus on Roosevelt's decision in October 1941 to expedite research and development on what it would take to build an atomic bomb. Figure 3-1 also makes clear that case analysis would be focused on the two years between Roosevelt's decision in October 1939 to ask that action be taken on exploring the potential for an atomic bomb – in response to Einstein's letter and other entreaties -- and his decision on October 9, 1941, to move forward on every aspect of R&D as fast as possible and with as much funding as was needed short of full-scale construction projects. In truth, this is a very interesting decision, because this decision was the turning point towards a large uranium bomb project with the full backing of the President. In making this decision, the President had to come to grips with several challenging questions about what it would take to create an atomic bomb and whether it would matter if he did or did not pursue it.

***Decision Analysis Timeline***. The second timeline, the Decision Analysis Timeline (DAT), is a primary product of research into the case. This timeline is limited to the date boundaries delineated by the Presidential Context Timeline. It displays all the known Presidential interactions relevant to the decision, and other areas key to the exploration of the potential variables. In particular, it displays the elements of the Presidential decision that will are required for the analysis of the variables:

- Meetings in which the President was involved
- Reports seen by the President, and
- Organizations and Committees that work on the issue.

To enhance readability, I will present the DAT for each case as two graphics, one that identifies events and reports from the President's perspective (DAT-P) and one from the perspective of the scientific advisers (DAT-S). Figures 3-2 and 3-3 show these two graphics for the illustrative example of President Roosevelt's decision to commit to a full-scale R&D effort on the atomic bomb project.

The Decision Analysis Timeline begins and ends with the two Presidential decisions that define the case of interest, as reflected in the two large milestone triangles on the top timeline. In general, the start of the timeline could be an event, but the end will always be a Presidential Decision. The top bar also shows time markers for the DAT, in this case the years 1939, 1940 and 1941. The vertical dashed lines starting at that top timeline and crossing the figure allow scaling of the timeline for comparing when events occurred.

The second bar of events on the DAT-P that are major meetings that the President was involved in on the atomic bomb project – in this case three meetings over two years. At the bottom of the timeline are shown six reports that were sent to the President about this issue. In between these two boxes of information this DAT-P shows two personal advocacy efforts that were not part of the formal advice process. In early 1940, Alexander Sachs, the Lehman Corporation economist who had actually delivered the Einstein letter to Roosevelt, spent time arguing to many government officials that insufficient urgency was being devoted to the uranium question, and wrote a letter on the subject that included a Presidential meeting on April 5, 1940. A second period in 1941 shows the effort by California physicists E.O. Lawrence and Karl Compton to instill urgency and to challenge the technical and managerial approach of the committees charged with developing a recommendation for the President. Vannevar Bush viewed this second effort as irritating pressure tactics. For each case, there are some important issues such as these that deserve attention, but do not represent a general category like meetings and reports. Such elements, if they reached the President, will be shown like the DAT-P illustrated here.

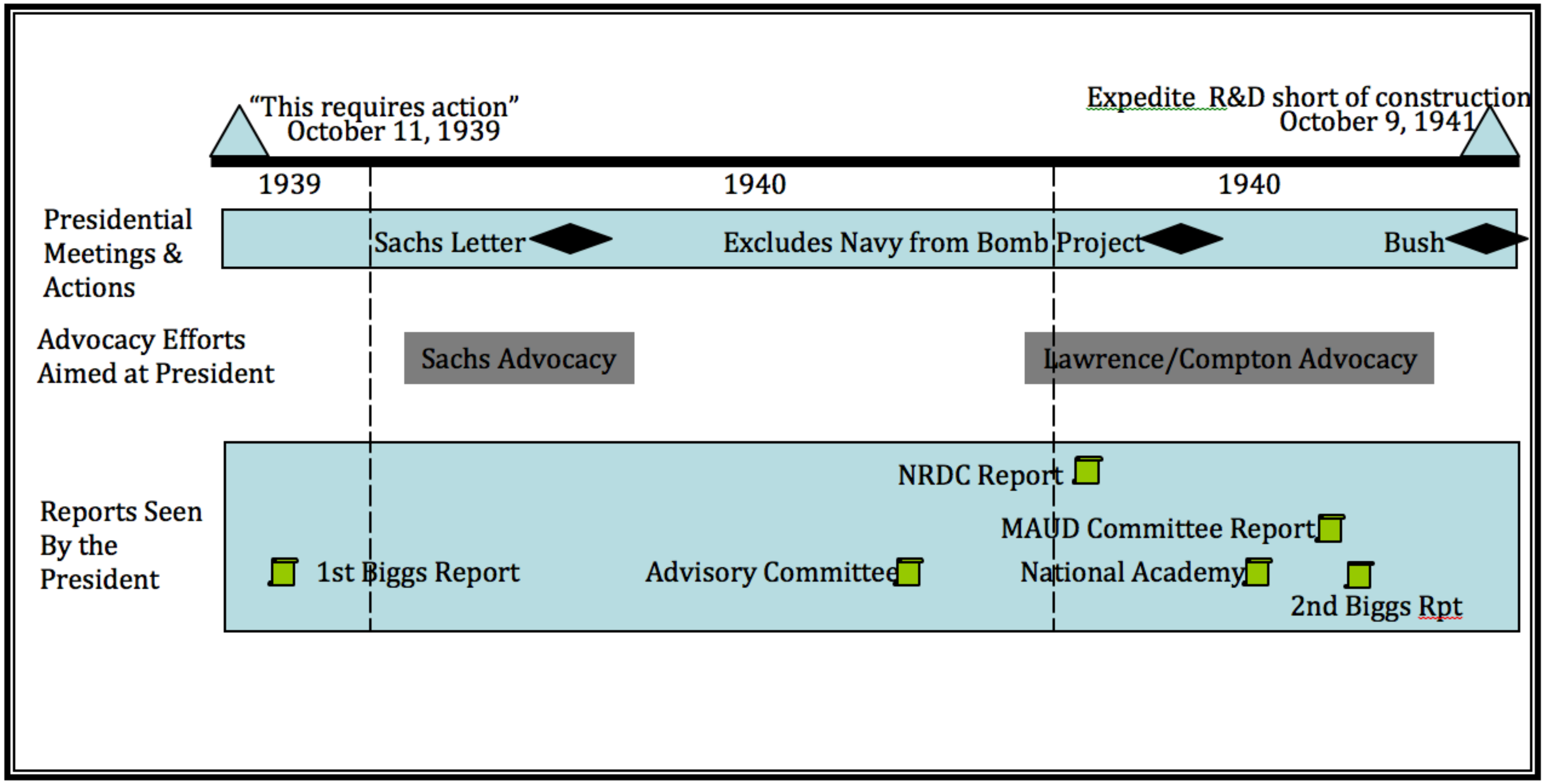


**Figure 3- 2 Example Decision Analysis Timeline for the President (DAT-P)**

The second graphic that makes up the Decision Analysis Timeline shows the key events from the perspective of the scientific advisers relied on by the President. I call this graphic the Decision Analysis Timeline – Scientists (DAT-S). The DAT-S has the same top timeline as the DAT-P, and is marked to the same timescale (in the example case 1939-1941). The most important elements of the DAT-S show:

- Reports prepared by science advisers for senior policymakers
- Meetings between science advisers and policymakers, and
- Timeframes for organizations and committees working on the issue.

In the example shown in Figure 3-3, there are only 5 reports, because one of the 6 reports used by the President came from a British advisory group, not from his own team. The DAT-S could also include important reports that never made it to the President. The DAT-S will also show, in the second line, major meetings between science advisers and policymakers. In this example, the most important such meeting was the presentation that Vannevar Bush made to Vice President Henry Wallace. Bush used this meeting to develop Wallace as an ally in arguing that it was time to invest major resources in the bomb program.

The third line of the DAT-S shows organizations and committees that work on the issue to develop recommendations for policymakers, including the President. In this example, the decisions on the atomic bomb project overlap with the creation of a number of new committees specifically for atomic fission issues (the Briggs Committee) or of new structures to coordinate defense-related R&D including, but not limited to, fission (the National Defense Research Committee and the Office of Scientific Research and Development). In contrast to the mythic version of the atomic bomb program, in which

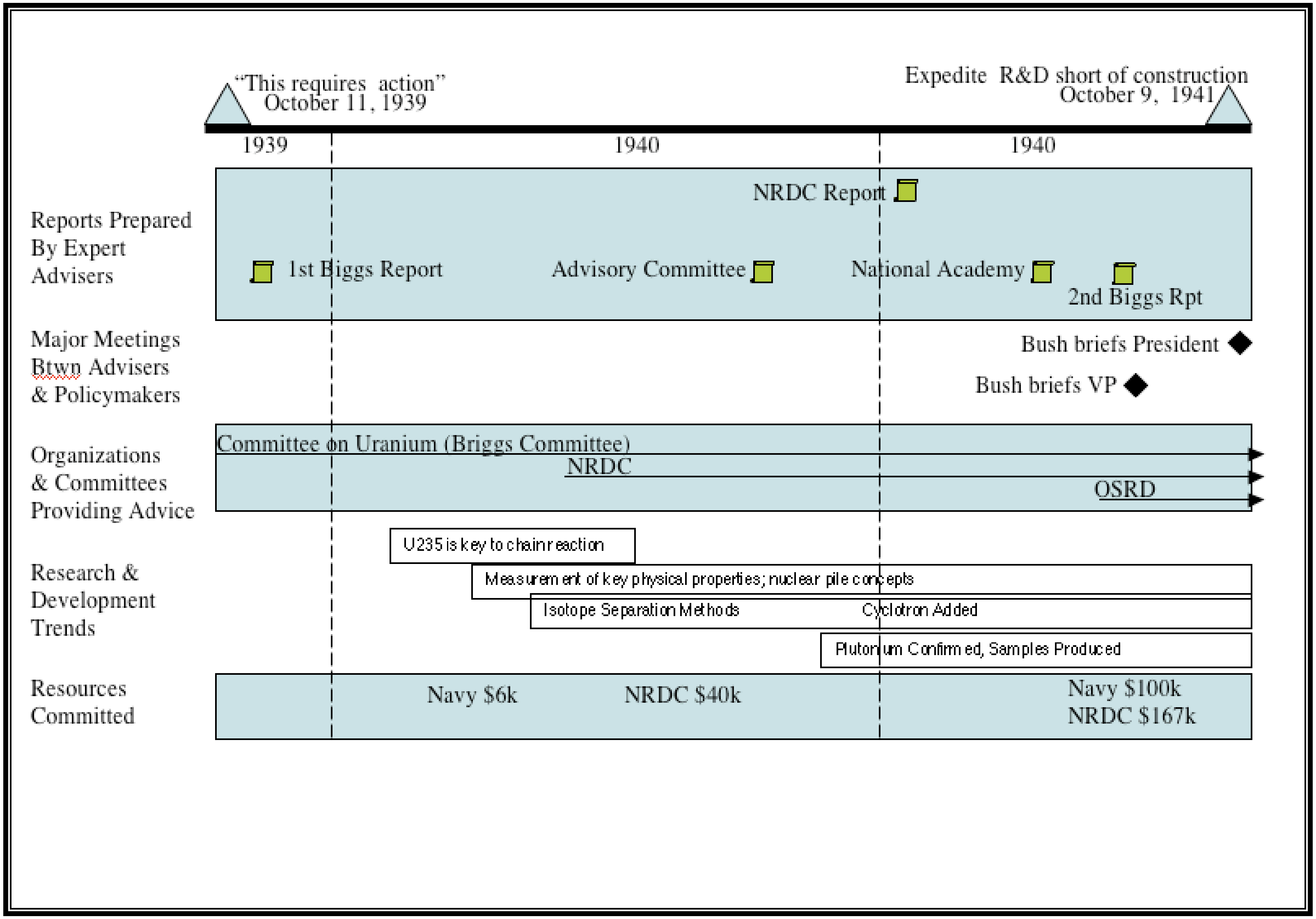


**Figure 3-3. Example Decision Analysis Timeline for Scientists (DAT-S)**

the President gave unqualified commitment to a program based on the advice of a few knowledgeable scientists, the potential for an atomic bomb was thoroughly assessed by committees of scientists in both *ad hoc* groupings and formal organizations. When considering the variables for this illustrative case, the role of these new organizations will be relevant to some of the proposed mechanisms for providing expert advice. For other cases, key meetings of the committees will be the most relevant factor to display on the DAT-S.

In addition to the factors required to assess the variables of interest, the DAT-S includes two additional lines of evidence that is relevant to understanding the issue from the perspective of the science advisers:

- Research activities and results during that time period, and
- Resources committed to the activity

For the illustrative case, the developing research on fission was key to understanding the feasibility of a bomb project, and was, in this time period, full of uncertainty. Research continued throughout this period, but had not come to many hard conclusions by the time of the Presidential decision in 1941. One major exception was the understanding that a chain reaction in uranium would require concentration of the rare isotope U-235, which became certain by August of 1940. That result was the basis for a much better understanding of what would be needed if a weapon were to be built, is one of the most important items in leading to the President's decision. When Roosevelt directed that the government should explore the potential for a bomb, the need for isotope separation was not known. Afterwards, the practicality of isotope separation techniques would be equally as important as the critical mass for the bomb.

The bottom section on the DAT-S, describing key resource commitments, shows the relatively little amount of government funding that was devoted to fission issues throughout this period. While the funding was increasing, there was certainly no crash program to build a bomb throughout this first two years after the President received the Einstein letter. The entire period of the Decision Analysis Timeline occurs before the U.S. entered World War II, and spending for military projects was not yet in strong favor with Congress. Even the key decision to commit whatever was required "short of major construction" was made before the U.S. is brought into World War II by the events of December 7, 1941. Comparing these resources committed to radar research and development, the uranium bomb project was not a priority effort until the President's October 1941 decision.

The Decision Analysis Timeline is a product of case research, not an input, and represents conclusions about the information relevant to the potential variables. It represents an explicit characterization of the events, organizations, and reports that were intended to influence the President on the issue at hand. As such, it provides a guide to the evidence that will be used in evaluation each variable, as discussed later in this chapter. If discussing the DAT after a narrative section on President Roosevelt's October 1941 decision, all the events called out, and their relevance, would be explained in the context of that narrative. Key events, other than the meeting that Vannevar Bush held with the President and Vice President on October 9, which laid out the current state of affairs and the argument for committing more resources to this work were the formation of the Office of Scientific Research and Development (OSRD), which gave the ability to implement R&D without competition from the military services operational requirements and the July 1941 report of the British committee on the Military Applications of Uranium Devices (MAUD) , which provided a strong endorsement of the idea that an atomic bomb could be built in the current war.

**Presidential Decision Decomposition.** For expertise to have an impact, there must be a set of key questions that the President or his advisors ask. The need for expertise is usually explained in terms of answering questions for which the policymaker won't know the answers. Understanding that set of questions is key to explaining the role of expertise, since the need for expertise is usually defined in terms of answering such questions.

For each case studied, a decomposition of the President's question is developed based on the evidence of what the President asked about in the course of developing the decision. As discussed in Chapter 2, any Presidential decision is likely framed by a set of issues such as the acceptability of the decision to Congress and other key players, the time available to reach a decision, and the current understanding of the problem and any solutions (George, 1980, p. 2). The focus of the decomposition is on what Alexander George called the "search for a quality decision", the rational choice part of the President's considerations. Scientific expertise is more likely to be accepted and used in this portion of the decision-making. In contrast President and other advisers likely consider themselves knowledgeable on the political and timeliness aspects of the decision.

Like the Presidential Decision Timelines, the Presidential Decision Decomposition is a product of case analysis. It reflects a review of what the President is known to have discussed and considered in the period leading up to the decision. The decomposition is used in addressing the variables on the type of decision, particularly the degree to which scientific questions play in the decision.

Figure 3-4 below provides for President Roosevelt's decision to commit major resources to the uranium bomb project in 1941. It is based on the list of topics that Roosevelt discussed in the key decision meeting on October 9, 1941. These four topics, and the subtopics, were the topics of that discussion. Vannevar Bush raised the first two, but the President was very engaged in asking about them. The President raised the last two topics of discussion, and they seem to have taken about equal time to the others. Some of the topics overlap each other. For example, the likelihood that the bomb project could succeed is a factor in whether the U.S. should proceed, but also influences how likely it is that there would be a Nazi program that might threaten the U.S. during the war.[2] Such interactions are common, but will not be included in the decomposition unless the President makes the connection himself. Roosevelt was trying to understand the likelihood of results on which he was aware that he could not judge for himself, and counted on Vannevar Bush to provide him a fair perspective. Those items, at least, are examples of issues where scientific expertise is sought.

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[2] This logical connection seems to have been very important in the German decisions about the importance of an atomic bomb project. An error in their technical calculations about the critical mass required for a bomb made them doubt that a bomb could be built within the time frame of the current war. This led them to minimize priority on the work themselves, and also to reduce their concern about the Allies efforts to build one.

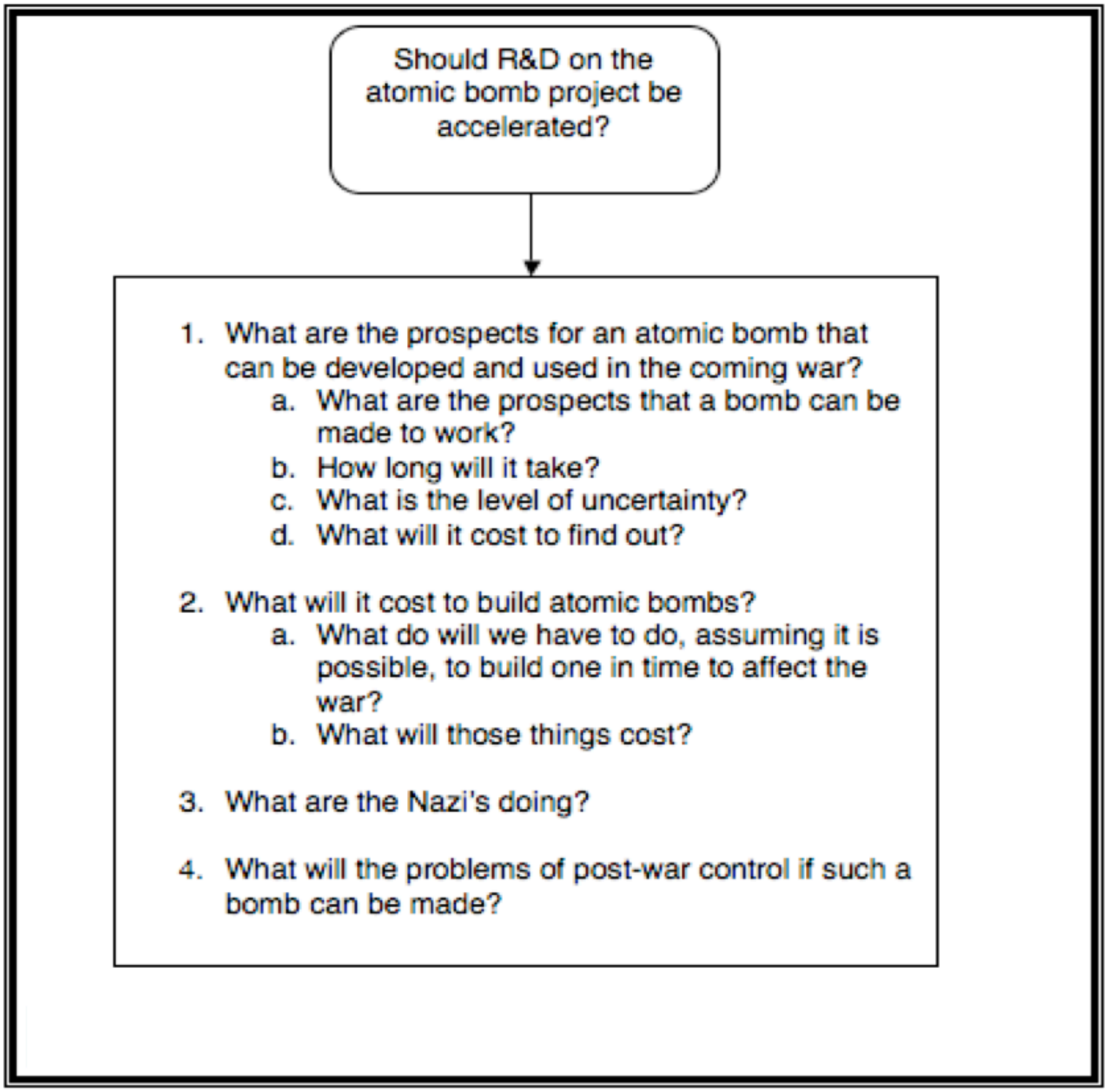


**Figure 3- 3 Example of a Presidential Decision Decomposition**

**Tables of Key Advisers and Scientific Experts.** For many of the potential variables, it is important to clarify the exact individuals who played a key role in the Presidential decision, since a decision about how the President used expertise will often turn on who were the experts.  Therefore, a key result of the case review, and a key tool for evaluating the potential variables is a clear identification of the experts and advisers who influenced the Presidential decision. For each case two simple tables were created to identify the key individuals.

First, a table was constructed to identify the three persons judged to have the most impact on the President's decision. A table of the Most Important Advisers for the Roosevelt October 1941 decision on the uranium bomb program is given in Table 3-2. For each of these persons, the Most Important Advisers Table will also show how these individuals had an impact on the decision, and address their scientific expertise. Three is a somewhat arbitrary number, but it is important to constrain such a list, since otherwise anyone participating in all the activities on the Decision Analysis Timeline might be considered as potential advisers. Individual cases where three seems excessively constrictive could be treated as exceptions. The table is intended to provide clarity about

| Adviser | Impact on Decision | Scientific Expertise |
|---|---|---|
| **Vannevar Bush,** Director of the Office of Scientific Research and Development | Summarized current understanding to the President, defined issues and options | PhD in Electrical Engineering; V.P. of MIT; inventor; original contributions to math and engineering |
| **Henry A. Wallace**, Vice President of the U.S. | Part of decision meeting, and was already prepared to support moving forward before meeting began | Undergraduate A&M coursework; agricultural inventor and entrepreneur; viewed as having more of a "scientific background" than most politicians |
| **Henry L. Stimson** Secretary of War | Provided sounding board for Roosevelt on the relative importance of the uranium bomb idea. Took responsibility for planning and executing project after Navy excluded by Roosevelt. | No formal scientific training. Lawyer (Harvard). Long experience in military affairs, including weapon development, as senior government official in multiple Administrations. |

**Table 3- 2 Example Table of Key Advisers (Roosevelt Decision)**

a major interim conclusion for any study of the influence of expertise: which experts were listened to in the actual case.

For each case, a second Table of Scientific Experts identifies the three scientific experts who had the most influence on the decision, even if from a greater distance than the individuals in the Most Important Advisers Table. For these individuals, the impact they had on the decision is identified, and a description is given of how their expertise was presented to the President. Note that there can be overlap between the individuals identified in these two tables if scientific experts were also the most influential advisers.

Table 3-3 is a Table of Scientific Experts for the October 1941 Roosevelt Decision on the uranium bomb program. Vannevar Bush is in both the Most Important Advisers Table and the Table of Scientific Experts.

| Scientific Expert | Impact on Decision | How Expertise Presented to the President |
|---|---|---|
| **Vannevar Bush,** Director of the Office of Scientific Research and Development | Argued that, even though it wasn't a proven case, there was enough information to expedite this work. | Directly to the President, in the key decision meeting, as well as in bureaucratic reports leading up to the meeting |
| **George P. Thomson,** Chairman of the (British) committee on the military uses of uranium (MAUD committee) | Provided strongest arguments, in written form, that a bomb would be possible and could be built during the current war | Summarized by Bush at October meeting, but Thomson's major recommendations had reached the President through multiple channels |
| **James B. Conant,** Director of the National Research and Development Council | Integrated range of opinions and information into plans for Bush to propose | Supported Bush in lead-up to meeting, and reports that the President had seen prior to the meeting |

**Table 3- 3 Example Table of Scientific Experts (Roosevelt Decision)**

**Operational Definitions for Variables about the Advisory Mechanism.** Much of the science advice literature is focused on the idea that a President (or other policymaking official) would pay attention to scientific expertise if the right mechanism for advice were in place. Chapter 2 identified seven potential variables that might make a difference in how scientific expertise were perceived.

***A-1. A Single Strong Scientific Advisor.*** A common theme in many discussions of science advice is the need for a single strong science advisor who can referee the scientific issues and speak of the scientific view with a single voice. This role is believed to have been a key strength of early Presidential Science Advisers like Vannevar Bush and George Kistiakowsky, and led to an increased impact on Presidential decisions. Of course, such a Presidential Science Adviser need not have that title. For much of the Eisenhower Presidency, Kistiakowsky did not that title, and he is often viewed as the seminal example of such a strong science adviser. For purposes of this study, it matters only whether the President put his faith in a single individual, with scientific training and expertise, to draw together the scientific information and make a summary or recommendation. The ***science adviser variable*** can be described by a question.

**A-1. In making this decision, did the President rely on a single scientific expert to provide the key insight and make recommendations based an integrated view of the science issues?**

The variable has two values, Yes and No.

To operationalize the variable, the three scientific experts with the greatest influence, identified in the Scientific Experts Table, will be reviewed. For each of those experts, three questions will be asked:

(1) Does the expert participate in the lead-up to the decision, and have direct access to the President during that time?

(2) Does the expert summarize the state of scientific knowledge on the issue for the President?

(3) Does the President base his decision on that person's summary, as opposed to seeking other advice in the weeks leading up to the decision?

If the answer to all questions is yes, the value of this variable will be Yes, and otherwise it will be No.

In the example of the October 1941 decision on the uranium bomb project, Vannevar Bush clearly played the role of a strong scientific adviser, as defined by those questions, and the value of this variable would be "Yes"

***A-2. Policy Advocacy by Scientific Experts***. There is a debate over whether scientific expertise is best done as an explicit advocacy for a policy recommendation -- marshaling scientific arguments for a specific action -- or is more effective if given as an evaluation of the pros and cons from a scientific perspective. As discussed in Chapter 2, some writers have argued that an effective adviser will need to emphasize the information that supports the desired decision, and downplay the uncertainty about the relevant science. The rationale is that if the full range of uncertainty is presented, then the policymaker is likely to get the impression that science doesn't offer any guidance for the decision, and should be ignored. Advocates of this position believe that other advocates in the policymaking process are more forceful than scientists, and more willing make their case in a one-sided manner. In contrast, scientists can be so committed to a balanced presentation, and so aware of uncertainties in their data that they sound equivocal even when there is a preponderance of data on one side of the question. The argument is that, if there is a preponderance of scientific evidence on one side of a question, scientists should not only advocate a policy, but that they should downplay uncertainties and information that contrasts with their recommendations.

This variable attempts to measure whether the effective use of expertise is tied to advocacy. The ***policy advocate variable*** can be described by a question.

> **A-2. In making this decision, was scientific information provided in the context of making a policy recommendation, in contrast to a presentation of information without such an advocacy position? In particular, was scientific information provided with minimum emphasis on uncertainties, as though the science itself was so clear that no other policy decision was reasonable?**

The variable will only have two values, Yes and No.

To operationalize the variable, the key event where scientific information was provided to the President for this decision will be identified on the Decision Analysis Timeline. The documentation of the scientific information will be reviewed, and to see if the uncertainty in the scientific information was addressed in the scientific information provided to the President. If the uncertainty was addressed as a serious issue in the discussion, the answer to the question will be no, and otherwise the answer will be yes.

In the case of the uranium bomb decision of October 1941, Vannevar Bush was clearly was acting as policy advocate who believed that the potential for an atomic bomb was credible enough to deserve accelerated effort. But Bush went out of his way to describe the uncertainties in the project, and told President Roosevelt that success was "no sure thing." He was very explicit about the large amount of uncertainty in whether a bomb could be built at all, whether the unique U-235 could be produced in sufficient quantity (a new issue to the President at that point) and whether the project could be accomplished on a timeframe that would be relevant to the coming war with Hitler. He then argued that only a large-scale effort could provide answers to those questions, but he went out of his way to make clear that the uncertainties were vast. The answer to the question for the example decision is "No".

***A-3 Committee created for this Decision (Discrete Variable).*** One mechanism for providing good science advice is to create a committee to sort out the scientific questions relevant to a particular policy. The ***special advisory committee variable*** can be described by a simple question.

**A-3. In making this decision, was a special committee created to consolidate scientific information for the President's decision?**

The variable will only have two values, Yes and No.

To operationalize the variable, a review of the case will consider whether at any time within the Decision Analysis Timeline a special committee was created to consolidate the scientific information for the decision. A special committee might be an ad hoc body, or it might be a special committee organized by a standing advisory board. The key factors are (1) that the committee be formed to support this policy decision, (2) that it try to form a consensus about the scientific questions, and (3) that its members include persons with scientific expertise as defined in this study. If there is a committee that fits all three of those factors, the value of the variable will be Yes, and otherwise No.

In the case of the uranium bomb decision, the Uranium Committee chaired by Briggs was created to address the President's direction that the issue of a uranium bomb be looked into immediately. The creation of the Uranium Committee was the immediate result of the first Presidential decision, in October 1939, on the potential for a uranium bomb. The Uranium Committee remained ineffectual as a tool for organizing and advocating a sizable program. The committee reports, which remained focused on measurement uncertainties, was not a major influence on the eventual decision to pursue the research at an expanded pace. None-the-less, throughout the period of this case, the Uranium Committee was a primary tool for consolidating expert opinion about the potential for practical applications of a nuclear chain reaction. The value of this variable would be "Yes."

***A-4 Using a Standing Advisory Committee.*** Another common mechanism for drawing together scientific expertise is to use one of the many science advisory committees that already exist and address issues where science affects policy-making. The ***standing advisory committee*** variable can be described by a simple question.

**A-4. In making this decision, was a standing advisory committee used to consolidate scientific information for the President's decision?**

The variable will only have two values, Yes and No.

To operationalize the variable, a review of the case considers whether, at any time during the Decision Analysis Timeline, a standing advisory board was used to consolidate the scientific information for the decision. The key factors are (1) that the committee be a standing advisory body chartered by some part of the federal government, and not brought together just to address the issues critical to this decision, (2) that it try to form a consensus about the scientific questions, and (3) that its members have scientific expertise as defined in this study. If there is a committee that addressed the scientific issues important to the decision, and fits all three of those factors, the value of the variable will be Yes. Otherwise the value is No.

In the case of the uranium bomb decision of October 1941, there was no standing committee that had jurisdiction over the new issue of nuclear chain reactions. In 1939, President Roosevelt could have assigned the problem to the National Academy of Sciences, which was created by President Lincoln to provide just this sort of advice. The Academy might have assigned it to an existing committee. But instead, the President's direction led to the ad hoc Uranium Committee. In July 1941, during the timeframe of this decision, Vannevar Bush convened a 2-month review by a committee of the Academy. But that review was done by a special-purpose committee created because Bush was preparing to ask for a Presidential decision. No standing committee was involved. The value of this variable would be "No."

***A-5 Reports on an Issue Prepared in Advance of Decision.*** It is sometimes argued that the best scientific advice comes from having conducted a scientific study divorced from the pressures of a specific decision. The rationale is that such a study, captured in a report, is more likely to represent a true view of the scientific knowledge about an issue, without the interplay of current political forces. The report itself could then be a major influence on a Presidential decision, because it appears more impartial and permanent that current debate, and because it actually captures a better picture of the actual knowledge on an issue.

The ***pre-existing report variable*** can be described by a simple question:

**A-5. In making this decision, did the President make use of or rely explicitly on a report that was developed about the scientific background for the issue and published prior to the decision-making timeframe?**

The variable will only have two values, Yes and No.

To operationalize the variable, a review of the information used in the decision will identify any reports of importance to the President or other participants in the most critical events. If a report produced before the beginning of the Decision Analysis Timeline, or a report developed before the President became aware of the issue, is one of the reports on which the decision is judged to turn, the value of this potential variable will be "Yes". Otherwise it will be "No."

For the October 1941 decision on the uranium bomb project, there were no reports of significance on this subject prior to the Decision Analysis Timeline. The Einstein letter of July 1939 was one of the factors that influenced the President to order an investigation of the potential of a uranium bomb in October 1939, but its effect during the Decision Analysis Timeline was replaced by the studies and reports of the Uranium Committee, the MAUD Committee and the OSRD. The value of the potential variable in the example case would be "No."

***A-6 Direct Report to the President.*** Some literature argues that the most important aspect of the impact of scientific expertise on the President is whether scientific experts had an opportunity to speak in person to the President about what can be discerned from science about the issue. The rationale for this argument is that the President is more likely to be influenced by scientific expertise if it is presented to him without filtering by non-scientists, and without confusion with other non-scientific factors about the decision. The ***direct report*** variable can be described by a simple question.

**A-6. In making this decision, did the scientific experts, acting in their role as scientists, have an opportunity to present their scientific findings to the President in person?**

The variable will only have two values, Yes and No.

To operationalize the variable, a review of the case will consider whether at any time during the decision process the President met personally with one or more scientific experts to discuss explicitly what scientific and technical expertise had to say about the problem. If so, the value of the variable will be Yes, and otherwise No.

In the example of the uranium bomb decision of October 1941, direct access was clearly important. Vannevar Bush fits the definition of a scientific expert by the standards of this study, and met with the President on the topic more than once during the timeframe of the Decision Analysis Timeline. The value of the potential variable for the example would be "Yes."

***A-7 Communication (without a policy recommendation).*** Some papers argue that scientific expertise is most effective when it is presented purely as findings of fact, without any direct statement about a recommended policy. This potential variable is different from A-2 in that it calls not only for a lack of advocacy, but a complete separation of the scientific issues from the policy issues and a presentation only of relevant scientific results. The rationale is that non-scientific policy considerations already make it difficult for the President to differentiate the known facts from the uncertain aspects of the scientific information, and scientists would be most effective and helpful if they focused only on the scientific fact. The ***facts-only*** variable can be described by a simple question:

**A-7 In making this decision, did the President consider so-called "facts-only" reports critical to his decision, in contrast to reports or memoranda that made a case for a particular policy?**

The variable will only have two values, Yes and No.

To operationalize the variable, a review of the case will consider whether at any time during the decision process the President was presented with a report or review that was structured to present the scientific framework without making a policy recommendation. The critical events in the Decision Analysis Timeline will be reviewed for evidence that the President or other participants gave special attention to the "facts-only" reports. If such evidence is found at those critical events, the answer is "Yes", and otherwise the answer is "No."

The President had received several reports over the period of the Decision Analysis Timeline that addressed the state of scientific knowledge on the uranium bomb and chain-reaction questions without trying to grapple with the related policy questions. Most of these reports were never discussed by the President (at least according to respected secondary literature on the development of the atomic bomb project). In contrast, the most critical report leading to the President's decision was the MAUD Committee report of July 1941. The importance of that report was specifically its call for an all-out effort to start development on a uranium bomb project, rather than taking a neutral position. Bush presented the arguments from the British report as key to his recommendation, and did not rely as heavily on the facts-only reports from the U.S. committees and reviews. For the illustrative case, the answer to this question would be "No."

**Operational Definition for the Variable on the Role of Scientists.** Some of the science advice literature described in Chapter 2 argued that political leaders are more or less open to scientists' input based on how that input is presented in relation to the policy-making process. Whether their advice is seen as an outside expert review or as an part of the political process can affect the acceptability of scientific experts claiming a role in the decision.

While most of the cited writings address only the importance of a particular role for the scientific experts, it was shown in Chapter 2 that these could be presented instead as particular positions on a range of roles from, at one end, an external scientist/engineer working on problems defined by politicians, to, on the other end, full participation by the scientists in balancing a range of political priorities and decisions. Using that method to aggregate the issues identified in the literature, there is only one variable on the role of scientific experts in the decision.

***R-1 Role of Scientific Experts in the Decision.*** Figure 3-5 displays five positions on a scale of engagement with the policy process, reflecting different perspectives on the roles that scientists could take in the policymaking process. On one end the scale is anchored by an engineering approach to policy problems, where political officials define the problems and scientists address purely technical solutions. The other end is anchored by a politician's approach: full participation in the tradeoff among the

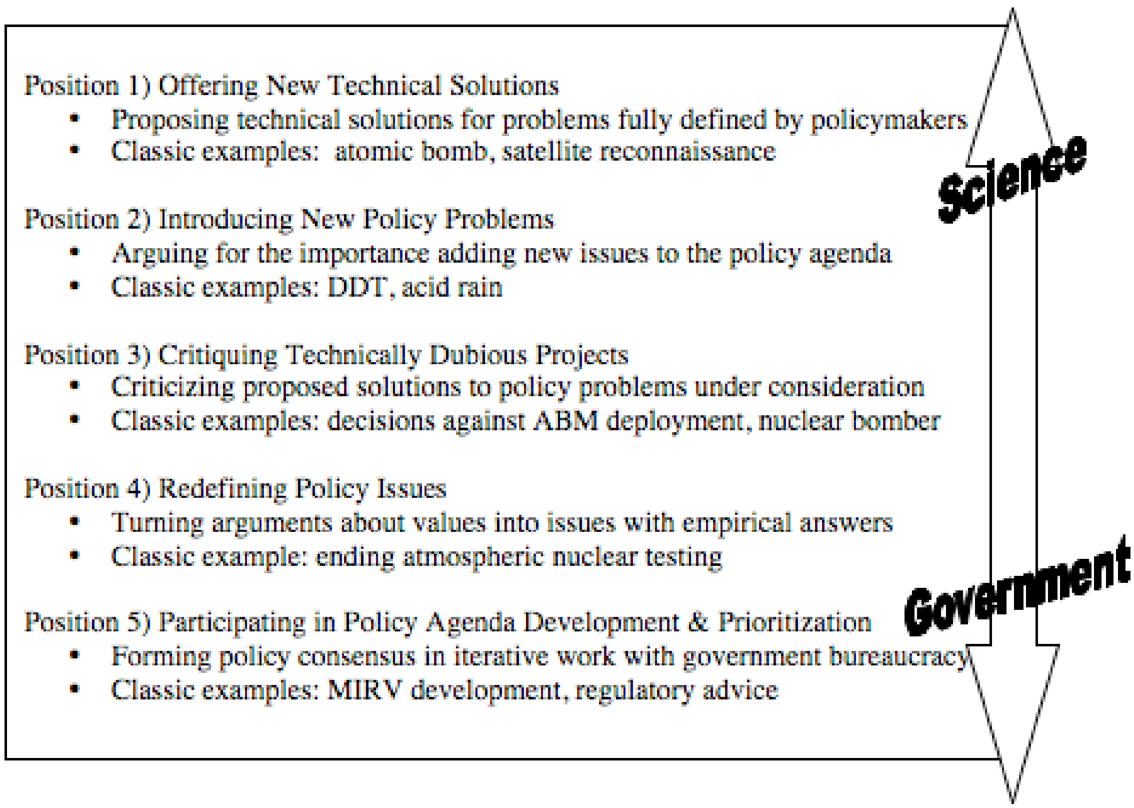


**Figure 3- 4. Five Positions on the Scale of Roles that Could be Taken by Scientists in the Policymaking Process**

priority of potential problems, the available resources, and technical and non-technical solutions.

Most discussions of the role of scientific expertise in the policy process emphasize roles at the science end of this scale. Advocates for more science advice usually claim more authority for scientific expertise when it is applying scientific knowledge to address a problem defined by the political leadership, and less when they appear to be just another player in the policy process. The claim to a unique role for scientific expertise, presented as an objective review of exclusively scientific facts, is most clearly justified on this end of the scale. The image of politically neutral scientific expertise is more likely to be challenged by policymakers as the role played by scientists moves from Position 1 to Position 5. As scientists begin to act in higher numbered roles on this scale, the resistance of political actors to claims for a role by scientific experts also goes up. The level of proof required to assert dominance of scientific expertise over other policy considerations becomes increasingly difficult as scientists attempt to influence policy by taking roles more closely associated with government and political functions. On the other hand, it is possible that the only way for scientific expertise to have an influence is to be more involved in the policy arguments across the board.

Scientific experts do act in all the roles shown on the scale. The figure identifies classic examples where scientific expertise has been a vital part of policy arguments and decisions in each of these identifiable positions. Some writings about science advice argue that scientific experts should operate at some specific point or range on this scale in order to maximize the impact of scientific expertise. While there is some overlap among the five anchor positions shown on this scale about the role of scientific expertise, the positions represent real examples of circumstances, which might determine whether scientific expertise affects policy decisions. These five positions serve as a proxy for the range of values that can be taken by this variable.

In order to operationalize the variable, Figure 3-6 presents a flow chart of four questions that can be used to distinguish among the five positions on this scale:

A. Do scientists claim to be addressing *the balance of government priorities* as well as scientific questions?
B. Do scientists *identify* the issue as requiring a solution?
C. Are scientists explicitly critiquing a proposed government solution?
D. Do scientists propose that new questions and new data are required?

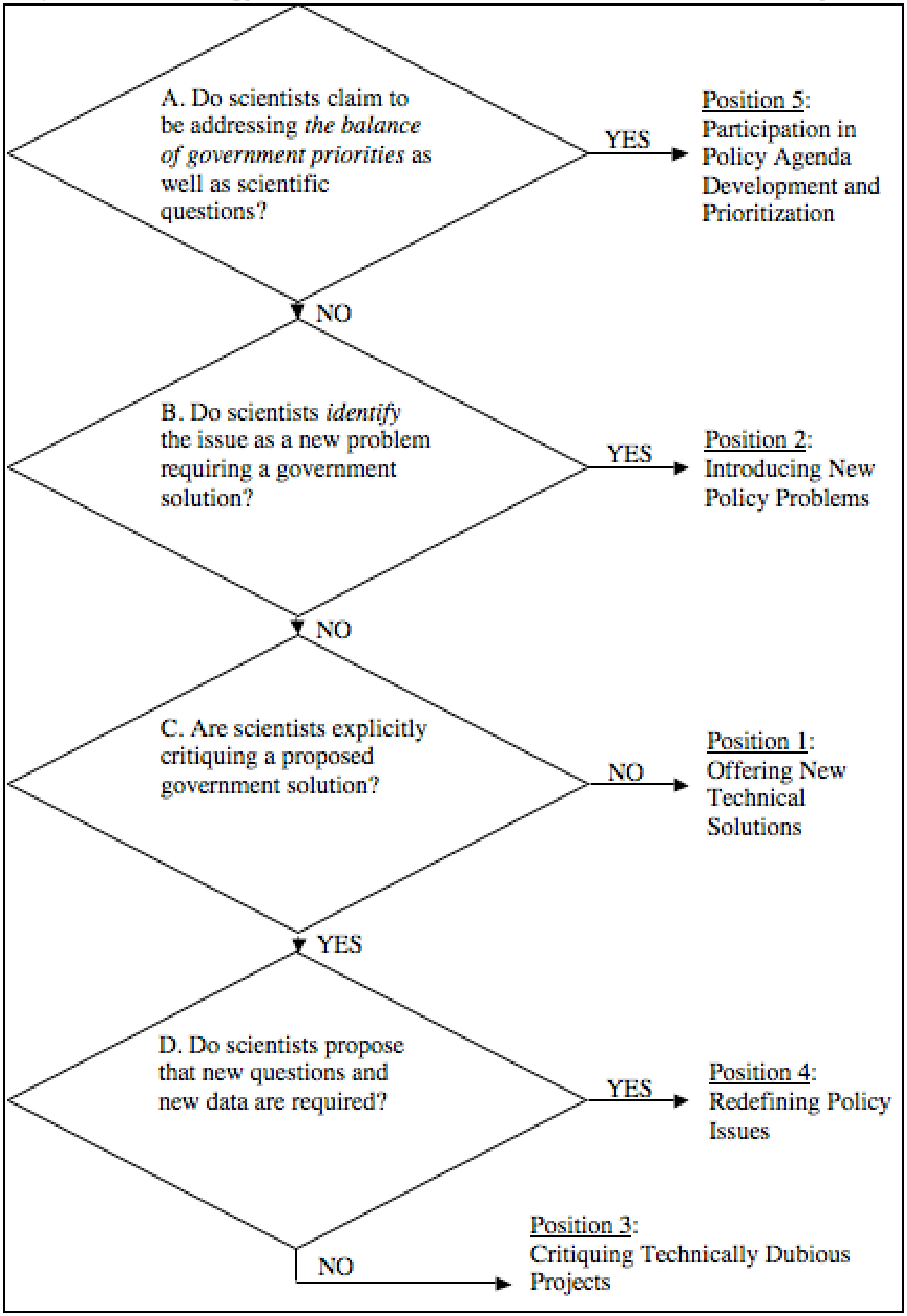


**Figure 3- 5 Process for Using Questions to Distinguish Among the Roles Played by Scientific Experts in the Policymaking Process**

If these four questions are answered in the order given in the flow chart, then the efforts of scientists to can be uniquely assigned to a position on the range of values for R-1. The questions are presented in an order that identifies the role played by scientists through a process of elimination.

Question A (Do scientists claim to be addressing *the balance of government priorities* as well as scientific questions?) uniquely identifies whether the scientists are acting in Position 5. Position 5 claims that scientists can be most effective if they are part of the total policy process, especially in addressing how the particular problem ranks in importance to other government issues. All the other roles claim neutrality on the relative importance of their issue to other government priorities, arguing only that the issue of concern is "important enough." Scientists who define themselves as acting in other roles resist making comparisons and priorities as either irrelevant to their task (in Position 1 and Position 2) or as a distraction from legitimate criticism (in Position 3 and Position 4). Specifically, for the first question, documentary evidence will be sought that at least one of the three scientific experts identified in the Scientific Experts Table presented, to the President or to the advisers in the Table of Key Advisers, arguments that the problem and solution were important in comparison to other important problems, and that a balance of resource allocations, political practicality, or other non-scientific factors had been considered in making that judgment. If so, the role of the scientific experts will be Position 5.

A positive answer to Question B (Do scientists *identify* the issue as a new problem requiring a government solution?) uniquely identifies the role as being in Position 2, if Position 5 has been excluded. This is the essence of Position 2: introducing new problems onto the government's agenda. In answering Question B, documentary evidence will be sought that at least one of the three scientific experts identified in the Scientific Experts Table was arguing that the government was not addressing a problem and that the scientific information available to experts demonstrates that the problem was so important as to require Presidential attention.

If Position 5 and Position 2 are excluded, Question C (Are scientists explicitly critiquing a proposed government solution?) can be used to uniquely identify scientists acting in Position 1. The presentations made by three scientific experts identified in the Scientific Experts Table will be reviewed for evidence that they believed there was a preferred government solution to the issue, and that there was a reason based on their scientific expertise to believe that the solution was incorrect. If none of the three experts make such an argument, then the experts will be in Position 1.

If all of the other Positions have been excluded, Question D (Do scientists propose that new questions and new data are required?) distinguishes between Positions 3 and Position 4. In Position 3, scientists claim that enough information is available to exclude the government's preferred solution. In Position 4 scientists argue that there is insufficient information on key questions, and that the focus of effort should be on generating new information and defining better questions. The presentations made by three scientific experts identified in the Scientific Experts Table will be reviewed for evidence that they argued that more research was necessary to determine if the government's solution was correct, in contrast to a position that that there was a reason based on their scientific expertise to believe that the solution was incorrect. If one of the three experts makes such an argument, then the experts will be in Position 4.

In all of the answers to the four questions, the emphasis is on whether the President might have seen the position of scientific experts as being in the role described by the five Positions. Although there are three advisers reviewed for each question, the President might have inferred a Position if even one of these influential scientists is known to express the opinions associated with the Position. Therefore, for this variable, the role is determined by evidence that even one of the three scientific experts identified in the Scientific Experts Table expressed such opinions. In three of the answers above, the position is determined by finding evidence for a positive answer by even a single adviser among the three scientific experts identified in the Scientific Experts Table. Position 1 is found only when all three of the experts do not criticize a government solution, equivalent to saying that there is evidence that at least one of them is doing so.

For the example of the uranium bomb decision of October 1941, there is a clear answer to Question A, "Do scientists claim to be addressing the balance of government priorities as well as scientific questions?" Vannevar Bush explicitly claimed that the uranium program deserved sufficient priority, because of its potential to the expected war effort, that it should be funded even at the expense of many other programs. His position as the head of the Office of Scientific Research and Development put him a position to make those kinds of priority decisions, and his presentation to the President was in that context. Only radar research was a higher priority for Bush at this point in his organization of scientists and engineers for the war effort.

It is interesting to see how quickly the work on the uranium bomb became part of the government policymaking process. Without the scientists, this issue would not have been on the President's agenda in 1939. When scientists made a case that the uranium bomb introduced both new problems (the Nazis might make a super-weapon that could defeat anyone) and a potential solution (should make an all-out effort to make one ourselves) they were acting in Position 2. By 1941, in contrast, the potential for a uranium bomb was one of several war-related research issues of interest to the President, and was being judged by scientific advisers on its merit relative to other research important to the needs of the expected U.S. involvement in World War II. By October 1941, scientists were acting as an integral part of the government's priority-setting process.

**Operational Definition for Variables about the Type of Expertise.** It is possible that the type of expertise available could be critical to whether a President is open to using scientific expertise in his decisions. Chapter 2 identified four potential variables related to the type of expertise.

***E-1, Using Expertise from Outside the Government.*** One of the most common opinions expressed in the science advice literature is that decisions would be better if the President tapped the expertise of scientists outside the government. For this study we are asking whether the President more likely to use expertise if it is from outside the government. The cases were picked to represent decisions where the President did use scientific expertise, and *the outside expertise variable* is the answer to the following question:

> **E-1. Whether the President relied for scientific expertise on experts whose primary employer was not the U.S. Government or a firm whose primary customer is the U.S. Government.**

This variable will only have two values, **Yes** or **No**.

To evaluate the variable, the scientific experts on whom the President relied (identified in the Table of Scientific Experts), and their employment will be assessed. If the President relied on experts whose primary employer was a government institution the value is yes. The value is yes even if the President also uses other experts who are part of the government bureaucracy.

For the example problem, the President's top three scientific experts (Bush, Thomson and Conant) were all currently working full-time as government advisers. The most important to this decision includes one not employed by the U.S. Government (Thomson) but who was working full-time organizing British R&D for the war effort. Thomson's independence from the U.S. Government scientists looking at the uranium issue seems to have been an influential factor for the President, but he still relied on government advisers. The value of the variable for the example would be "No."

Note that the mythic version of the atomic bomb decisions, in which non-governmental scientists such as Einstein and Szilard bring the critical information to the President, was probably a correct version of events for the October 11, 1939 decision by President Roosevelt to look more closely at the potential for an atomic bomb. But in order to commit major resources to the R&D on a bomb, he relied on scientists who were committed full time to balancing the potential of this project against other government R&D efforts.

***E-2: Using Experts other than the Advocates.*** One of the key concerns about providing good science advice has been whether the President has an opportunity to hear from experts other than the ones who are advocating for a particular decision.  This could involve hearing the other side of an issue from opponents of the decision with comparable expertise, or simply hearing opinions from scientific experts who are not associated with the policy proposal (but are not necessarily opponents of the recommendation). The question for the ***non-advocates variable*** is:

> **E-2. Did the President hear information about the scientific issues from experts who were not involved in advocating for the recommended policy approach on his decision?**

The variable will only have two values, Yes and No.

To evaluate the variable, the point in the decision process where the President is presented a recommended course of action should be identified on the Decision Analysis Timeline.  Research should determine whether the President sought or received information on the scientific questions from anyone other than an advocate of the recommendation, and thereby heard alternative or dissenting views, before he made his decision.  The key evidence would be interaction by the President on the scientific questions someone not already committed to the recommendation. If the President has such interaction, the value of the variable will be Yes, and otherwise No.

For the example of the uranium bomb decision in October 1941, the President did not seek an alternative opinion, and relied on the objectivity of Bush in presenting the recommendation.  The value of the variable would be "No."

***E-3: Using the Best Experts on the Issue.*** One of the key concerns in the science advice literature has been whether the President has an opportunity to hear from the best possible scientific experts. Critics maintain that a President would be better served, and might be more open to science advice, if he knew that the best experts on the question were advising him. In contrast, critics suspect that scientific questions may be assigned to trusted aides with or without a scientific background, and that when the President asks for scientific expertise he is more often answered by the same set of scientific advisers that address every question. The ***best expertise variable*** can be operationalized as a simple question.

> **E-3. Is there evidence that the President sought the best scientific experts on the issue, or questioned whether the experts on whom he relied were in fact the best experts, or was provided with the best expert's opinions by his staff?**

The variable will only have two values, Yes and No.

To evaluate the variable, the events when the President asked about scientific questions will be identified. If the President asked about the qualifications of this scientific experts, or asked for the best scientific expertise at any point, or was presented with statements that the best scientists were sought, the value of the variable will be Yes. Otherwise the answer will be No.

For the example problem, more research would be required. Secondary sources do not indicate that Roosevelt asked the question of whether the best experts were being sought out. He likely relied on Bush to ensure that was true, and Bush was committed to engaging the best range of experts in all of his OSRD activities. Based only on limited secondary sources, the value of the variable would be "No," but further research might change that value.

***E-4: Using Expertise from Scientists with Experience in Science Advice.*** Because the process of giving advice that is useful to a policymaker is a skill to be developed, rather than a skill that comes directly with scientific expertise, a President might be more apt to give weight to advice generated by persons who have experience with such advice. The ***experienced advisor variable*** can be operationalized as a simple question.

**E-4. Did the President's information about the scientific issues come from experts who had significant previous experience in providing scientific advice to a President, or significant experience in science advice at a lower level?**

The variable will only have two values, Yes and No.

To evaluate the variable, the events when the President asked about scientific questions will be identified, and the scientific experts who provided input will be identified in the Table of Scientific Experts. For each scientist, a review of what role he had previously played in recommendations to the President, or as an advisor to another senior policymaker, or as part of a lower-level government advisory board. If the three advisers have significant experience giving advice to senior policymakers before this decision, the value of the variable will be Yes. Otherwise the answer will be No.

For the example of the uranium bomb decision in October 1941, the key advisers were Bush, Thomson and Conant. All three of these had experience in providing scientific advice during the First World War. The value of the variable would be "Yes"

**Operational Definitions for Variables about the Type of Decision.** It is reasonable to consider that a President might be more open to scientific advice based on the kind of decision. The literature in Chapter 2 suggested four potential variables related to the type of decision.

***D-1. Scientific Questions are Key to the Decision.*** The most obvious question about whether the President listened to scientific expertise is a judgment about how important scientific questions are to the decision. One would hardly expect the President to seek scientific advice about a primarily political issue like Congressional re-apportionment. You are more likely to think he should care about scientific expertise when addressing missile defense or the spread of AIDS. Of course, there are some questions where scientific expertise might be useful but not the only factor, and this variable is going to be primarily about the degree to which scientific questions are important.

There is no objective standard about how scientific questions play into a Presidential decision. And it isn't reasonable, for this study, to seek information about whether the President saw the question as scientific – to be included as a case, the President must have seen scientific expertise as important. So the variable needs to be defined in some way that is external to the President's perspective.

For the purposes of this study, the ***scientificity variable*** will be defined as:

**D-1. The degree to which an outside observer would judge that scientific questions are critical to the President's decision.**

The scientificity variable will be evaluated using the Presidential Decision Decomposition, scoring the subordinate questions (which are more easily judged as being based on scientific issues), and computing an overall score for the decision.

Each element in the decision diagram will be rated on a scale, where “1” represents an input that would appear to be best made with scientific expertise, “0.5” represents an input that includes both scientific and non-scientific requirements, and “0” represents an input that would most likely not require scientific expertise. The average score on the Presidential decision will then be based on adding the scores for each input, and dividing by the total number of inputs.

The degree to which the decision depended on scientific expertise will be rated on a five-point scale:

**Very Scientific**, if the average score is greater than 90% scientific
(requiring that 9 out of 10 questions are purely scientific)

**Highly Scientific**, if the average score is between 67% and 90%

**Scientific**, if the average score is between 50% and 67%
(the purely scientific questions outnumber the mixed)

**Partially Scientific**, if the average score is between 33% and 50%

**Not Scientific**, if the average score is between 0% and 33%.

For the example of the October 1941 decision to go all-out on research to determine if a uranium bomb could be made, the Presidential Decision Decomposition was given in Figure 3-4. There are eight questions at the lowest level of the decomposition:

- What are the prospects that a bomb can be made to work? (100% scientific)

- How long will it take? (50%)
- What is the level of uncertainty? (100%)
- What will it cost to find out? (50%)
- What do we have to do, assuming it is possible, to build on in time? (100%)
- What will it cost to build a bomb? (50%)
- What are the Nazis doing? (50%)
- What will be the problems of post-war control? (0%)

The average value of these seven questions is 63%, and the decision would be judged "scientific." Even on a question that turns on so many scientific issues, the President was also considering whether the project was affordable, and whether the bomb project *should* be pursued given the impacts on a post-war world.

***D-2. National Security Issues.*** Decisions that affect national security might be decisions where a President is apt to seek the best expertise before making a decision. In a decision about domestic policy, the consequences of being wrong are usually considered less critical. Political scientists, in fact, tend to treat national security and foreign policymaking as somewhat different from other policy-making activities.

But defining what issues are national security issues is not always easy. Issues such as energy, the environment and the economy are sometimes claimed as national security issues. But that meaning is a bit different from the usual intent of the phrase: issues that address the protection of the country against malicious action by foreign countries or non-state actors. That original meaning is reason to believe that a national security decision might be more likely to lead a President to seek and use scientific expertise. Such issues as energy and the environment may become reasons for malicious foreign activities, but national security is treated as a special case when it deals with managing those malicious foreign activities. It may be that a President would downplay the political and resource issues if protection against foreign actors is the issue under discussion, since the consequences of failure could be national destruction. The evaluation of the national security variable will be tied to the more narrow meaning of the term.

For the purposes of this study, the ***national security variable*** will be defined as:

**D-2. The degree to which the decision is tied to the protection of the U.S. against foreign threats.**

The national security variable will be evaluated on a four-point scale, using as a proxy whether the actors involved in advocating positions to the President are key players in the protection against foreign threats. The scale indicates less likelihood that a decision is a national security issues as it falls from Critical to Domestic.

- **Critical**, in which positions are advocated to the President by the principals of the key national security agencies (the Secretary of Defense, the Secretary of State, or the Director of Central Intelligence);
- **Clear**, in which positions are advocated to the President by either lower-level officials in the three agencies above (but not by the principals), and by principals of any other member of the National Security Council, and in which the decision,

as presented to the President, clearly involves consideration of the impact of the decision on the threat from foreign countries;

- **Nominal**, in which none of the above are true, but national security is raised as an issue in the argument before the President's decision; and
- **Domestic**, in which none of the above conditions apply.

It is not practical to evaluate the October 1941 example on this scale, since the decision occurred before there was a National Security Council. The uranium bomb decisions were certainly national security decisions. One could argue that it fits with the proxy variables, if extended to that time. As part of his October 1941 decision, President Roosevelt limited information on the full scope of the project to key officials of the OSRD, the Vice President, the Secretary of War and the Army Chief of Staff. The choice of those officials suggests that he considered it a national security decision in the context of this potential variable.

The problems with the example will not apply to the actual cases, which all occur after the Nixon Administration, when the National Security Council system was well–established.

***D-3 Based on a Wide Scientific Consensus.*** Literature suggests that a President, or in fact any policymaker, is more likely to be influenced by a scientific expertise that represents a wide consensus among scientists, as opposed to cases where there are dueling groups of opinions. The consensus of the scientific community should carry more weight than one without such a consensus.

But it is often controversial how much consensus there was at a certain time about the scientific basis for a decision. There are rare issues with a total scientific consensus, such as proposals that violate well-established scientific principles. For example, zero-point energy devices continue to be denied patents on the basis that they violate the second law of thermodynamics. More often a review of a decision will identify dissenters about the consensus on any scientific information that was used for a controversial decision.

Perception of scientific consensus, when a decision is made, is the critical factor for this study of why a President might use scientific expertise. A policymaker obviously cannot know of dissent if it is not presented to them.

For the purposes of this study, the scientific consensus variable will be operationalized as:

**D-3. The degree to which the President, at the time of the decision, believes the scientific judgment supporting his decision represents a consensus of the relevant scientific experts.**

The consensus variable will have 3 possible values:

No Scientific Consensus: The President believes that there is no scientific consensus behind to the arguments used to support his decision. The key measure will be explicit evidence that the President consciously knew of the lack of scientific consensus and yet made his decision in light of such knowledge.

Mixed: The President either expresses no perception about the scientific consensus, or believes that there is no firm consensus on scientific issues relevant to the decision. This is the default value – if there is no evidence that the President heard or asked about scientific consensus, the case would be judged mixed; it would also be the value if the President was told there was no scientific consensus, or if he became convinced that there was no consensus.

Yes, Scientific Consensus: The President believes that the scientific consensus is largely in agreement with the arguments used to support his decision. The key measure will be explicit evidence that the President consciously believed in such a consensus when he made his decision.

Cases may be judged "mixed" due to lack of evidence. If so, that will weaken the case that scientific consensus is critical to a President being open to using scientific expertise. If the variable is anything but "Yes," and yet the President bases his decision in large part on scientific expertise as was required for selection of the cases, scientific consensus is unlikely to be critical to the use of scientific expertise in all cases.

The secondary literature reviewed for the example does not make clear that President Roosevelt asked for or discussed the level of scientific consensus. It may be that he counted on Bush to adequately probe the level of consensus in the scientific community. More review of the example would be required to know for sure. Within the bounds of the work for this example, this variable would be evaluated as "mixed."

***D-4 Led by an Agency with a Scientific Culture.*** It has been suggested that scientific expertise is more likely to play a key role in a Presidential decision if the *organization* presenting the issue to the policymaker values scientific information, is made up of scientists, and is usually led by technical people. NASA is such an agency, and has a tendency to address decisions in terms of scientific knowledge and engineering trade-offs. The State Department, in contrast, is not such an agency, and is likely to address decisions in terms of relative power, bilateral relationships, and national goals. In some cases, an agency such as State might even argue for ignoring technical facts if it makes the U.S. position easier to defend. In contrast, NASA would have trouble making that argument, since it would conflict with NASA culture.

For the purposes of this study, the ***scientific culture variable*** will be defined by:

**D-4. The degree to which the decision is presented to the President by an organization that is mainly staffed with professional personnel trained in the physical and natural sciences, medicine or engineering.**

The scientific culture variable will have five possible values:

**Very High**: Almost complete influence by scientists on the culture of the institution. The agency or agencies presenting the issue to the President will be judged to have a high scientific culture if its leadership, from the time of its founding until the date of the decision, has been led by someone with scientific training more than 95% of the time.

**High**: Significant influence by scientists on the culture of the institution. The agency or agencies presenting the issue to the President will be judged to have a high scientific culture if its leadership, from the time of its founding until the date of the decision, has been led by someone with scientific training 66% of the time or more.

**Mixed**: Sometimes led by scientists, sometimes not. The agency or agencies presenting the issue to the President will be judged to have a low scientific culture if its leadership, from the time of its founding until the date of the decision, has been led by someone with scientific training for more than 33% of the time and less than 66%

**Low**: Little influence by scientists on the culture of the institution. The agency or agencies presenting the issue to the President will be judged to have a low scientific culture if its leadership, from the time of its founding until the date of the decision, has been led by someone with scientific training less than 33% of the time.

**Very Low**: Very little influence by scientists on the culture of the institution. For this study a simple measure will be used. The agency or agencies presenting the issue to the President will be judged to have a very low scientific culture if its leadership, from the time of its founding until the date of the decision, has been led by someone with scientific training less than 5% of the time.

The example problem again requires some interpretation, since the recommendation was made by a very new agency, the Office of Scientific Research and Development. As that name suggests, the organization was made up of scientists and engineers. It had only had a single leader, Bush, who fits the criteria for a scientific expert. The variable would be scored as "Very High."

**Chapter Summary**

Chapter 3 has provided a detailed methodology for identifying cases where scientific expertise is important to Presidential decisions, selecting cases likely to illustrate a strong role for scientific expertise among those cases, analysis tools that will be used in case assessment, and an operational definition for the assessment of each potential variable suggested by the science advice literature. In addition, a classic example of the role of scientific advice – the October 1941 decision by President Roosevelt to accelerate research and development on the atomic bomb project – was used to illustrate the tools and variable assessment. The next chapter applies the methodology of this chapter to identifying, selecting and analyzing three cases of Presidential decisions.

## Chapter 4. Research and Findings

This is the longest chapter in this research study, and represents the heart of the original research presented in the study. The chapter is divided into seven sections:

- Case Identification
- Case Selection
- Case 1, President Ford's Decision to Initiate the National Swine Flu Vaccination Program
- Case 2, President Ford's Decision to Suspend the National Swine Flu Vaccination Program
- Case 3, President Reagan's Decision to Sign an International Agreement Binding the U.S. to Ban Production of Ozone Depleting Industrial Chemicals
- Integrating the Impact of the Variables Across the Three Cases
- Summary Findings

The first section is a discussion of the research done to identify strong cases where scientific expertise had a major impact on Presidential decisions during the administrations from President Ford to President Clinton. The second section explains the rationale used to select the three presidential decisions that were selected for more detailed case study analysis. The next three sections address those cases individually. Each section includes a narrative about each case, an assessment of the presence or absence of each variable discussed in the science advice literature, and a summary of findings about the variables and other observations about the reasons that the President was influenced by scientific expertise.

Together these sections provide the findings of this research. The sections are not entirely a linear progression from identification of cases to findings from cases, however. One of the goals of this research is to demonstrate that there are strong cases of scientific expertise driving Presidential decisions. The case identification approaches provide a basis for identifying such cases, but the detailed exploration of three Presidential decisions provides a stronger basis for showing that science advice sometimes matters. The detailed cases are also used to explore the presence or absence of the variables that the science advice literature suggested would enhance the likelihood of a President paying attention to science advice. The actual research showed that some of these cannot be easily dismissed on the basis of their absence from a single case, as was originally hoped. Some of the variables (for example the National Security variable) can only be interpreted as more likely to lead to a President paying attention to scientific experts, and must be evaluated on a more probabilistic basis. While this study is explicitly exploratory about such matters, the case identification will provide the only basis for preliminary conclusions about such variables. Each section will be addressed as outlined in chapter 3, but conclusions in Chapter 5 will be based on the findings from all the research, not on the three detailed case studies alone.

## Case Identification

The identification of cases where science made a major impact on a Presidential decision is critical to both selecting good cases for detailed analysis and for addressing the broader research questions of this study. Case identification has been approached from two perspectives. First, an attempt was made to contact former science advisers for their perspectives on what were strong cases in these five administrations. Second, memoirs of the President were reviewed to find cases where he describes an issue as driven by the science or the scientific advisers. In addition, the memoirs of the President's National Security Adviser, Science Adviser, and Chief of Staff were reviewed for similar observations.

**Responses from Former Science Advisers.** The first approach used to identify strong cases where scientific expertise was critical to a Presidential decision was to contact persons who had acted as science advisers to the President, or had served on some version of the President's Scientific Advisory Committee (PSAC), and ask them to identify such cases. Such persons have seen the process at first hand, and are not naïve about the range of forces that act on a Presidential decision. If they felt that scientific expertise was critical to a decision, it seems likely that they have the perspective to make that judgment.

In 2008, I attempted to contact all of the persons who had held the office of Science Adviser to the President (PSA). At that time, there had been 22 persons who had held that position, either formally (14) or in an acting capacity (8). All of those who served before the Johnson Administration had died prior to this research, as had three of those who served since. Table 4-1 lists the 18 persons who served from the Johnson Administration forward; the three who had died before 2008 are identified in the tables as "Deceased". I was able to find a method of contact for ten of the remaining 15 Presidential Science Advisers.

| Adviser | President Served | Attempted Contact | Response Received |
|---|---|---|---|
| Donald Hornig | Johnson | No | N/A |
| Lee DuBridge | Nixon | Deceased | N/A |
| Edward David | Nixon | Yes | No |
| Guyford Stever | Ford | Yes | No |
| Frank Press | Carter | No | N/A |
| Benjamin Huberman | Reagan | Yes | No |
| George Keyworth | Reagan | Yes | No |
| John McTague | Reagan | Yes | |
| Richard Johnson | Reagan | No | N/A |
| William Graham | Reagan | Yes | Yes |
| Thomas Rona | Reagan | Deceased | N/A |
| D. Allan Bromley | Bush (41) | Deceased | N/A |
| John Gibbons | Clinton | Yes | Yes |
| Kerri-Ann Jones | Clinton | No | N/A |
| Neal Lane | Clinton | Yes | No |
| Rosina Bierbaum | Bush (43) | Yes | No |
| Glifford Gabriel | Bush (43) | No | N/A |
| John Marburger | Bush (43) | Yes | Yes |

**Table 4-1 Contact Attempts with Presidential Science Advisers Regarding Strong Cases Where Science Made a Difference in Presidential Decisions**

Appendix 1 provides an example of the letter sent to each PSA. Each person, PSA or one of the other science advisers shown below, were asked the same general questions about examples of Presidential decisions, across the five administrations of interest. Three of the PSAs provided me with a response.

In addition to their direct response to me, I also reviewed the comments on science advice made during a 1999 panel discussion among nine of the former PSAs. The panel was a wonderful discussion of the highlights and problems of providing science advice to the President, and was organized as part of the Centennial Celebration of the American Physical Society. Their remarks on this panel, addressing points where they saw scientific expertise make a difference in the admittedly complex world of policymaking, are treated as valid responses to the question of interest in this research.

I also sought opinions from six scientific experts who have served on a scientific advisory council providing advice to the President. In this case, I identified persons that I already knew how to contact, that were scientific experts in their own right, and who had personal experience with providing advice to the President. These additional science advisers are identified in Table 4-2. I had a higher level of response form this group; all but one of them provided a response.

The most common point made by all the science advisers who responded to me was the difficulty of identifying strong cases. My respondents wanted to be sure that I understood that no Presidential decision is based entirely on science advice, and that science doesn't provide sufficient answers for many Presidential issues. Even for cases where scientific expertise played a major role, they wanted to be sure I understood that a President would have to balance the scientific evidence with the political art-of-the-possible. Some of the respondents also commented on places where they thought science had not been sufficiently respected in Presidential decisions.

| Adviser | Relevant Position | Response Received |
|---|---|---|
| Rita Colwell | National Science and Technology Council | Yes |
| Richard Garwin | President's Science Advisory Committee | Yes |
| Paul Gray | President's Science Advisory Committee | Yes |
| Norman Neureiter | Assistant to the President's Science Advisor | Yes |
| Anthony Oettinger | President's Foreign Intelligence Advisory Board | Yes |
| Anthony Fauci | Advisor to President Reagan on Auto Immune Deficiency Syndrome | No |

**Table 4-2 Contact Attempts for Other Scientific Experts with Presidential Science Advice Experience**

From among the nine advisers who responded five Presidential decisions were suggested as strong examples where scientific expertise was critical, based on their personal experience and observations. The five proposed cases are listed in Table 4-3. The most striking feature of this table is that three of the scientific advisers mentioned one case – President Ford's Swine Flu Vaccination Program – as one of the clearest cases

| Proposed Strong Case | Number of Respondents who Mentioned the Case |
|---|---|
| Ford Swine Flu Vaccination Program | 3 |
| Carter Neutron Bomb Program | 1 |
| Reagan and Ozone-destroying Chemicals | 1 |
| Bush Revisions to the Ballistic Missile Defense Program | 1 |
| Clinton Comprehensive Test Ban Plans and Priorities | 1 |

**Table 4-3 Scientific Adviser Suggestions for Cases Where Scientific Expertise Strongly Influenced a Presidential Decision**

where scientific expertise directly drove a Presidential decision. Among these very experienced and sophisticated experts fully one-third of them thought this was an important case. The other feature of the table is that at least one decision was mentioned for each Presidential Administration under study.

**Review of Presidential Memoirs and Other Related Memoirs.** The second approach taken to defining strong cases where scientific expertise played a critical role in a Presidential decision was to review the memoirs written by the five Presidents, their science advisers, and their National Security advisers. Each memoir was reviewed for cases where the person involved says that the scientific expertise, results or advisers were a critical factor in the decision.

The Presidential Memoirs reviewed are listed in Table 4-4. Some of these Presidents have written extensively since leaving office, and others wrote very little. The only memoirs reviewed for case identification were the books that covered the years they served as President, which was either a focused memoir of the Presidential years (Ford and Carter), a diary from those years edited later (Carter and Reagan), or lacking those, the Presidential sections of a general autobiography (Reagan, Bush and Clinton). All were considered valid statements by the principal for purposes of this research, even though researchers who use published memoirs point out that memoirs written soon after the term ended, with a strong authorial voice (the Ford and the first Carter memoir) are more useful indications of how the President thought during his term.

| President | Memoirs that Cover Presidential Term |
|---|---|
| Gerald R. Ford (1974-1977) | • *A Time to Heal* (1979) |
| James E. "Jimmy" Carter (1977-1981) | • *Keeping Faith: Memoirs of a President* (1982)<br>• *White House Diary (2010)* |
| Ronald W. Reagan (1981-1989) | • *An American Life* (2003)<br>• *The Reagan Diaries* (2009) |
| George H. W. Bush (1989-1993) | • *All the Best, George Bush: My Life in Letters and Other Writings* (1999) |
| William J. "Bill" Clinton (1993-2001) | • *My Life* (2004) |

**Table 4-4. Presidential Memoirs Reviewed for Case Identification**

In addition to memoirs by the President, memoirs by presidential science advisers and National Security Advisors to the President were reviewed for their description of their time serving with the President. Twelve persons served during this period as National Security Advisor to the President, and eleven served as Science Advisor to the President. Eight of these advisers have written memoirs that include descriptions of their time serving with the President. The National Security Advisors with such memoirs are listed in Table 4-5, and the memoirs by Science Advisers are listed in Table 4-6.

| National Security Advisor | President and Period Served | Memoir of Time Served |
|---|---|---|
| Henry Kissinger | Ford, 1975 | • *The White House Years* (1979)<br>• *Years of Upheaval* (1982) |
| Zbigniew Brzezinski | Carter, 1977-1981 | • *Power and Principle: Memoirs of the National Security Adviser, 1977-81* (1983) |
| Robert McFarlane | Reagan, 1983-1985 | • *Special Trust* (1994) |
| Colin Powell | Reagan, 1987-1989 | • *My American Journey* (1995)<br>• *A Soldier's Way* (2001) |

**Table 4-5. Memoirs by National Security Advisers Reviewed for Case Identification**

| Presidential Science Advisor | President and Period Served | Memoir of Time Served |
|---|---|---|
| Guyford Stever | Ford, 1973-1977 | • *In War and Peace: My Life in Science and Technology* (2002) |
| Allan Bromley | Bush, 1989-1983 | • *The President's Scientists: Reminiscences of a White House Science Adviser* (1994) |
| John Gibbons | Clinton, 1993-1996 | • *This Gifted Age: Science and Technology at the Millennium* (1997) |

**Table 4-6. Memoirs by Science Advisors to the President, Reviewed for Case Identification**

Based on a review of these memoirs, a number of issues were identified where scientific expertise was considered critical to the President's decision, sufficiently important that it was mentioned in one of the memoirs.

**Summary of Case Identification.** The first research question for this study addressed whether there were good examples where scientific expertise has a significant impact on Presidential decisions. This is a very difficult question to answer with certainty. There is no Presidential decision that cannot be challenged by someone as purely political. Both scholars and practitioners caution that no Presidential decision can be judged easily as driven by a single factor.

The methodology used in this study has identified five issues that likely include good examples of Presidential decisions that were significantly driven by scientific expertise. The two criteria used for case identification – judgment of scientific advisers and mention of scientific expert input in memoirs – do not prove that the cases could not be influenced by other factors as well. But meeting those criteria do indicate likelihood that scientific expertise played a major part. Some of these issues involved more than one Presidential decision, and would therefore potentially be multiple cases for use in this research. This subsection addresses whether the methodology has answered the research question about whether such cases exist, and which issues represent the strongest examples for consideration as a detailed case study.

Detailed review of each of the cases would be required to provide a judgment, on balance, of how much scientific expertise mattered. For the three cases selected for further research, a review of counter-arguments was completed before final selection. That review is presented in the next section of this chapter (Case Selection). But the question of how much scientific expertise mattered will be reviewed again for each case in the observations section of each case study. The issue of whether there are such cases has been raised sufficiently that strong counter-arguments require careful justification.

Finally, each issue identified usually involved multiple Presidential decisions. Not all of those decisions turned on scientific expertise, even if the principals remember the issue as being mainly about scientific questions. For each case identified for further study, the Presidential decisions had to be identified and a specific decision selected. As Yin indicated, when the unit of analysis is a single decision, care must be taken to be clear what and when the decision occurred.

Initial review of the issues identified in this section suggested that the strongest cases might be found in the issues surrounding the swine flu vaccination program in the Ford Administration, the decision to commit to building a stealth bomber during the Carter Administration, and the banning of ozone-destroying chemicals during the Reagan Administration. All three of these represent very clear examples where the principals claim that science drove the decision. For all three, a rationale can be explained as to why the decision was not consistent with the thrust of the Administration's policies, and therefore all three are less likely to have been decided on ideological or partisan grounds.

Exploration of the swine flu issue led to a decision to include two decisions from that issue as cases for further study. President Ford made four decisions about the vaccination program. The decision to stop the vaccination program in December 1976 is the decision that best matches the criteria for this study, because President Ford was now making a decision to end an effort to which he had committed significant personal prestige and political capital. That case will be one selected. However, it is clear that most of the persons mentioning the swine flu case as a strong example are referring to President Ford's decision to begin the national swine flu vaccination program in March 1976. While that does not meet this study's criterion of being clearly contrary to the Administration's policy approach, it would be desirable to use the start of that program as a case to explore the relevance of the 16 variables. Moreover, it is impractical to study the decision to stop without studying the decision to begin in sufficient detail. Therefore, the decision to start and stop will be treated as Case 1 and Case 2 for this research.

The Reagan decision to commit to a ban of ozone-destroying chemicals was selected as the third case. In the 1970s, studies on the impact of photodissociation of chlorofluorocarbon compounds (CFCs) began in government laboratories. Despite strong industry resistance to the very idea that CFCs could be harmful to the environment, significant efforts by NASA, NOAA and EPA scientists demonstrated that CFC release would lead to a reduction in ozone concentration in the stratosphere, with serious health consequences. Despite the Reagan Administration's suspicion about the value of environmental regulation, especially the banning of economically useful chemicals, the

U.S. led the successful international effort to phase out the use of CFCs as document in the Montreal Protocol of 1987. Writings emphasize President Reagan's personal involvement in making the critical decision to negotiate a binding commitment to reduce CFC production.

Since this is an exploratory study, three cases were considered sufficient to provide a basis for preliminary conclusions and to guide further research.

## Case Selection

**Case Selection Criteria and Approach.** Using the cases identified in the previous section, three cases were selected for the initial exploration of the role of variables identified from the science advice literature. The primary selection criterion was the strength of the evidence that scientific experts, their knowledge and advice, had been absolutely necessary to the President's decision. It is widely understood that no Presidential decision turns only on a single factor, including scientific expertise. But this research project seeks an understanding of factors that are necessary for a President to use scientific expertise, and therefore the cases must be the best ones available.

Three factors were used to select the cases: mention by the science advisers contacted in the preliminary research, mention of the importance of scientific experts in the memoirs reviewed, and a subjective review of the relative strength of the cases identified as examples of a strong case. As discussed in Chapter 3, consideration was also given to whether the President's decision was contrary to what was expected for his administration and personal priorities, as such cases are harder to explain away as not driven by the scientific evidence. Finally, a preference was given to cases with an extensive base of available data. For strong cases, it was expected that the Presidential decision would be well studied (although not reviewed for the variables of interest in this study). The preliminary review of cases in the section above provides a basis for tentative case selection. The case for and against the selection of each case, as a strong example where scientific expertise was a driving factor in the President's decision, will be reviewed in sections below.

**President Ford's Decision to Initiate the National Swine Flu Vaccination Program (Selected as Case 1).** Case 1 was selected because it was mentioned by three of the contacted science advisers as an outstanding example of a case where science had an impact on a President's decision, because a preliminary review of the case suggested it was a strong case of such an impact, and because information on the case was readily available. It represents a case where most commentators believe the President made the wrong choice, but for purposes of this study the most important factor is whether the President based his decision on scientific expertise rather than whether the experts were correct.

Case 1 was actually selected second. Case 2, President Ford's decision to suspend the swine flu vaccination program, was selected first. The emphasis on the case by the science advisers, and the preliminary review of the literature available made the swine flu issue one that should be addressed. But, at least at first review, it did not meet my desired criterion of a decision that would appear to be counter to the President's political interests or expressed policy preferences. However, as the case was reviewed it became clear that there was more than one Presidential decision about the swine flu vaccination program. The final decision, the one to suspend the vaccination program after President Ford had given it the full force of his prestige and commitment, did meet that criterion. Having decided that the decision to suspend would be one of the cases, it seemed necessary to also provide analysis of the initial decision to begin the vaccination program. For clarity of presentation, the two cases are presented in chronological order, so the decision to initiate the program is presented as Case 1.

***How the case was selected.*** Three of the science advisers I contacted mentioned this case as a very strong example of science advice leading directly to a Presidential decision. This was the only case that more than one adviser mentioned in their response to my inquiry. In addition, another Presidential science adviser mentioned in a 1999 panel discussion among all the living science advisers that he thought this was one of the clearest cases of scientific experts getting what they wanted on the basis of their expertise (APS Past Science Advisors Panel, 1999). He seemed to get agreement from people at the table, though no one added any specific comments. On the basis of such recommendations, it would seem desirable to address such a case when selecting the strongest cases for review of the presence or absence of the variables proposed in the science advice literature.

An initial search of writings on the case demonstrated quickly that there was an abundance of material available to explore the variables of interest to this study. The initial review supported the advisers' suggestion that there is a strong agreement that President Ford had based his decision on scientific expertise.

The 1976 swine flu vaccination program has been the subject of two short books, has been the subject of dissertations, and is a staple discussion in reports and popular articles about influenza pandemics and decision-making (Dehner, 2004; The Flawed 1976 National "Swine Flu" Influenza Immunization Program, 2005; Goetz, 2006; Neustadt & Fineberg, 1979; Silverstein, 1981). The Kennedy School of Government at Harvard has built as a series of 8 case study documents on decision-making about the swine flu program (Kleiman, 1996). Most of the principals are on the record with interviews about their participation in the decision-making to start the program; some of these interviews took place less than a year after the events, and some were much later. The formal documentation related to the case has been thoroughly explored. Even documents stored only at the Ford Presidential Library, the National Archives and Records Service, and the Centers for Disease Control archives have been well-documented in previous work or are available on-line. After a review of this material, it was judged likely that information relevant to the 19 variables of interest would be identifiable in this broad range of documentation.

A preliminary review of the most widely read work on the swine flu program – Neustadt and Fineberg's *The Swine Flu Affair: Decision-Making on a Slippery Disease* – confirmed the impression that this would be a strong case. Neustadt and Fineberg were asked to study a fiasco, and provide insight to the incoming Secretary of Health, Education and Welfare (HEW) on how to avoid making the same mistakes in the future. Neustadt and Fineberg conclude that President Ford based his decision on the best scientific advice available and that such advice was the vital basis for his decision. In their words, "politics had no part in it" (Neustadt & Fineberg, 1979, p. 25).

In fact, Neustadt and Fineberg's report indicates that this decision was based almost entirely upon Ford's acceptance of the experts' opinion – the opinion that something needed to be done to prevent a swine flu pandemic in 1976-77. The detailed analysis of the case will provide an opportunity to explore the degree to which science advice mattered, but an initial review supports the idea that this is a strong example of scientific expertise making a difference.

***Arguments against this as a strong case.*** The major arguments against the case being a strong example of scientific expertise influencing a Presidential decision were fourfold. First, some opposing press coverage and scientific experts at the time who argued that this was a decision based on politics rather than science. Second, scholarly work since the publication of Neustadt and Fineberg's book has taken issue with their conclusions. Third, this decision does not show up in any of the memoirs reviewed during case selection, so one might wonder how critical the science advice was to the decision. Fourth, the case does not inherently run counter to the ideology of the President or put him at odds with his political constituency, which was a selection criterion. All four of these arguments will be addressed in turn.

From the launch of the swine flu vaccination program, there were critics of the program who saw it as more of a political ploy than a health need. These critics fall into two groups: the press and the professionals. CBS News and the New York Times were critical of the program from the beginning. A member of the Walter Cronkite production team said afterwards "It was a rotten program, rotten to the core. We thought it was politically inspired … unwarranted … unnecessary" (Neustadt & Fineberg, 1979, p. 30). The CBS opinion hardened on the day after the announced, and was based largely on a combination of the timing and the impression of some scientists interviewed at the Center for Disease Control (CDC). The day President Ford announced the swine flu vaccination program was the day after the President had lost the North Carolina Republican Presidential Primary to Ronald Reagan, and was the first time during the campaign that President Ford looked vulnerable to Reagan's challenge. CBS reporters suspected that Ford wanted to make an announcement that showed he was Presidential, decisive, and had a deeper understanding of the country's needs than an outsider and challenger. CBS reporter Robert Pierpoint followed that hunch in asking researchers he knew at CDC about the program. The ones he asked told him that there was not enough information on swine flu to make a commitment to a national vaccination program, and they therefore assumed that the program had been forced on CDC leadership by political pressure from above. The CBS News team was always suspicious of the program from that first day forward (Neustadt & Fineberg, 1979, pp. 30, 64-65). Harry Schwartz of the New York Times editorial board wrote a series of editorials throughout the program questioning the rationale and impetus for the program (Silverstein, 1981, p. 124). After the vaccination program was suspended, Swartz wrote that the program suffered from "scarcity in the White House and in Congress of officials with sufficient sophistication in medical problems to be able to put biological reality before political expediency" (Schwartz, 1976).

The professional criticism of the decision to begin the program was initially limited to Dr. Sydney Wolfe and others at Ralph Nader's NGO Public Citizen, and J. Anthony Morris at the Bureau of Biologics. Dr. Wolfe raised doubts about the likelihood that this swine flu would be deadly, and suggested that the pharmaceutical industry was exaggerating the threat for profits and to squeeze out improved regulations. Dr. Morris was fired in early 1976 for a sequence of problems that could be summed up as a continuing disagreement about the proper role of vaccination and other public health practices. After being fired, he claimed that he had been responsible for the testing of the Swine flu vaccine and that it could cause serious allergic and neurological reactions, had a very low potency, and was completely unnecessary as the virus concerned was an ordinary pig virus, and not highly pathogenic, and had died out within two weeks of it's being detected.[3]

Unless Neustadt and Fineberg got the details of what happened completely wrong, contemporary critics were far off the mark. The press critics were perhaps understandably wrong. CBS, in particular, based their opinions on reactions from CDC staff that were unaware of the actual events that led up to the decision. As Neustadt and Fineberg point out, there were great scientific uncertainties about whether a pandemic would occur, and scientists who don't see a quantitative proof for an action will often ascribe the motive vaguely to politics. With respect to Wolfe, Nader, and Schwartz, it is hard to ignore that these individuals were challenging the appropriateness of major public health initiatives of any kind. Their critique of this program was the same challenge they would have for other health initiatives: that it benefits industry more than the public, is under-researched and too expensive, and represents unwarranted federal intrusion into citizens lives. These critiques, as well as Morris' claims, are challenges to the consensus view of public health policy and medical knowledge. They may be valid points, but they don't challenge Neustadt and Fineberg's point that scientific leadership recommended the program and that the President decided on the basis of the best scientific advice he was presented.

After Neustadt and Fineberg's report came out in 1979, there have been many reviews of the 1976 swine flu episodes. Many of these are no more than re-hashes whenever a new flu outbreak is suspected. Most reference Neustadt and Fineberg; some

[3] In the case of Morris, he had come to believe that, "There is a great deal of evidence to prove that immunization of children does more harm than good."

take issue with their conclusions, but offer no new evidence for such a dispute. The most explicit response to Neustadt and Fineberg is Arthur Silverstein's *Pure Politics and Impure Science: the Swine Flu Affair*. Silverstein was a science fellow on the Senate Health Subcommittee throughout 1976, and he felt that Neustadt and Fineberg missed the essential politics of the case as he saw it from Congress. Despite the title, Silverstein is actually defending scientific experts in his book, and believes that Neustadt and Fineberg are too willing to blame nefarious personal agendas among the scientists, when he believes they could have done nothing other than recommend the swine flu vaccination program. He sees a compelling combination of political and scientific reality in the March 1976 decision to begin the program. But he also argues that substantial unanimity in the scientific community was the determining initial condition for this decision, and that once the scientific position was established the political realities for the President and Congress required action. That's a strong argument that scientific expertise made a difference.

The third concern about selecting this case is the absence of the swine flu decision from the memoirs of President Ford, his science adviser and his national security adviser. It seems likely that the science adviser and national security adviser did not mention this episode in their memoirs because they were not involved. President Ford took his science advice from HEW. And the national security adviser was not involved because this was treated as a problem for the Domestic Policy Council, not the National Security Council. It is perhaps more surprising that President Ford did not mention the swine flu program in his memoirs. Perhaps this because the program was view so strongly as a disaster when he was writing, and he didn't want to bring up old arguments. In any case, we have his statements to Neustadt and Fineberg in 1977 about his reliance on scientific experts at HEW. In contrast to Ford's memoir, the Ford Presidential Library treats the swine flu episode as one of the most important aspects of the Ford Administration. The absence of swine flu from these memoirs is not sufficient reason to exclude it as a strong case.

Finally, the case does not meet the criteria of appearing to run counter to the political ideology or interests of President Ford. In reviewing Neustadt and Fineberg, it is clear that potential negative consequences were raised by his political staff as the President considered the decision to initiate the swine flu vaccination program. In addition, some in HEW were concerned to suggest that the program need not be in conflict with the Republican administration's goals of minimizing new federal programs that could better be conducted on a state or local basis. But in general, the decision wasn't inherently counter to the President's agenda or ideology; it was more of an issue that popped on the agenda unexpectedly. It was not primarily seen through a political lens. That does not disqualify it as a strong case for this study. The criterion of being counter to the ideology of a President was created to provide a counter to the view that such decisions are always made on political grounds with science used only to justify them after the fact. This case has sufficient basis for identification as a strong case without that criterion.

***Case 1 Selection Summary.*** The identification by advisers of this case as a particularly strong example where science advice mattered, supported by an initial review of secondary literature on the case, was sufficient to select it as a case study. A review of the arguments against this being a strong case was not convincing.

**President Ford's Decision to Suspend the National Swine Flu Vaccination Program (Selected as Case 2).** Case 2 was selected because it represented a strong case where the President's prestige had been committed to one course of action, but he chose to follow the scientific advisers in taking a different course of action. Counterarguments have never been raised to that viewpoint, although it could be argued that President Ford had no other choice, that it was more of a political decision than one based on expertise, or that President Ford no longer had his prestige committed to the program. On balance, the case was judged a strong case of scientific expertise driving a Presidential decision, for which there seemed a good deal of previous research and documentation on which to base this study.

***How the case was selected.*** When it became clear that the swine flu vaccination program was a case which many people thought was a strong example of a President responding to the insights from scientific expertise, one concern for selecting the case was that it did not represent an example where the President's prestige was at risk. But review of the secondary literature on the case suggested that the swine flu vaccination program included more than one Presidential decision. Since the President had committed his prestige to the initiation of the program, it seemed likely that the swine flu vaccination program could also offer an example of the President backing out of a decision to which he had publicly committed.

Once it was clear that the decision to stop the swine flu vaccination program would be one of the selected cases – it met all the criteria, including the interest in decisions against the President's interest – it was equally clear that the decision to start the program would have to be addressed and explored. So the two Presidential decisions, to initiate and eventually to suspend the vaccination program, were selected as a pair of relevant cases.

Since there was sufficient available material to explore the impact of the nineteen variables for the decision to initiate the vaccination program, it seemed likely that sufficient information would also be available for the decision to stop.

***Arguments against this as a strong case.*** Most of the literature on the swine flu vaccination program focused on the decision to begin the program, and most of the criticism is focused either on the decision to initiate the program at all or on the failure to distinguish between producing vaccine for swine flu and actually beginning a program of vaccination with that vaccine. No one seems to have explored the decision to suspend the vaccination program in December 1976. The general consensus seems to be that it was the right decision at the time, and was perhaps inevitable. But even without previous critiques of the decision, three counterarguments to this being a strong case should be addressed.

First, the decision might have been inevitable – essentially there might have been no decision to be made. By December 1976, the vaccination program was being accused of causing deadly side effects, and it was suspected that the program was unnecessary after swine flu had failed, thus far, to reappear. Yet even a short review of the secondary literature shows that President Ford did not call for a decision to end the program based on public outcry. These arguments had been made since October 1976, and the President had stood behind the program. The President continued to support the program until the experts came to tell him that that the balance of public health concerns now argued for ending the program.

Second, although there was a decision to be made, the Presidential decision might have been obvious. That is a weaker counterargument; if a President is presented with expert opinion that is overwhelming it may still represent a case of science driving the President's decision. In this case, the experts may have presented the President with a strong recommendation to end the program, but it would be hard to say the decision was obvious. Only a few days earlier, the technical team working the program had recommending continuation, and the decision to suspend required some serious discussion among the HEW leadership before it was presented to the President. Some flu experts would argue for years afterwards that the program should have been carried to completion.

Third, there could be an argument that the President no longer had his prestige tied up in this program, so he suffered no risk in going along with the scientists. The President had recently lost re-election to Jimmy Carter, and he might not have felt his reputation was tied up with swine flu. If so, he was mistaken, since the swine flu program is one of the key episodes in the Ford Presidency. Moreover, he had supported the program through it's troubled implementation, and he should have known that the press reports on the suspension of the program would suggest this had been a blunder from the start. While it is undoubted that President Ford must have been in a weary post-election state on December 16, he was still the person most associated with the swine flu vaccination program in the minds of the public. At the time, President Ford thought he might run against Carter again in 1980, and it would have benefitted him politically to let the Carter administration handle its termination. The impact of the program would be perceived differently if a swine flu pandemic did come later in 1977, or even in later flu seasons.

***Case 2 Selection Summary.*** President Ford's decision to suspend the swine flu immunization program in December 1976 qualifies as a strong case of a President acting on scientific expert judgment, under conditions where it might have been more advantageous politically for him to continue the program until his administration ended. Potential counterarguments to this as a decision driven by scientific expertise are not persuasive. Although detailed review of the case will provide another chance to explore alternative motives for the decision, that review can only be done at the level of detail that will be developed in preparation for assessment of the nineteen variables.

**President Reagan's Decision to Sign an International Agreement Binding the U.S. to Ban Production of Ozone-Depleting Industrial Chemicals (Selected as Case 3).** Case 3 was selected because it represented a strong case where the President's general ideological position, and that of his supporters, ran counter to the President's decision. The decision was influenced by many factors, and represented a position that evolved over time during the Reagan administration. But the scientific arguments that chlorofluorocarbons would eventually cause dangerous levels of ozone depletion were sufficiently convincing that the President chose to negotiate and sign an international agreement, the Montreal Protocol, committing the U.S. to join with other countries in eliminating the use of these ubiquitous, useful and profitable chemicals. He did so despite his administration's aversion to binding international treaties and to environmental regulation at home and abroad. President Reagan made this decision despite significant and open opposition from senior members of the administration, including the Secretary of the Interior.

***How the case was selected.*** This issue was identified by the science advisers contacting in the case identification phase, identified as a particularly strong case because it so contradicted the ideological approach to environmental legislation in the Reagan administration. The case was cited as an example where the President was eventually persuaded that the ozone-depleting chemicals were an exception to the generally poor arguments for environmental regulation. A review of on-line references made clear that the decision is considered an important decision by both supporters and detractors of President Reagan, and that many writers felt that the science made the difference. After a short review of the literature, it was felt that the most important decision that turned on science was the decision to negotiate binding international controls in the Montreal Protocol.

***Arguments against this as a strong case.*** The primary arguments against this case as a strong example of scientific expertise critical to a Presidential decision have not been made explicitly in previous literature. Most discussions of the decision assume that the President simply became convinced that there was a need to do something about chlorofluorocarbons. But there are two alternative interpretations that should be discussed.

First, is would be possible to argue that President Reagan was not hostile to new environmental regulations that required changes in industry, nor to international treaties. Such arguments are made in some reviews of the Reagan Administration, and the Montreal Protocol is often used as a prime example of his leadership on such issues. But such interpretations don't change that President Reagan campaigned on an argument that environmental regulations were stifling business, that his Administration sought to rollback existing regulations and challenge the need for new ones, and that he expressed skepticism about many environmental challenges, especially acid rain. While it may be true that the chlorofluorocarbon ban represents evidence that President Reagan could take more than one position on environmental matters, that actually makes this case more interesting. Why was this environmental regulation worth the costs, when others were not? And it is worth noting that members of the Reagan Administration fought against the Montreal Protocol for most of its negotiation, arguing that it was counter to the Administration's principles.

Second, one could look for evidence that the decision was not based on the scientific expertise arguing for chlorofluorocarbon effects on the ozone layer, but rather was a political decision. Science would then be used to justify the decision, rather than to drive it. The initial review of the literature did not support this interpretation. President Reagan did not trade support for the Montreal Protocol for some other political goal he wanted more. He did not provide this as boon to some part of this constituency (most of which actively opposed the idea). And, while taking action on ozone-depleting chemicals was popular among the public by the time of President Reagan's decision, he does not seem to have been driven by public opinion on the issue. In fact, the Administration seemed to drive public opinion on this issue rather than the other way around.

***Case 3 Selection Summary.*** President Reagan's decision to negotiate and sign an international agreement to ban chlorofluorocarbons qualifies as a strong case of a President acting on scientific expert judgment, under conditions where it might have been more advantageous politically for him to have opposed the international negotiations or to have weakened the restrictions on industry. Potential counterarguments to this as a decision driven by scientific expertise are not persuasive. In particular, arguments made that the Montreal Protocol shows that President Reagan was not a reflexive opponent of binding environmental restrictions make the case even more interesting, since understanding how scientific expertise contributed to this exception may provide clarity on when the science is good enough to influence a President.

**Case 1, President Ford's Decision to Initiate the National Swine Flu Vaccination Program**

**Introduction.** On February 4, 1976, a soldier in Fort Dix New Jersey collapsed during a forced night-time march and later died. It was eventually determined that he died from a strain of influenza different from those commonly in circulation. About 500 soldiers at Fort Dix had been infected with this strain, related to the types of influenza common in swine. The outbreak of an unusual form of flu at Fort Dix at the end of the winter flu season sparked a rapid sequence of research, planning and advocacy among health professionals. Over the next 41 days, led President Ford to initiate an unprecedented plan to vaccinate everyone in the U.S. against this strain of swine flu.

The question of whether to vaccinate was only raised to the President because of the advice of technical experts. The recommendation of experts was based on evidence about the initial occurrence and spread of this type of influenza in New Jersey, beliefs among medical researchers about the manner in which influenza pandemics occur, and technical assessments of the pharmaceutical industry and the health system's ability to conduct a vaccination program that could prevent a catastrophic outbreak of influenza. Before making his decision, the President was briefed on the scientific investigations, raised questions about uncertainty in the information, and sought advice from a range of scientists. Although no Presidential decision is entirely driven by scientific advice, it appears that President Ford made this decision based on what he understood as the best scientific information.

The public image of the resulting vaccination program is one of a political disaster and an implementation fiasco. The public impression seems to be that the

President should never have directed a major vaccination program for swine flu. But many of the participants at the time continue to say that they would make the same recommendations today if presented with the same information, and believe that President Ford made the right decision.

The focus of this case study is on the conditions which led to President Ford to treat the scientific experts' inputs as critical to his decision-making. The remainder of this case study is divided into four parts. First is a narrative review of key events that led the President to order a massive vaccination program. Second, the key elements of the case are captured for analysis in the timelines, decision decomposition and tables of key advisers defined in Chapter 3. In the third section, each variable is evaluated individually. In the fourth and final section, an assessment is made of the variables which can be excluded as not necessary for a President to make use of science advice, and other observations about the case are summarized.

**Narrative Review of the Case: From Fort Dix to the Oval Office.** The story of the swine flu vaccination program begins with an outbreak of respiratory disease at the Army Training facility in Fort Dix, NJ, in early 1976. Since Fort Dix was the initial training site for new Army recruits coming from around the country, infections from all over the country came together at Fort Dix and doctors there regularly observed outbreaks of respiratory diseases. Even the death of one soldier, who had refused the opportunity to be treated in the hospital and died during the stress of a 5-mile hike, was not unusual.

The discovery that this soldier and several others were infected with an unusual flu virus was accidental. A disagreement between one of the military physicians and a New Jersey health official over whether the spreading illness was influenza or adenovirus led them to send samples to the Centers for Disease Control (CDC) in Atlanta. It was discovered on February 12 that some of the soldiers, including the fatality, were infected with a new form of influenza virus designated A/NewJersey.[4] This flu was different from the strains of flu (A/Victoria and A/HongKong) responsible for most infections in the 1975-76 flu season. Furthermore, detailed characteristics of the new strain showed that it likely derived from antigen shifts in a swine virus that allowed it to infect humans (Neustadt & Fineberg, 1979, p. 5).

A new variant of influenza infecting a sizable number of soldiers was a matter of immediate concern to the military and the Public Health Service (PHS), in addition to the influenza research community. Even in a normal year, influenza can cause tens of thousands of deaths worldwide. Occasionally, it can generate a worldwide pandemic killing millions of people (World Health Organization, 2009). The most recent large-

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[4] There are many ways to describe an influenza virus, each with valid reasons for use in specific contexts. The flu virus may be described by the virus type (A, B, or C), by geographic origin (e.g. Hong Kong or New Jersey), year of isolation, virus subtype based on the Hemagglutinin and Neuraminidase structure(e.g. H1N1, H2N3), and it's natural animal reservoir (swine, birds or other mammals such as ferrets). For this case, the primary strains of interest are the two responsible for most seasonal flu in humans during the winter of 1975-76 (A/Victoria/1957/H2N2 and A/HongKong/1968/H3N2) and the new strain isolated from the Fort Dix outbreak (A/NewJersey/1976/H1N1). When it is necessary to make clear distinctions among them, they will be referred to as A/Victoria, A/HongKong and A/NewJersey. In most cases, however, the case will refer only to "swine flu" and mean A/NewJersey. A/NewJersey is the only one of these three strains to commonly infect swine.

scale pandemic experienced by the United States had been the Hong Kong Flu of 1968-69, estimated to have killed about a million people worldwide and 34,000 people in the United States (Paul, 2008, p. 1273). Such pandemics are most likely to occur after a virus mutation -- a shift in the antigens on the surface of the influenza microbe – to a new virus structure for which the population has relatively little immunity.

The worst influenza pandemic, the 1918 Spanish Flu pandemic, was believed to have infected about a third of the word's population, killing about 10% to 20% of those infected. That pandemic was arguably the most deadly disease in recorded history; estimates of worldwide deaths range from 20 to 100 million people (Taubenberger & Morens, 2006). It is hard to summarize the impact of the 1918 flu, and how large it looms in the minds of influenza specialists involved in public health. The total number of deaths, the rate of spread, the high contagion and mortality rate, and the surge of three deadly waves of flu around the world were out-of-scale with any other public health experience. The 1918 flu was also unusual in its ability to kill healthy people in the prime of life rather than just the oldest, youngest or health-compromised high-risk individuals. The impacts on society had no counterpart in modern history. The 1918 flu was a terrifying disease so prevalent that everyday life was affected in almost every community (Crosby, 1976; Dehner, 2004; Kolata, 1999; Taubenberger & Morens, 2006). The 1918 flu is considered a worst-case example of what the Public Health Service might see from an influenza pandemic. Nearly 60 years later, there was still no way of knowing how bad a pandemic could become, no certainty that a new pandemic would not become as bad as the one in 1918, and no treatment for influenza once infection occurred. Vaccination before infection had spread, and quarantine and sanitation afterwards, were the only tools available to the PHS. If an influenza pandemic like 1918 ever comes again, most experts suspect that those tools won't be enough to preclude a disaster.

On February 14, only two days after the isolation of A/NewJersey, the CDC hosted a meeting to discuss the potential impact of the new strain. The meeting was called by CDC Director David J. Sencer and included a variety of PHS researchers, the New Jersey physicians, and a good cross-section of influenza specialists from industrial, academic, military and government organizations. The primary purpose of the meeting was to determine what impact the discovery of A/NewJersey might have on the plans for vaccine produced for the 1976-77 flu season (Neustadt & Fineberg, 1979, p. 7).

Everyone present at the February meeting understood the need for a rapid decision. The notes of the meeting include the statement that "within the next 30 days or so a decision will have to made as to whether manufacturers should start production of vaccine to these new strains" (Dehner, 2004, p. 68). The vaccine formulation for the next winter's flu season must be made in early spring, since influenza vaccine requires about six months of preparation. Influenza vaccine production relies on the slow process of growing quantities of the relevant virus in fertilized chicken eggs. The pharmaceutical companies need early definition of what strains of influenza will be likely in the coming season and how much will be required (Gerdil, 2003). The people gathered on February 14 were part of the scientific and bureaucratic structure that made recommendations to industry on both of those questions.

Two committees were already scheduled to meet in March as part of the normal sequence of scientific advice leading to vaccine composition recommendations for the 1976 flu season. The two committees had different powers and responsibilities. The

Department of Defense (DoD) used a committee called the Armed Forces Epidemiological Board (AFEB). Based on its recommendations, DoD would purchase vaccine, ensure that all military personnel and veterans were vaccinated. In addition, the AFEB could maintain continual surveillance of any influenza and vaccine side effects through mandatory blood testing and integration of military hospital records. The Department of Health, Education and Welfare (HEW) convened a civilian Advisory Committee on Immunization Practices (ACIP) to make recommendations on vaccination planning for industry and the health community. Normally the ACIP could only recommend a formula to industry, would not be responsible for purchase, and had no power to compel that its recommendations be followed (Neustadt & Fineberg, 1979, p. 7). The participants in the February 14th emergency meeting wanted to understand what impact, if any, the new strain would have on their imminent decisions.

The assembled group had personal experience with responding to pandemics, and most of them believed that the Public Health Service had done less than it could have done to minimize the impacts of post-war influenza pandemics in 1957 and 1964. Slow decisions, mixed recommendations on vaccine preparation, and insufficient follow-through by state and local health officials had been identified as primary causes for thousands of preventable deaths. It was believed by many at this meeting that the next time a pandemic occurred, more could be done to prevent unnecessary death and the large economic impacts from widespread sickness. Studies by CDC had included recommendations for a more active role by government in ensuring adequate vaccination production and managing the immunization program (Dehner, 2004, pp. 57-59).

CDC studies had convinced them it could only happen with a stronger government intervention. Private companies were expected to be unlikely to produce the right amount of vaccine unless government provided incentives. In both of the post-war pandemics, the pharmaceutical companies had lost money on vaccine production. At government urging, companies had produced larger amounts of vaccine for those pandemics, but only sold half or less to health providers who treated the pandemics as similar to seasonal flu. In a normal flu season, providers gave immunizations only to the seriously ill, the aged, and children. A serious effort to stem a pandemic probably meant government guarantees to purchase much of the vaccine, improved surveillance networks for tracking influenza, a public relations campaign to get physicians and the public to actually follow-through with vaccination of a larger fraction of the public, and a more coordinated plan for getting the vaccine delivered to local physicians and clinics.(Dehner, 2004, pp. 59-60)

The February 14 meeting was focused on considering whether the discovery of A/NewJersey represented an early warning of what to expect in the 1976-77 influenza season. It was accepted by those present that a new flu strain might appear at a low level in one season, seed itself through the population over the summer with little evidence, and then break out as the dominant strain in the following flu season. The group wanted to determine what information would be needed, and could be gathered quickly, to judge whether the chance discovery of A/NewJersey represented early discovery of such an outbreak late in the winter season, or merely occurrence of a variant that would die out on its own. (Dehner, 2004, p. 69)

The participants addressed the small amount of information available, and discussed how to get more information, what guidance to provide to pubic health agencies in the near term and what, if anything, to say to the public. The available information was scarce, but did indicate two things clearly to those assembled:

- the strain was never before isolated, but it was clearly derived from swine flu, not the avian influenzas more commonly in circulation, and
- some of the infected soldiers had clearly been infected by interaction with other soldiers, so human-to-human transmission was possible for this strain. (Dehner, 2004, pp. 68-72)

Even in that first meeting, concerns were raised that A/NewJersey might be more than just another strain of influenza (Barry; Dehner, 2004, pp. 133-135; Neustadt & Fineberg, 1979, pp. 6-9). There were two factors that led the researchers to think particularly of the 1918 epidemic when considering A/NewJersey.

First, it was believed at the time that the 1918 flu had been a swine-related virus. A milder swine flu had circulated among humans until about 1930, but since then avian-derived influenza had dominated among human infections. A/Victoria and A/HongKong -- the common influenza viruses in 1976 -- were avian-related viruses. So the appearance of a new swine flu in humans inherently raised questions about a potential repeat of 1918 (Dehner, 2004, p. 74).

Second, in 1976 there was a widely circulating hypothesis in the influenza community that suggested that the next pandemic would be a reappearance of a virus related to the 1918 pandemic. The idea, called "recirculating reservoirs of influenza," was that that there were only about four types of influenza virus that could affect humans, and that these four types, with small variations, were always present in the human population. According to this idea, pandemics occurred when small mutations in one of these forms of virus led to rapid spread among people who were young enough to have missed the last pandemic of that type of influenza. In support of the "recirculating reservoirs of influenza" hypothesis, proponents argued for similarities between the 1957 pandemic and historical accounts of a pandemic in 1889, and between the 1968 pandemic of A/HongKong and an 1899 outbreak. Since anyone exposed to the 1918 flu would be in their fifties by 1976, a variant of the 1918 flu would be expected to spread well in the U. S. population. A related thought, though viewed as crude even among its advocates, was that the review of parallel pandemics suggested that a pandemic would recur about every decade. From the viewpoint of the "recirculating reservoirs of influenza," a variant of the 1918 swine flu was expected as the next great pandemic, and was expected to occur by 1978-79 (Neustadt & Fineberg, 1979, pp. 6-7).

Because these speculations about potential relationships to the 1918 flu formed the background for the discussion of the swine flu outbreak at Fort Dix, even the first discussions included consideration of the need for a larger-than-normal vaccination program. If there was little herd immunity to a swine flu, and especially if the flu was expected to strike as strongly at the able-bodied as it did at the health-compromised, influenza vaccination would be required for most of the civilian population. That expectation, in turn, had implications for both vaccine production quantities and the design of an immunization program (Dehner, 2004; Neustadt & Fineberg, 1979, pp. 11-12).

The consensus that emerged at the February meeting was to take several key actions before the March meetings that would make recommendations for the 1976-77 flu vaccines (Dehner, 2004, pp. 69-74).

- A thorough epidemiological survey would be taken in New Jersey to see how widely the swine flu had spread, in the hope of determining the communicability of the disease
- Industry would take the isolated strain and determine if it could support vaccine production, and, in particular, if production could ramp up to support total vaccination of the U.S. population.
- State and local health officials would be informed of the new flu strain and asked to increase surveillance across the country for evidence that the swine flu was spreading.

Initially the group decided against issuing any press releases or engaging with journalists about the new strain of swine flu. But discussion of the meeting and concerns about the potential of a pandemic spread to journalists focusing on public health issues. The CDC chose to hold a press conference on February 19 to provide basic facts about the Fort Dix outbreak. The prepared remarks made no mention of the 1918 flu, but in response to questions, Dr. Sencer did explain the potential connections between swine flu and the 1918 pandemic. Naturally the media included that potential connection in press reports and on television. The responsibility of the press for possibly overplaying the 1918 connection remains controversial among the scientific experts who participated in the lead-up to the Presidential decision.(Dehner, 2004, pp. 73-76; Neustadt & Fineberg, 1979, p. 8).

The results from the epidemiological surveys in New Jersey were more confusing than enlightening. The military could command all personnel in New Jersey to provide blood samples that could be checked for swine flu antibodies. Such samples showed that over 500 soldiers had been infected with swine flu, most of them without noticeable symptoms. On the other hand, the state health service could find no evidence for the spread of the virus outside of Fort Dix, but could only conduct a more limited sampling of New Jersey citizens. The surveys clearly showed that the new strain was communicable among humans. But the surveys could neither confirm nor deny contagion rates or severity of symptoms (Dehner, 2004, pp. 84-93; Neustadt & Fineberg, 1979, p. 8). The flu season was winding down in late February. Lack of spread beyond the base could be taken as a sign of low contagion, or merely as a late outbreak that had no time to spread. Just how contagious and virulent was this new strain of flu? Another outbreak, that could be monitored more carefully, would be necessary to measure those characteristics.

Industry began test production on samples of the swine flu strain. The new strain grew somewhat more slowly than an average influenza virus. However, there was reason to hope for more rapid production. Dr. Edwin Kilbourne, one of the country's most respected virologists, had invented a recombinant DNA technique to create virus strains tailored for good production characteristics. These genetically engineered vaccines would allow production at a faster rate while maintaining the correct antibody structure. Dr. Kilbourne had participated in discussions on isolating the new swine flu strain, and he proposed to make swine flu vaccine the first practical application of his approach. If Kilbourne's approach worked as promised, enough vaccine could be produced by August

1976 to vaccinate everyone in the U.S. against swine flu (Dehner, 2004, pp. 99-105; Neustadt & Fineberg, 1979, pp. 10-11).

In addition to the assignments for an industry study and an intense epidemiogical survey of New Jersey, participants at the February meeting agreed to alert state health organizations to the new strain of flu and its potential to be active in the waning flu season of early 1976. When possible, state officials were asked to report on unusual outbreaks of flu and to submit samples for analysis. This avenue produced no new data in the weeks between February 14 and the March 10 meeting of the ACIP. However, the lack of new information was not considered an argument against the possibility of swine flu spreading quietly in preparation for the next flu season, given the limited ability of the public health system to provide surveillance of flu epidemics[5] (Dehner, 2004, pp. 94-99; Neustadt & Fineberg, 1979, pp. 8-9).

If A/NewJersey had not been an issue, the committees would probably have recommended the production of something like the 1975-76 vaccine, which was a bivalent mixture of weakened A/HongKong and A/Victoria influenza. [6] Industry was

[5] Hospitals, doctors and state and local health departments rarely type influenza cases or even confirm that influenza is present (as opposed to a number of other diseases with similar symptoms) for most cases reported in health statistics as influenza. Only in cases with a clear contagion outbreak, or an unusual death potentially attributed to influenza, are local health systems likely to take the time to culture influenza virus and prove its presence in a patient. Typing the influenza virus is even more rare; such typing does not help with treatment of the patient. Given these limitations, information about the prevalence or absence of diseases reported as "flu" was taken with a grain of salt in epidemiological planning. If a national vaccination program would be attempted, or a major pandemic tracked without such a program, CDC would have to develop a more rigorous surveillance program based on structured sampling of the U.S. population.

[6] All influenza vaccine is initially produced by growth of a single virus strain in a single egg. The vaccine delivered for injection into patients may be of a single virus

already growing both strains in preparation for vaccine delivery in the summer. Now the options included continuing that approach, a trivalent mix that would combine those two strains with A/NewJersey, or parallel production of the bivalent vaccine with a monovalent vaccine addressing only swine flu. The trivalent approach would hedge the country's influenza vaccine bet more effectively, but would make all production and immunization dependent on a late start on swine flu vaccine. The bivalent vaccine alone would be inexpensive and easy to produce, but would ignore the risk from swine flu. A parallel approach would divorce the swine flu production risk from the bivalent vaccine already begun, but would require two shots for the public and potentially lead to confusion if the flu vaccines were available at different times. (Dehner, 2004, pp. 120-123)

Most of the participants in the February meeting were also represented at the two meetings in March that had been long-scheduled as the time for decisions on the vaccine formulations for the flu season of 1976-77. The ACIP met first, on March 10, and was therefore first to struggle with the relative importance of swine flu. (Neustadt & Fineberg, 1979, p. 125) The ACIP meeting took most of the day, with widespread discussions about the potential for a swine flu pandemic, the potential risks to production of vaccine for the A/Victoria and A/HongKong strains that would certainly be present in the next flu season, and the likely impacts on the federal, state, local and private health systems if the government sought to promote a massive vaccination campaign. The minutes hint at,

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strain (monovalent), or mix together more than one strain (bivalent, trivalent, etc.) to efficiently deliver immunity to more than one influenza variant. Of course, production of multivalent vaccine increases the amount of single-strain virus that must be grown by a factor equal to the number of strains in each injection dose.

and interviews after the fact indicate, that CDC staff participants were not enthusiastic about a major new program, suspecting that they would be blamed for not doing enough if a pandemic occurred and for wasting money if it did not. They agreed that the possibility of a pandemic existed, even if the uncertainty could not be quantified (Dehner, 2004, pp. 109-119; Neustadt & Fineberg, 1979, pp. 10-15).

Similarly, there was no way to estimate the severity of the swine flu. One death at Fort Dix proved nothing, yet it was hard to say that a high mortality could be excluded. The specter of 1918 haunted the discussion, and, as one participant said "flu can do strange things." Finally, the contagion among healthy Army recruits, together with the tendency of the 1918 flu to attack the healthy among all age groups and the worry that this swine flu might be related to that virus, led to a conclusion that assuming normal high-risk immunization would not be enough. Therefore the ACIP committee agreed that "the production of vaccine must proceed and that a plan for vaccine administration [should] be developed" (Dehner, 2004, p. 113). But there was not a strong consensus, and the group hoped more information would be discovered on the swine flu virus before they had to make a final decision (Dehner, 2004, pp. 109-119; Neustadt & Fineberg, 1979, pp. 10-15).

The AFEB, with a more focused mission, decided instead to pursue production of a trivalent vaccine for its specific military needs. They were willing to wait for a complete vaccine, since they had a captive population that could be vaccinated in an efficient manner over a short time in the fall. And it was clear that the military needs could be met with a small fraction of the swine flu vaccine production recommended by the ACIP. Both committees had recommended that plans for vaccination include swine flu, despite the relatively small amount of information available (Dehner, 2004, pp. 120-123; Neustadt & Fineberg, 1979, p. 125).

CDC Director Sencer was apparently convinced that the discovery of A/NewJersey required an early and massive response of the type laid out in the recommendations from studies of the 1957 and 1968 pandemics. His notes at the time show personal concern over the potential for a 1918-type event, and a belief that action was preferred over waiting and watching. Throughout the next year, he would sum up his perspective by indicating "the country could much better afford the costs of a unnecessary massive vaccination program than it could afford the impacts of a major pandemic." He thought production of enough swine flu vaccine for everyone should be planned, with parallel production of the bivalent vaccine incorporating the currently prevalent strains. The monovalent swine flu vaccine would be the critical one for widespread vaccination. He believed that industry should prepare over 200 million doses of swine flu vaccine over a period somewhat shortened from the usual 6 months. This was about four times the total production ever attempted for influenza vaccine (Dehner, 2004, pp. 124-127; Neustadt & Fineberg, 1979, pp. 10-16).

Sencer made personal phone calls to each ACIP member until he got their concurrence with a recommendation on a campaign to produce enough swine flu vaccine to immunize the U.S. population. He then drafted a memorandum that presented an established scientific need for a national vaccination program, and addressed alternatives to implement it. Sencer's memorandum said that the ACIP would recommend "formally and publicly, immunization of the total U.S. population against A/swine influenza." He began the memorandum with a set of facts and assumptions that justified the need and capability to conduct such a vaccination campaign.  Then he summarized four options (No Action, Minimum Response, Government Program, and Combined Approach).  In classic bureaucratic maneuver, Sencer structured the first 3 alternatives to highlight problems that would be met with the Combined Approach.  His preferred option was for the U.S. government to purchase 200 million doses to inoculate everyone in the U.S., to initiate a major public information campaign on vaccination, but to allow private and State organizations to execute the programs on their own schedules and with their own resources.  Such a program would cost one-third of the second option, and Sencer believed it would alleviate Administration concerns about taking too much power and responsibility into Federal hands. The education campaign and the free provision of the vaccine to state and local agencies were, in his mind, the keys to getting large numbers of people vaccinated.  Federal procurement of the vaccine in bulk would ensure that it was produced in time by overcoming industry worries that their production would remain unpurchased inventory (Dehner, 2004, pp. 126-132; Neustadt & Fineberg, 1979, pp. 14-16).

Analysts of the swine flu episode point out that Sencer's memo had the bureaucratic effect of putting a gun to the head of the Administration.  Since it raised the specter of a major public health crisis, and proposed that something reasonable could be done to prevent it, the existence of the memo would stand as a condemnation of inaction if a pandemic occurred in 1976-77.   However, that is only true if one accepted that the science was settled, and that the best judgment by the experts was that something should be done to respond to the discovery of the swine flu outbreak.  The only reason to not act would be if you doubted that the science was settled – if you believed that Sencer and the two committees were far away from a scientific consensus – or if you thought that the consensus did not imply the need for action (Dehner, 2004, p. 132; Neustadt & Fineberg, 1979, pp. 16, 25).

On March 15, Sencer met with Dr. Jonathan Mathews, the Secretary of HEW, and other HEW officials to review the memo and ask for support. Mathews agreed with the argument that something would have to be done unless you could say the possibility of a pandemic was negligible. He also thought that the possibility of another 1918 had to be considered more than zero. Mathews realized that this couldn't be resolved completely inside of HEW. There was a need for additional funds; estimates provided to Mathews were that another $130 million beyond the HEW appropriation was needed, so Congress would need to be involved. Moreover, he concurred with suggestions from his staff that, given the uncertainties involved, everyone in the government would need to be on-board (particularly in a Presidential re-election year). Mathews sent a short note to James Lynn, Director of the Office of Management and Budget (OMB), summarizing the need for rapid action ("within the next week or two"), for a supplemental appropriation, and indicating that HEW would provide a recommendation to the President on the issue. This had now become a Presidential decision. Later that day, Mathews ordered copies of a recent book on the 1918 pandemic, *Epidemic and Peace, 1918* by Alfred Crosby, and gave them to HEW and White House staff. He gave one to President Ford in person at his next meeting with him. (Neustadt & Fineberg, 1979, pp. 17-19)

**Narrative Review of the Case: Presidential Engagement.** While it is possible that President Ford had heard about the Fort Dix outbreak of swine flu before it became a Presidential issue, it was introduced to his agenda on March 15. OMB Director Lynn discussed the issue based on Secretary Mathews note during a regular meeting with the President that afternoon, and told him that he should expect HEW to meet with him on the issue. (Dehner, 2004; Neustadt & Fineberg, 1979)

President Ford had a formal science adviser. In response to repeated requests from the scientific community, President Ford had given the formal title of Science Adviser to the President to H. Guyford Stever, director of the National Science Foundation. Stever had been asked to reconstitute an office to provide science advice to the President after the disbanding of that structure in the Nixon Administration. But President Ford did not ask Stever to take any role in the swine flu decision; instead he relied on HEW and the White House staff to provide him with proposals and advice (Dehner, 2004; Neustadt & Fineberg, 1979).

The White House staff – the Chief of Staff's Office, the OMB, and the Domestic Council – were predisposed to be skeptical of a major new program. They viewed Sencer, then in his tenth year as head of the CDC, as a holdover from past administrations who might be pursuing empire building not consistent with the Administration goals of "New Federalism." In any case, OMB is institutionally skeptical of any request for significant new funds. OMB examiners focused on potential ways to reduce costs, and focused on the option of stockpiling the swine flu vaccine while awaiting evidence of a swine flu outbreak. OMB argued that funding for vaccination, awareness and surveillance activities could be redirected from existing authorizations if stockpiling by manufacturers was instituted, instead of providing vaccine to state and local organizations as quickly as it was produced. OMB further argued that a rapid vaccination program could be undertaken in about six weeks if CDC prepared for it and surveillance could confirm outbreaks of swine flu quickly when they occurred (Dehner, 2004; Neustadt & Fineberg, 1979).

Dr. James Cavanaugh was the key staff participant outside of OMB. Cavanaugh was Deputy Director of the Domestic Council in the White House, and had managed the health accounts within the Domestic Council. He wondered if such a program was really necessary, and reached out to his contacts in the health community. He found support for the idea of a mass vaccination against the potential of a swine flu pandemic. With respect to the OMB proposal for stockpiling vaccines, he was told that such an option would be a mistake in an era when widespread air travel might overcome traditional quarantine approaches to controlling contagious diseases (referred to as the "jet-spread" argument during the discussions). By the time CDC could confirm a swine flu outbreak was more than localized, most Americans might be infected. It takes about two weeks for influenza vaccine to confer full immunity in adults, and a pandemic could be out of control during those two weeks (Dehner, 2004; Neustadt & Fineberg, 1979).

The formal meeting seeking Presidential concurrence for the HEW recommendation was held on March 22, 1976, in the Oval Office. Participants were limited to Mathews, Ted Cooper (HEW Assistant Secretary for Health), Dick Cheney (President Ford's Chief of Staff), Cavanaugh, Spencer Johnson (Cavanaugh's replacement for health issues on the Domestic Council), Lynn, Paul O'Neil (OMB Deputy Director) and the President. OMB had prepared a memo raising uncertainties about the assumption of a swine flu pandemic. Most of the memo was devoted to the stockpiling option, and implied it could save costs and better deal with the uncertainties. However, OMB ignored the jet-spread argument, and suggested that most of the new appropriations would still be required if the federal government took the unprecedented step of procuring the swine flu vaccine in order to ensure sufficient industrial production. HEW had prepared a presentation on the need for action and the details of the Combined Approach (Dehner, 2004; Neustadt & Fineberg, 1979).

According to participants, the meeting was more discussion than presentation. Primarily HEW made the arguments for action, and they made the points about jet-spread and the need for the federal government to guarantee purchase of all the swine flu vaccine. But the group discussed the great uncertainties in whether there would be a swine flu pandemic, and the political and policy risks of both doing nothing and going all-out. If no pandemic came, the Administration would be seen as needlessly frightening people and wasting money. If it did come, they would be blamed for not preventing the deaths and illness that would undoubtedly occur despite preparations. And the group recognized the uncertainties about what they could accomplish even if they tried. In particular the vaccine might not be produced on time or in sufficient quantities, since neither had been done on this scale before (Dehner, 2004; Neustadt & Fineberg, 1979). [7]

In an interview in 1977, President Ford said that his feelings during this meeting were that he wanted "to gamble on the side of caution." He further said,

> "I had a great deal of confidence in Ted Cooper and Dave Mathews. …Now Ted Cooper was advocating an early start on immunization, as fast

[7] A key aspect of producing influenza vaccine is the availability of fertilized eggs. The Department of Agriculture had been contacted in mid-February to let them know of the potential need for many more fertilized eggs than normal, which in turn meant that the normal yearly cycle of killing roosters for meat in late February should be delayed. Before the meeting, Mathews had contacted Secretary of Agriculture John Knebel to make sure that fertilized eggs were still being produced, and was reassured that "The roosters of America are ready to do their duty."(Neustadt & Fineberg, 1979)

> as we could go … So that was what we ought to do, unless there were some major technical objection." (Neustadt & Fineberg, 1979)

President Ford pressed mainly on those points where there might be a technical objection. What was the likelihood of a swine flu pandemic? (No one was willing to estimate a number.) What was the likelihood that we could accomplish a mass vaccination? (No one knew. But they felt that immediate action, involving an unprecedented Federal response, could improve the possibility.) Were there any alternatives? None were offered. The stockpiling option had been rejected as not meeting the risk if a pandemic did occur, and wasn't mentioned to the President. Did all the relevant experts agree that this was the right course of action? HEW and White House staff had uncovered no dissenters (Dehner, 2004; Neustadt & Fineberg, 1979).

On this last point, Paul O'Neil raised the suggestion that a group of medical experts not involved in the normal influenza community should be consulted to see if there were dissenting views. As he remembers it, he thought that the President had to rely primarily on scientific judgment, and so the scientific community ought to have to go on record with its beliefs. President Ford thought this was a very good idea, and asked Cavanaugh to organize a meeting where he could hear directly from the best experts on the subject. Participants remember a call for a full spectrum of scientific views. Given the apparent urgency to begin vaccine production if a total vaccination of the population was envisioned, the President wanted the meeting in two days (Dehner, 2004; Neustadt & Fineberg, 1979).

Cavanaugh had to quickly get the best scientists to a meeting at the White House. Availability and familiarity with the problem were both important criteria, but Cavanaugh also wanted to ensure that any dissent or unstated problems with the HEW proposal would be brought out in the discussion. He hit on the idea of inviting both Dr. Jonas Salk and Dr. Albert Sabin to the meeting. Salk and Sabin were professional and personal rivals, and were likely to find problems in anything the other supported. The list would need to include the most well known experts to the American public. Table 4-7 shows the experts he selected.

- Dr. Fred M. Davenport, of the University of Michigan
- Dr. Maurice Hilleman, of Merck, Sharp and Dohme Research Laboratories
- Dr. Edwin D. Kilbourne, of the Mount Sinai School of Medicine
- Dr. Harry M. Meyer, of the Food and Drug Administration
- Dr. Albert Sabin, of the Medical University of South Carolina
- Dr. Jonas Salk, of the Salk Institute for Biomedical Sciences
- Dr. David J. Sencer, of the Centers for Disease Control
- Dr. Reul Stallones, of the University of Texas

**Table 4-7. Members of the Blue Ribbon Panel of Scientific Advisers who met with President Ford on March 24, 1976**

He invited Dr. Kilbourne, who would command the respect of the U.S. scientific community. Dr. Maurice Hilleman was personally responsible for the development of more vaccines than any other researcher in the twentieth century and could address the practical implementation of industrial capacity as a Vice President of Merck Pharmaceuticals (Offit, 2007) . Cavanaugh invited two other prominent virologists who were on existing government boards, but not currently on the ACIP or AFEB. He added Sencer and Meyer of HEW as members of the panel, even though their support of the program was well known (Dehner, 2004; Neustadt & Fineberg, 1979).

The March 24 meeting was a large one, held in the Cabinet Room at the White House. All participants in the March 22 meeting were there, as well as the assembled group of scientific experts, additional staff from the White House and HEW, a small group of state health officials and a representative of the American Medical Association. HEW gave a briefing on its proposal. President Ford then asked Salk for his opinion. Salk strongly backed the HEW proposal, and emphasized that influenza was a major disease deserving Federal action. President Ford then asked for the opinion of Sabin, then Hilleman; both endorsed the program. He went around the table seeking the views of each member of the panel. Eventually Ford asked for a show of hands on proceeding with the HEW proposal; all the hands went up. He asked for dissenting perspectives, and got none. Then he said he would wait in the Oval Office for a short time after the meeting if anyone had concerns that had not been addressed. (Dehner, 2004; Neustadt & Fineberg, 1979)

Ford then went to the Oval Office with Cavanaugh and Cheney to discuss how to announce the program. Having found no technical weakness in the HEW proposal, President Ford preferred to announce it immediately, begin the actions that could be done within the Executive Branch and seek Congressional action at once. Believing that such a large group had been assembled that leaks were a certainty, the President arranged for a Press Announcement within the hour. He returned to the Cabinet Room and asked Salk and Sabin to join him in the announcement, and asked Mathews and Cooper to come and answer detailed questions from the press. (Dehner, 2004; Neustadt & Fineberg, 1979)

At the press event the President provided a summary of the issue and the Administration's plan (*President Gerald R. Ford's Remarks Announcing the National Swine Flu Immunization Program*, 1976). His decision was to identify three actions:

> First, I am asking the Congress to appropriate $135 million, prior to their April recess, for the production of sufficient vaccine to inoculate every

man, woman, and child in the United States.

Secondly, I am directing the Secretary of HEW David Mathews, and Assistant Secretary, Dr. Cooper, to develop plans that would make this vaccine available to all Americans during the 3-month period from September to November of this year.

Finally, I am asking each and every American to make certain he or she receives an inoculation this fall. Inoculations are to be available at schools, hospitals, physicians' offices, and public health facilities.

**Abstracting the Case: Timelines.** Figure 4-1 presents the Presidential Decision Timeline for President Ford's decision to begin the National Influenza Immunization Program. Over the course of 1976, President Ford made four decisions about the swine flu program: to begin an unprecedented program to immunize every American against swine flu, to turn down requests from our Allies for swine flu vaccine as it became available, to take action to ensure that liability protection issues did not prevent the production of the 200 million doses of vaccine, and to terminate the program of vaccination. Case 1 deals only with the time period, shown within the dashed box, between (1) the isolation of swine flu from the Fort Dix samples on February 12 and (2) the Presidential decision on March 24 to initiate the National Influenza Immunization Program. As discussed in the narrative above, the scientific experts made a case that a decision was required as quickly as possible if there was to be any opportunity to take preventative action to minimize the effect of a potential pandemic.

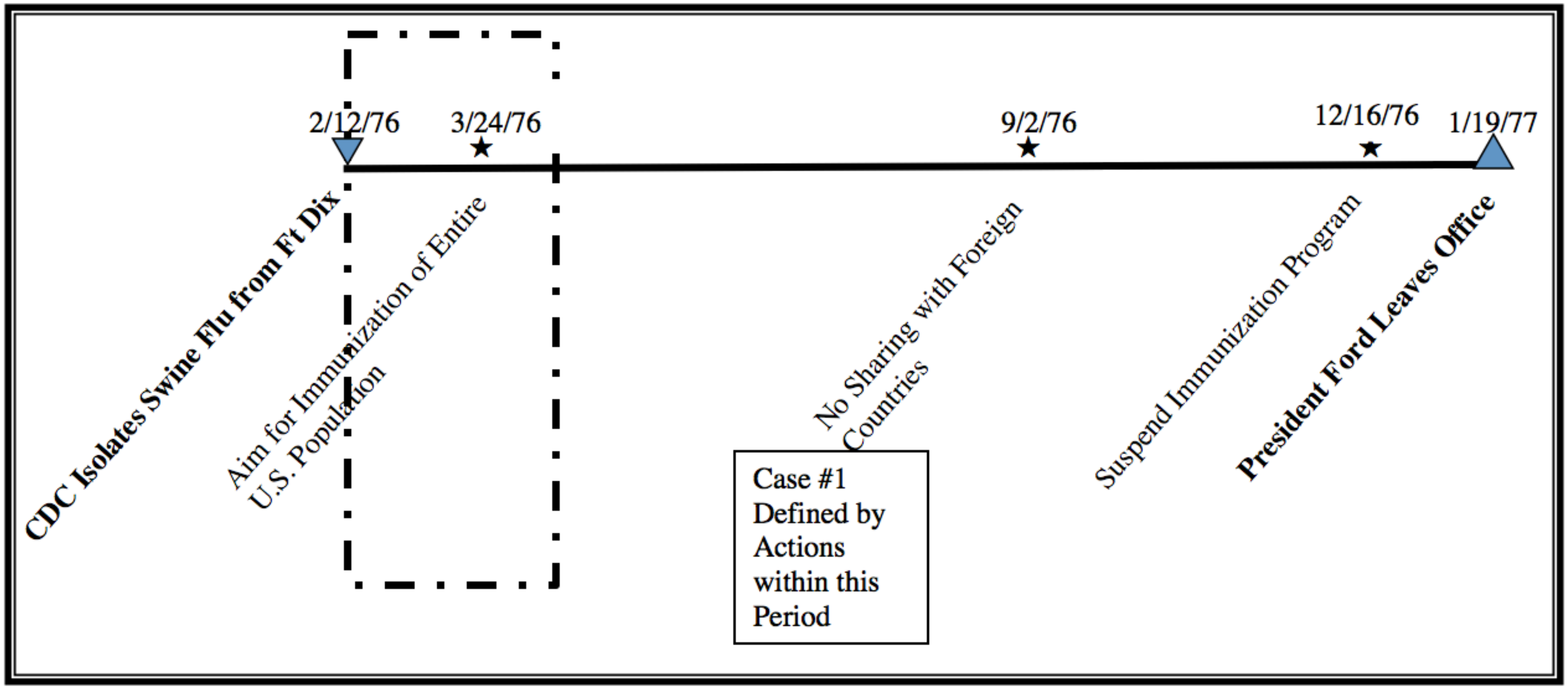


**Figure 4-1 Presidential Context Timeline for President Ford's Decision to Initiate the National Influenza Immunization Program (★denotes Presidential Decision)**

Figure 4-2 shows the Decision Analysis Timeline from the perspective of President Ford (the DAT-P). The forty-one days covered is a very short period for an item to go from initial discovery to being on the agenda for a Presidential decision. The dashed vertical lines in Figure 4-2 break the 41 days up into weeks. The President was formally brought into discussions on this issue only nine days before his decision, when OMB first raised the question of the HEW request for additional funds. Counting that initial meeting, the President was in four meetings where the proposed immunization program was discussed. Three of these meetings – the March 22 review of the HEW proposal, the pre-announcement meetings with the same officials on March 24, and the President's meeting with the *ad hoc* committee of scientific experts – were the primary mechanisms through which President Ford received advice to inform his decision. The March 22 meeting seems to have been a very wide-ranging discussion, with the arguments for the immunization program presented effectively but with a broad discussion of practical issues and likely drawbacks to such a program. The March 24 meeting was mainly devoted to the President's hour-long meeting with the scientific experts, and focused on his request for reassurance that there were no technical objections to the program HEW proposed. Figure 4-2 also shows the Republican primaries that occurred during this time, since they were clearly a major issue in the mind of President Ford and his advisers. President Ford won the first four of these handily, and was initially viewed as certain to win the Republican nomination. However, he lost the North Carolina primary to Ronald Reagan, and the nomination was in question from then until August.

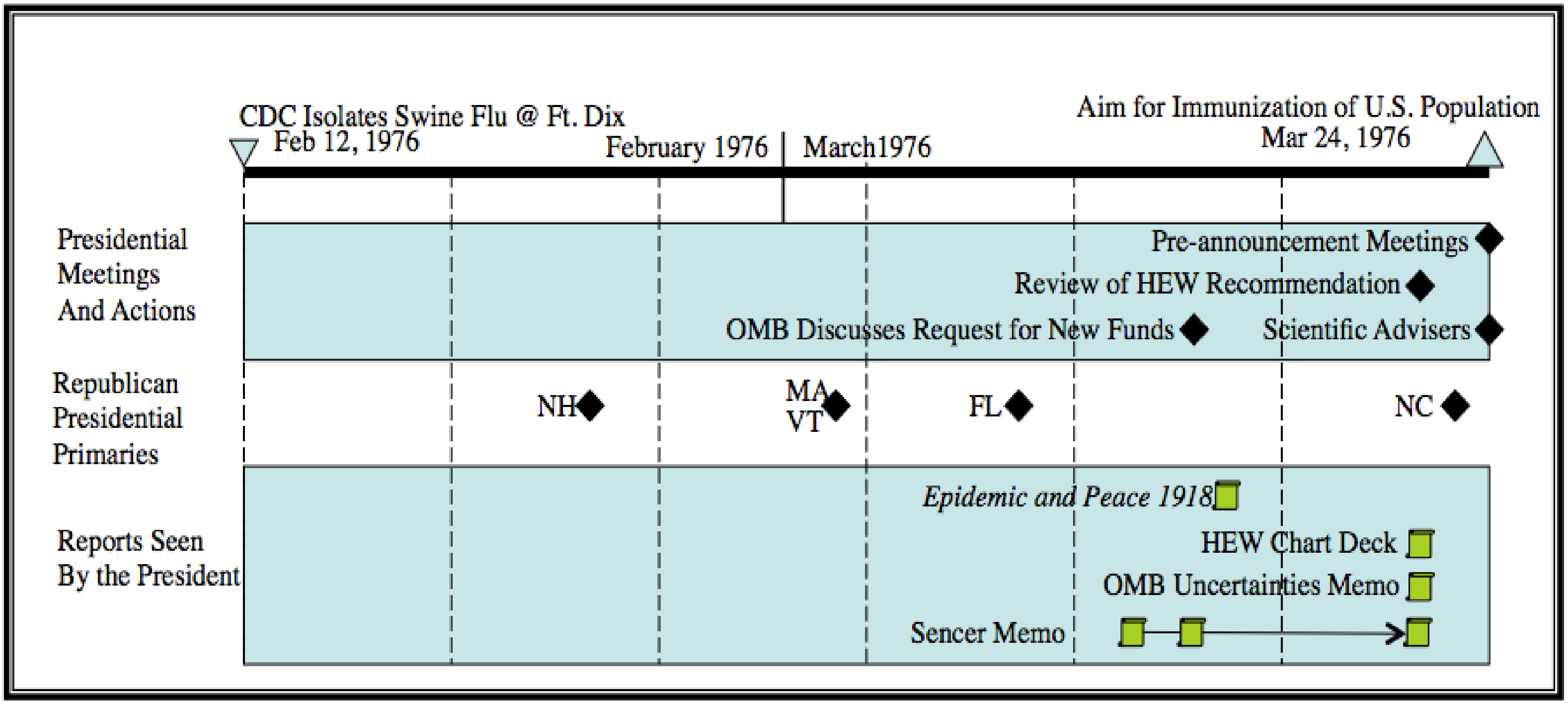


**Figure 4-2 Decision Analysis Timeline for the President (DAT-P) Regarding the Decision to Initiate the National Influenza Immunization Program**

The documents prepared for the President on this decision were few, and may have counted less than the in-person discussions with the President. It is unclear that President Ford read the memos, since he generally preferred to hear the arguments from his aides. He has been described as "brushing aside" the presentations in favor of discussion at the March 22 meeting. Matthew's decision to send over a copy of *Epidemic and Peace 1918* to ensure that the President had a background on the 1918 influenza was a potentially influential gesture. Comments from participants make clear that no discussion of this issue was engaged without someone discussing their own perceptions or family stories about the 1918 influenza pandemic (Dehner, 2004; Ford, 1979; Neustadt & Fineberg, 1979).

Sencer's memo is certainly the most critical document. The memo was prepared originally for Secretary Mathews and passed through to the President with no changes. It presented four options (do nothing, minimum response, government program, and combined approach) but did so mainly to argue that the combined approach would be best for the country (*Memorandum to the Secretary, Subject: Swine Influenza -- ACTION*, 1976). At core it made the argument that the risks of anything less than the combined approach were unacceptable. As at least one participant in the March 22 meeting noted, just the existence of the memo provided an incentive to act (Neustadt & Fineberg, 1979). If the President decided to do nothing, the memo was certain to leak at some point and lead to criticism that the Administration was uncaring about the potential death of Americans from a flu pandemic.

Figure 4-3, the DAT-S, shows a more active period of work in the 41 days from the viewpoint of the scientific experts. Once the CDC confirmed that swine flu was present in the lungs of four soldiers at Fort Dix, the relevant scientific community was very active in research, meetings, and seminars designed to find out as much as possible about the outbreak in New Jersey, the virus strain, and the potential for vaccine production. Major meetings are shown in the DAT-S, but daily meetings were held among some of the participants. The most important meetings among scientific experts (excluding the March meetings to advise the President), were:

- the CDC emergency meeting on February 12, in which all government organizations were brought up to date on the Fort Dix results, and a division of labor was agreed upon,
- the CDC press conference on February 19, where the news media were first introduced to the swine flu issue,
- the joint DOD and HEW workshop on vaccine production and immunization potential for swine flu,
- the formal meeting of the Advisory Committee on Immunization Practices (ACIP) on March 9, where a recommendation was made to immunize the total U.S. population against swine flu, and
- the formal meeting of the Armed Forces Epidemiological Board (AFEB) on March 12, which made a decision to request production of a trivalent vaccine, including swine flu, for all military personnel and veterans.

Together these five meetings laid the groundwork for a consensus among all the relevant parts of the U.S. Government that swine flu was a threat to public health requiring action before the next flu season. As shown on the Organizations and Committees line, the research, planning and advocacy was undertaken entirely by elements of HEW and DOD.

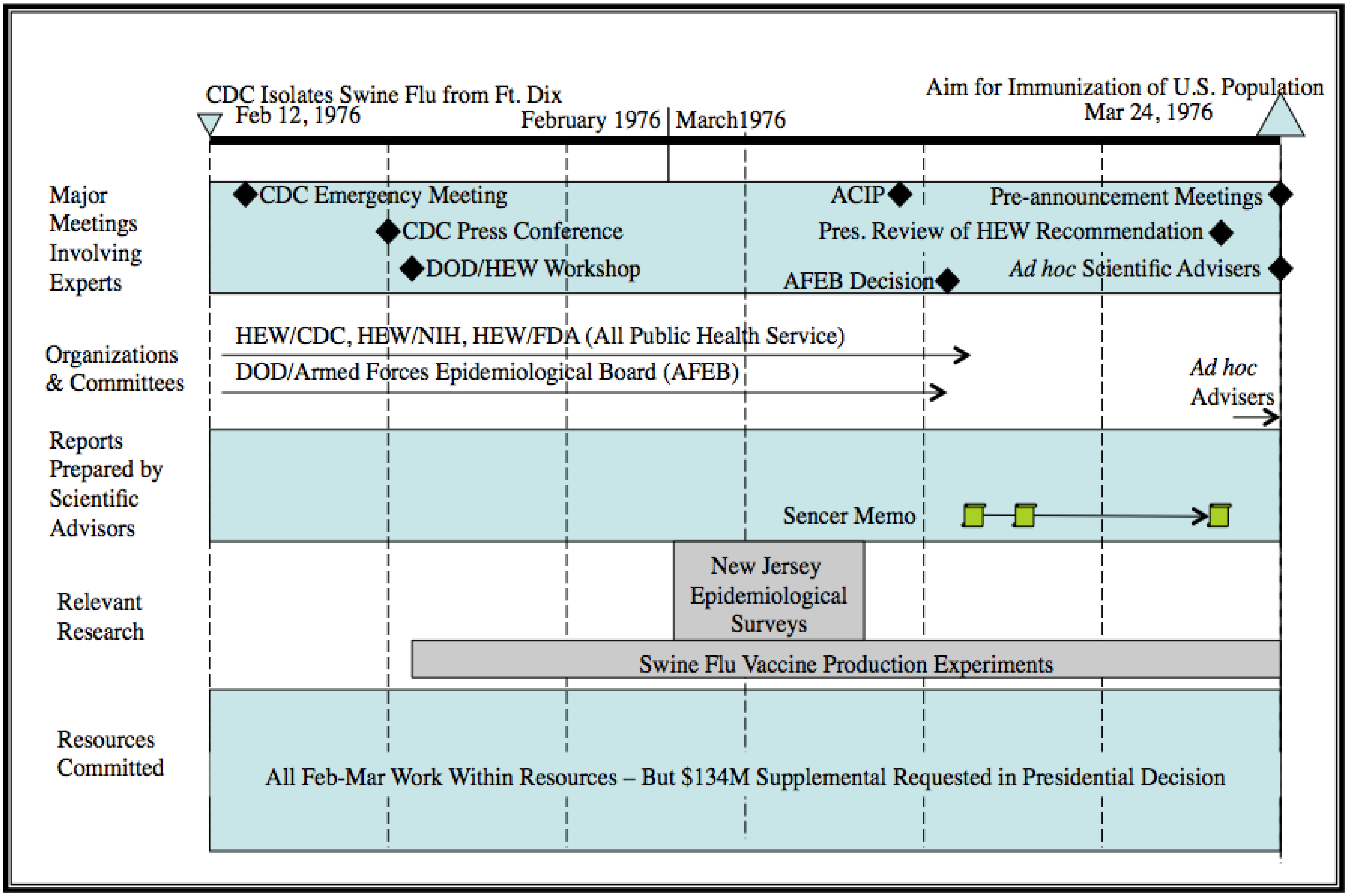


**Figure 4-3 Decision Analysis Timeline for the Scientists (DAT-S) regarding the decision to initiate the National Influenza Immunization Program**

Throughout this period, there is little doubt that the scientists involved wanted more information than they had at the time. They commissioned or began research on a variety of topics. They requested surveillance of influenza from the state and local authorities, and began an intense survey of the exposures in and around Fort Dix. None of the data provided them with confidence to determine whether the New Jersey strain of swine flu was an isolated outbreak or the initial signs of a new dominant strain of human influenza. Industry and the research laboratories also began to test the strain for vaccine production potential. They concluded that the Fort Dix strain would have to be grown quickly and in quantity. The recombinant DNA production approach proposed by Dr. Kilbourne offered hope that large-scale production was possible, but not with high certainty. There was little formal reporting of activity during this period, given the rapid pace of work and the large uncertainties involved. Most of the information was provided on a person-to-person basis among the researchers. The only report claimed to have the authority of scientific expertise was Dr. Sencer's memo, which distilled the information into seven facts and eight assumptions about the potential risk from swine flu.

**Abstracting the Case: Presidential Decision Decomposition.** Figure 4-4 provides the Presidential Decision Decomposition, which lists the questions that President Ford asked in preparation for his decision. There was a relatively small group of people in the March 22 and March 24 meetings, but interviews and minutes confirm that these were the questions on the President's mind. Much of the discussion on March 22 apparently turned on the no-win aspects of the decision: if there were a pandemic in 1976-77, no amount of preparation would be considered enough when Americans died despite vaccination, and if there was no pandemic the program would be considered wasteful. But President Ford kept coming back to what he described as technical questions. What are the odds? Could we do it? Is there any alternative view among the experts? He found comforting answers only to the question of the feasibility of a vaccination program. For the other questions he sought more information in the March 24 meeting with experts. In that meeting he focused only on two of these questions: whether there was any disagreement over the facts, and whether the experts agreed that a national vaccination program was the way to go.

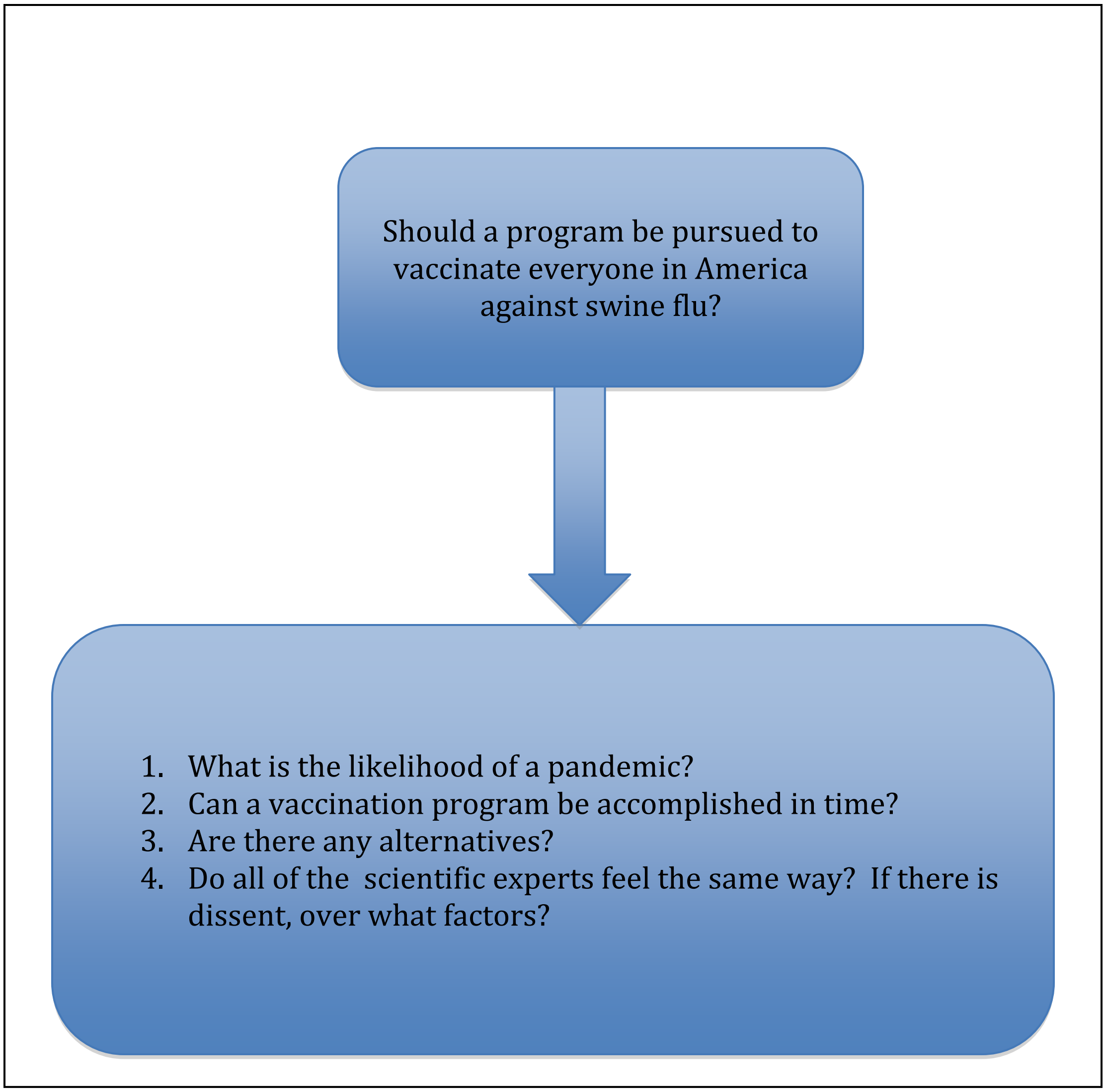


**Figure 4-4. Presidential Decision Decomposition for President Ford's Decision to Initiate the National Influenza Immunization Program**

**Abstracting the Case: Tables of Key Advisers.** Table 4-8 identifies the key advisers that the President relied on to make his decision. The key advisers were determined by the following criteria:

- Presidential statements. President Ford says that he relied on Mathews and Cooper and had a lot of confidence in their judgment
- Participation in the key meetings where the President addressed the issue. O'Neil was in all of them, and Mathews and Cooper in all but the March 15th meeting. Only O'Neil, Richard Cheney (the chief of staff) and James Cavanagh (a health advisor in the Domestic Policy Council) were in all of them.

| Adviser | Impact on Decision | Scientific Expertise |
|---|---|---|
| **Dr. F. David Mathews, Secretary of Health, Education and Welfare, 1975-1977** | Primary advocate for mass vaccination program to the President. Proposed program formally, and participated in all but one Presidential meeting on the topic. Trusted by President as an expert with good judgment and no ulterior motives. | PhD. in history, primary writings on effectiveness in higher education. Former President of University of Alabama during a period when improving preventative medicine was a major initiative. |
| **Paul H. O'Neill, Deputy Director, Office of Management and Budget, 1974-1977** | Advocate for the President to seek outside scientific expertise to be sure that all the experts felt the same about the elements of this decision | Primarily a manager and public servant. Bachelors in economics, and MBA. At the time of this decision, he had served in OMB for nine years. |
| **Dr. Theodore Cooper, Assistant Secretary for Health, HEW, 1975-1977** | Also an advocate for the program, and officially the primary adviser to the Secretary of HEW on matters of public health | Physician, cardiac surgeon, director of the Public Health Service |

**Table 4- 8. Key Advisers on President Ford's Decision to Start the National Influenza Immunization Program**

- Evidence that their proposals carried the President's mind. Mathews and Cooper eventually carried the day. O'Neil and Cavanagh were more suspicious. O'Neil was able to make his concerns seem more critical than budget or politics, and his suggestion to assemble a panel of outside experts was taken up by the President.

Of the three advisers in Table 4-8, only Cooper could be considered a scientific expert. Cooper is therefore included in Table 4-9, the key scientific experts relied on for this decision. The other experts selected are Dr. Jonas Salk and Sencer, for the reasons shown in the table.

| Scientific Expert | Impact on Decision | How Expertise Presented to the President |
|---|---|---|
| **Dr. Theodore Cooper, Assistant Secretary for Health, HEW, 1975-1977** | Also an advocate for the program, and officially the primary adviser to the Secretary on matters of public health | Participated in key decision meetings with the President, and was the expert on whom President Ford relied most |
| **Dr. Jonas E. Salk, Founding Director, The Salk Institute for Biomedical Sciences, 1960-1995** | Primary outside expert whose concurrence with the plan for mass vaccination confirmed, in the President and staff, that the plan represented the best scientific consensus | As a participant in an *ad hoc* committee of experts convened to provide input to the President's decision. |
| **Dr. David J. Sencer, Director, Centers for Disease Control, 1966-1977** | Primary government advocate for rapid action, driving the issue upward to a Presidential decision. Drafted the key memo that defined the problem, the timeline for decision, and the options considered. | Primarily represented by his March 15 memo, although his thoughts were echoed by Mathews and Cooper (who agreed on recommendations). He was also a participant in the *ad hoc* committee of experts. |

**Table 4-9. Key Scientific Experts Relied on by President Ford in his Decision to Start the National Influenza Immunization Program**

Sencer was certainly the driving force in proposing the national immunization program. He defined the option that was adopted, and made the case for urgent and extraordinary action. Not only a physician and researcher, he was viewed as someone with over a decade of experince making govenrment recommendations on matters of public health.  Cavanaugh felt Sencer needed to be on the panel of experts despite his obvious advocacy.

Salk is on the list, in preference to other outside experts brought into the *ad hoc* committee, because he provided his reputation, experience and enthusiasm to recommending the national immunization program at a time when President Ford was explicitly looking to see if there were alternative scientific opinions or technical objections to the HEW proposal.  President Ford was probably equally impressed by the recommendations of Salk and Sabin, but other participants who were more skeptical (like O'Neil and Cavanagh) were reassured particularly by Salk's enthusiastic endorsement of the approach, given that they knew Sabin was already on record as supporting the HEW proposal.

**Assessing the Variables: Variables on the Advisory Mechanism.** Table 4-10 summarizes the assessment of the Advisory Mechanism variables for President Ford's decision to begin the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **Single Strong Adviser** | **No** |
| **Policy Advocate** | **Yes** |
| **Committee Created for this Decision** | **Yes** |
| **Committee of Standing Advisory Body** | **Yes** |
| **Reports Prepared in Advance of Issue Reaching the Agenda** | **No** |
| **Direct Report to the President** | **Yes** |
| **Communication (without a policy recommendation)** | **No** |

**Table 4-10. Assessment for Case 1 regarding the Variables on the Advisory Mechanism**

***Single Strong Adviser.*** President Ford did not rely on a single strong science adviser to lay out the science and tell him the scientific facts of the case. There are three lines of evidence that he did not do so. First, using the operationalization of the variable from Chapter 3, it is clear that none of the potential science advisers meet the criteria established by the three questions. Second, the President went to great lengths to seek information directly from other scientific experts in the meeting he called for March 24, showing that he did not rely on the opinion of only one senior expert. Finally, he did not make use of the official President's science adviser to help with this issue.

The candidates for a Single Strong Adviser, as shown in Table 4-9, are Dr. Theodore Cooper, Dr. Jonas Salk, and Dr. David Sencer. Each fail the tests for a single strong science advisor based on the three questions defined in the operationalization of this variable in Chapter 3. The key question that disqualifies all three is "Does the President base his decision on that person's summary, as opposed to seeking other advice in the weeks leading up to the decision?" In an interview about the decision in 1977, President Ford said that he relied heavily on the advice of Cooper and Mathews. But in the March 22 meeting, he expressed the view that he did not feel that his internal advisers provided him with enough confidence on the state of scientific knowledge and consensus (Dehner, 2004, p. 140; Neustadt & Fineberg, 1979, p. 25). In a 1977 interview, President Ford recalled:

> I had a great deal of confidence in Ted Cooper and Dave Mathews. …Now Ted Cooper was advocating an early start on immunization, as fast as we could go … So that was what we ought to do, unless there were some major technical objection. (Neustadt & Fineberg, 1979, p. 25)

His exception "unless there were some technical objection," shows Ford's desire to seek a broader perspective on whether the program was necessary, feasible and the best course of action. In this sense, the President was seeking more expert input.

In the March 22 meeting, Paul O'Neil raised the suggestion that a group of medical experts should be consulted to see if there were dissenting views. As he remembers it, he thought that the President had to rely primarily on scientific judgment, and so the scientific community ought to have to go on record with its beliefs. President Ford thought this was a very good idea, and asked Cavanaugh to organize a meeting where he could hear directly from the best experts on the subject. Participants remember a call for a full spectrum of scientific views. The President remembered that he asked for the best scientists, to see if this was indeed the right course of action, and whether there were other opinions (Dehner, 2004, pp. 140-142; Neustadt & Fineberg, 1979, pp. 26-28). Did all the relevant experts agree that this was the right course of action? HEW and

White House staff had uncovered no dissenters. Here was a chance to reach more broadly into the scientific community.

From the day of the March 24 meeting forward, there has been controversy over whether this meeting was a genuine outreach for advice. Critics of the swine flu decision argue that the decision was already made on March 22, and that the gathering of scientific experts was done only for show: to enlist their visible support for the program in a forum where dissent would be unlikely or where dissenters would be excluded. The primary arguments that the meeting was *pro forma* are: that the President announced the program the same day, the fact sheet on the program was already printed up before the meeting, and the meeting included a range of federal, state and local officials that might have intimidated the scientists. As noted above, O'Neil acknowledged that he was interested in getting the scientific support on the public record. He felt that the President was putting a lot on the line based on their expertise, and wanted their reputation on the line as well as the President's.

On the other side of the argument are: the memories of the President and key advisers that this was a genuine outreach for a variety of opinions, the effort made by Cavanaugh and others to gather the best scientists, the President's manner in the meeting when he asked the scientists one-by-one if they thought this was the right course of action, and the concern reflected by Sencer to shore up support for the program during the time between the March 22 and March 24 meetings (Dehner, 2004; Neustadt & Fineberg, 1979). Sencer was certainly trying to call the selected scientists to ensure that they would support the program, and that very effort indicates that he did not believe the decision had been made, and that he thought the President would be influenced by what they said (Neustadt & Fineberg, 1979, p. 28).

The March 24 meeting undoubtedly served more than one function. It was used to explore whether there were dissenting views among experts, to provide visible scientific backing for the program proposed by HEW, to create a sense of urgency among state and local officials about the need to prepare for mass vaccinations, and to enlist some of the most famous names in medicine for public relations about the need for vaccination. For purposes of this variable assessment, it is clear that the President did not make the decision on the basis of the scientific summary of a single adviser, no matter how trusted. Seeking additional scientific opinions was one of the goals on March 24.

Finally, the President did not use the President's Science Adviser in this decision. President Ford had a formal science adviser, albeit one in transition in 1976. Ever since President Nixon had abolished the entire White House apparatus for science advice, H. Guyford Stever, director of the National Science Foundation, had held the title of Science Adviser to the President. Under President Ford, Stever had been asked to reconstitute an office to provide science advice to the President, to be established by law so that it could not be summarily dismissed. The reconstitution by law of the Office of Science and Technology Policy did not occur until May 1976, but Stever had the formal title and responsibilities throughout the Ford Administration. President Ford did not ask Stever to take any role in the swine flu decision; instead he relied on HEW and the White House staff to provide him with proposals and advice (Neustadt & Fineberg, 1979; Stever, 2002, pp. 220-226).

***Policy Advocate.*** The argument for the importance of the Policy Advocate position is that science expertise is more effective if presented as a strong argument for a specific action, and therefore uncertainties and disagreements about the proposals are minimized. The operationalization of the Policy Advocate variable required two things to judge its presence in a case: (a) the clear advocacy of a position by the scientists involved in providing expert advice, and (b) a tendency to downplay the good aspects of other alternatives and the uncertainties associated with the policy advocated. This case meets both those requirements very clearly, given the advocacy in Sencer's memo, the clarity of the HEW position, and the increased certainty with which a pandemic flu was predicted as the recommendations went up the chain to the President.

By the time the decision on initiating the swine flu vaccination program reached the President, it is certain that Mathews, Cooper and Sencer were arguing for a specific course of action. The Sencer memo itself represents the classic bureaucratic strategy of presenting only patently unacceptable alternatives to the preferred option (the "Combined Approach"), and explaining how that approach to the need so effectively that no other option is possible (Neustadt & Fineberg, 1979, p. 14). By the time of the March 22 meeting, all three of the key scientific experts shown in Table 4-9 were advocates for the program. The meeting with the President was described as addressing an HEW proposal for a massive immunization program, not a general discussion of the potential impacts of swine flu; Sencer's recommendation had become the Department's recommendation (Dehner, 2004, pp. 139-140; Neustadt & Fineberg, 1979, pp. 19-24). The responses of OMB to the memo were clearly couched in the context of responding to a specific program recommendation (*Swine Flu Influenza Program Meeting*, 1976).

From the CDC Emergency meeting on February 14 through the preparation for the meetings with the President, there was a systematic increase in the certainty of the language with which the likelihood of an influenza pandemic and the potential for large numbers of deaths was described. Participants at the CDC meetings remember thinking that there was perhaps as much as a 20% likelihood of a pandemic, and a much lower chance that such a pandemic would involve a recurrence of the 1918 levels of mortality. But none of them went on the record with such a subjective judgment, knowing there was no basis for quantifying their estimates (Neustadt & Fineberg, 1979, p. 19). Table 4-11 presents quotes from documents how the likelihood of a pandemic of swine flu was presented as the issue moved closer to a Presidential decision. As the information was transmitted upward, the pandemic was presented as more likely, and the consequences as increasingly dangerous.

The policy advocate variable is judged as clearly evident in this case. It was the intent of at least some of the scientific experts, and certainly of those whose work made it to the President, to make a strong case for nationwide vaccination against swine flu. Consciously or unconsciously, they made their case stronger over the last few weeks, despite having no new evidence on which to make stronger assertions.

Vanishing Uncertainty in the Likelihood of a Flu Pandemic

- February 14: "The real question is – is this the beginning of the next pandemic? ... This decision will be very difficult if the only evidence is that of a small localized outbreak at Ft. Dix." Dr. John Seal (Dehner, 2004, pp. 68-69)

- March 13: "There is a strong possibility that this country will experience widespread A/swine influenza in 1976-77." Dr. David Sencer (*Memorandum to the Secretary, Subject: Swine Influenza -- ACTION*, 1976, p. 2)

- March 15: "There is evidence there will be a major flu epidemic this coming fall. The indication is that we will see a return of the 1918 flu virus that is the most virulent form of flu. In 1918 a half million people died. The projections are that this virus will kill one million Americans in 1976." Dr. F. David Mathews (Neustadt & Fineberg, 1979, p. 19)

- March 24: "This flu strain, which has been dormant for almost half a century, was the cause of an epidemic in 1918-19 that killed an estimated 548,000 Americans ... Prior to 1930, this strain was the predominant cause of human influenza in the U.S. ... the President believes that it is important to take effective counter-measures to avoid an outbreak similar to the one in 1918." (*Fact Sheet Swine Flu Immunization Program*, 1976)

**Table 4-11. Quotes Showing the Increasing Certainty with Which a Pandemic of Swine Flu was Described over a February and March 1976**

***Committee Created for This Decision.*** There certainly was a Committee Created for this Decision. After the HEW recommendations were reviewed on March 22, the President decided to postpone the decision until after a group of experts, including scientists from outside government could be assembled. As discussed above, there was likely a mixture of motives for the meeting, but one of the goals was to see if there was unanimity among a range of scientists. President Ford had asked for a range of scientific experts, not just influenza experts (Dehner, 2004, p. 140). Because the HEW leadership made the argument that production had to begin within two weeks, the President asked that the meeting occur on March 24.

The March 24 meeting was to be a large one, held in the Cabinet Room at the White House. Cavanaugh was charged to quickly get the best scientists to a meeting at the White House. Meyer, Seal and Sencer drew up a list of fifty specialists including: scientists, physicians, manufacturing specialists, local and state public health leaders, an AMA representative, and a few elected officials. In their mind, the meeting should include representatives of all the groups that were required to implement the proposed vaccination program(Dehner, 2004, p. 141). Availability and familiarity with the problem were both important criteria, but Cavanaugh also wanted to ensure that any dissent or unstated problems with the HEW proposal would be brought out in the discussion (Neustadt & Fineberg, 1979, p. 27). Although large by White House standards, the Cabinet room would only fit 30 people. Cavanaugh found well-known scientists to fill about a third of those seats. Another third of the room was taken up by people who had attended the March 22 meeting (including the President) and additional White House staff. HEW filled the rest of the room with its choices from the federal, state, local and private health system.

The *ad hoc* group met only once, on March 24, but their consensus was key to the President's decision to proceed with the program. HEW gave a briefing on its proposal. President Ford then asked Salk for his opinion. Salk strongly backed the HEW proposal, and emphasized that influenza was a major disease deserving Federal action. President Ford then asked for the opinion of Sabin, then Hilleman; both endorsed the program. He went around the table seeking the views of each person. Eventually Ford asked for a show of hands on proceeding with the HEW proposal; all the hands went up. He asked for dissenting perspectives, and got none. The President said he would wait in the Oval Office for a short time after the meeting to meet with anyone who had concerns that had not been addressed (Dehner, 2004; Kolata, 1999; Neustadt & Fineberg, 1979; Silverstein, 1981).

It is easy to imagine the group being used more effectively, perhaps with a pre-meeting to discuss the issues, or to use time in the meeting for them to more explicitly distinguish the scientific uncertainties from the proposals for action. But there is no doubt that the President asked for and received advice from a Committee created for this decision (Dehner, 2004, pp. 140-143; Neustadt & Fineberg, 1979, pp. 26-28).

***Committee of a Standing Advisory Body.*** In addition to the special *ad hoc* committee, the decision relied on the action of a Committee of a Standing Advisory Body. The Advisory Committee on Immunization Practices (ACIP) is a standing committee of outside experts advising CDC on what vaccines should be produced each year, in what volume, and for what target populations. The March 10 meeting of the ACIP was the first step in recommending the program that the President approved two weeks later. Sencer's March 15 memo relies on the ACIP, stating that the committee "will recommend, formally and publicly, the immunization of the total U.S. population" against swine flu (*Memorandum to the Secretary, Subject: Swine Influenza -- ACTION*, 1976, p. 3).

In fact, on March 10, there was not a consensus among the ACIP that swine flu should be included in the plan for vaccinations in 1976-77. Some members of the group were very concerned about the limited amount of information. Others were convinced that the combination of antigenic shift in the swine flu virus and demonstrated person-to-person transmission were sufficient to call for a massive vaccination program. After the full-day meeting on March 10, the committee could only agree to enhanced surveillance, and a request to industry to be prepared to supplement the high-risk vaccine (targeted at A/Victoria and A/HongKong) with production of a monovalent vaccine for A/NewJersey. Over the next three days, Sencer called the members one-by-one to reach agreement on the wording in his memo (Dehner, 2004, pp. 110-114). Sencer felt that a public position by ACIP on the need for vaccination of the total U.S. population was critical to making the case for this unique vaccination program.

In addition to the ACIP, the Armed Forces Epidemiology Board (AFEB) is a standing committee in the DoD that determines the types and amounts of vaccine to be produced and used by DoD and the Veteran's Administration. The DoD order for influenza vaccine, which is intended to cover both DoD personnel and a range of other essential federal civil servants, makes up the largest single customer for influenza vaccines, although it was usually less than 20% of the total order placed with U.S. industry. The AFEB decided on March 12 that the DoD vaccine produced for the 1976 flu season should include a swine flu strain in a trivalent mix of A/Victoria, A/HongKong and A/NewJersey. The ABEB defined a dose concentration of all three strains, and recommended a purchase of 2.9 million doses. The DoD decision, while on much smaller scale than the National Influenza Immunization Program, increased the credibility of arguments that there was a need to prepare for a potential swine flu outbreak (Dehner, 2004, pp. 120-123).

The AFEB decision on March 12 provided a strong tool for making the case for a national immunization program. First, using only the same facts available to the ACIP, the AEFB decided that military effectiveness required giving swine flu vaccinations to the troops. That meant that swine flu vaccine would be produced, and that the military and key civil servants would be vaccinated. There would definitely be pressure to vaccinate everyone else, once this was known. Military personnel would probably want to know that their dependents were being protected, and that would only happen if swine flu vaccine were produced on a larger scale. And, if a pandemic occurred, it would now look as though the government had decided to leave the public at risk to an influenza that the military had judged a significant risk. It is not known what arguments Sencer used to convert the more cautious ACIP members between March 10 and March 13, but the AEFB decision must have been a powerful tool to argue for HEW action on swine flu.

***Reports Prepared in Advance of Decision Period.*** This variable reflects the idea that reports are prepared on an issue before the issue reaches the President's agenda will do a better job of laying out the facts than one prepared in the context of policy options. In this case, such documents either don't exist or did not have an effect on the President's decision.

Figure 4-2 shows the documents known to have been seen by the President about this issue. There weren't many: the versions of Sencer's memo, and the chart package prepared by HEW (which the President seems to have set aside without reading in favor of discussion.)) There documents were prepared in the last 11 days before the decision, and were clearly prepared in the context of recommendations to the President, not as dispassionate reviews of the proper approach to managing a potential pandemic.

One document on Figure 4-2 was completed before the decision, and was provided to the President, but it is not clear whether he ever read it. Around March 16, Mathews gave the President the book *Epidemic and Peace 1918*, the most recent of a long line of books detailing the overwhelming impacts of the 1918 influenza pandemic (Crosby, 1976; Neustadt & Fineberg, 1979, p. 19). If he read it, the book may have had some influence on letting the President understand how bad a pandemic could become. However, it is hard to credit the book as having a major impact alone, since tales of 1918 directly from his advisers supplemented it. Many of the advisers and leaders in this story had family stories about 1918 pandemic.[8] Each of the meetings from March 15 to March 24 seems to have included some relation of those personal stories (Dehner, 2004, pp. 133-135; Neustadt & Fineberg, 1979, pp. 17, 24).

There had been several studies and seminars produced before the decision that likely influenced ACIP members, Dr. Sencer and Dr. Cooper. A number of studies showed that there was very poor response during the 1957 and 1968 influenza pandemics, and suggested the need for a rapid, large-scale federal response if performance was to be better in a future pandemic (Dehner, 2004, pp. 54-55). Undoubtedly, these reports primed the scientific and administrative elements of the Public Health Service to recommend a non-routine response to the potential of a swine flu pandemic. But there is no evidence that these studies were seen by or even mentioned to the President. President

[8] Dr. Cooper's father was a physician treating patients in Pennsylvania during the 1918 outbreak. Dr. Cooper had heard stories of patients dying so fast that mass graves were the only practical public health option. Neustadt and Fineberg point out that "the worst case was vivid in the mind of the Assistant Secretary for Health" (Neustadt & Fineberg, 1979, p. 22).

Ford relied instead on the expert judgment of Cooper and Mathews about the relevance of the previous studies.

In any case, this decision came on very quickly, and there may not have been time for his staff to identify relevant reports. There is no evidence that the President was relying on the impartiality of reports prepared in the calmness of academic speculation as a guide to the current decision.

***Direct Report to the President.*** This decision involved scientific experts providing Direct Report to the President. All three of the scientific advisers listed in Table 4-9 had an opportunity to present directly to the President. Dr. Cooper – who was officially the primary adviser to the Secretary of HEW on public health issues – was present in all the major decision meetings with the President. Both the President and the Secretary of HEW turned to Dr. Cooper for scientific conclusions. Dr. Salk and Dr. Sencer made direct presentations to the President during the March 24 *ad hoc* meeting.

In addition, the President provided his *ad hoc* committee of scientific experts several opportunities to give him direct advice on March 24. President Ford devoted over an hour to questioning and listening to the *ad hoc* committee of scientific experts before finalizing his decision. The President wanted to hear and understand the arguments of scientists, and actively sought evidence for differences of opinion among them. He asked each of them for personal comments on the proposed action. He also offered each of them the opportunity to provide any concerns in a one-on-one discussion with him after the meeting (Neustadt & Fineberg, 1979, pp. 27-28).

***Communication (without a policy recommendation).*** In this case, there was no Communication (without a policy recommendation). The documentation provided and the meetings with the President were in the context of recommending a specific non-routine approach to the potential pandemic. In fact, the rationale for raising the issue to a Presidential decision was the perceived need to go beyond the routine capabilities of the Public Health Service in terms of budget, breadth of national action, and evidence of support within the Administration(Neustadt & Fineberg, 1979, p. 19). If the group were not recommending such action, there would have been no point in coming to the President.

**Assessing the Variables: Variable on the Role of Scientists**. On the scale of potential roles for scientists in the policy process, as presented in Figure 4-5, the scientists in this decision acted in Position 5: Participating in the Policy Agenda Development & Prioritization. The critical question, using the operationalization from Chapter 3, is "Do scientists claim to be addressing the balance of government priorities as well as scientific questions?" There is no doubt that the three scientific advisers identified in Table 4-9 do so. In the meetings, Cooper was part of discussions that balance technical, budgetary, political and other priorities. Sencer's memo explicitly made a comparison along the lines of balancing risks and priorities. Dr. Salk believed that this program represented an example of the right role for the government. At every step in the process – in the CDC, in the ACIP, at HEW and in meetings with the President – the scientific groups debated the relative importance of the issue.

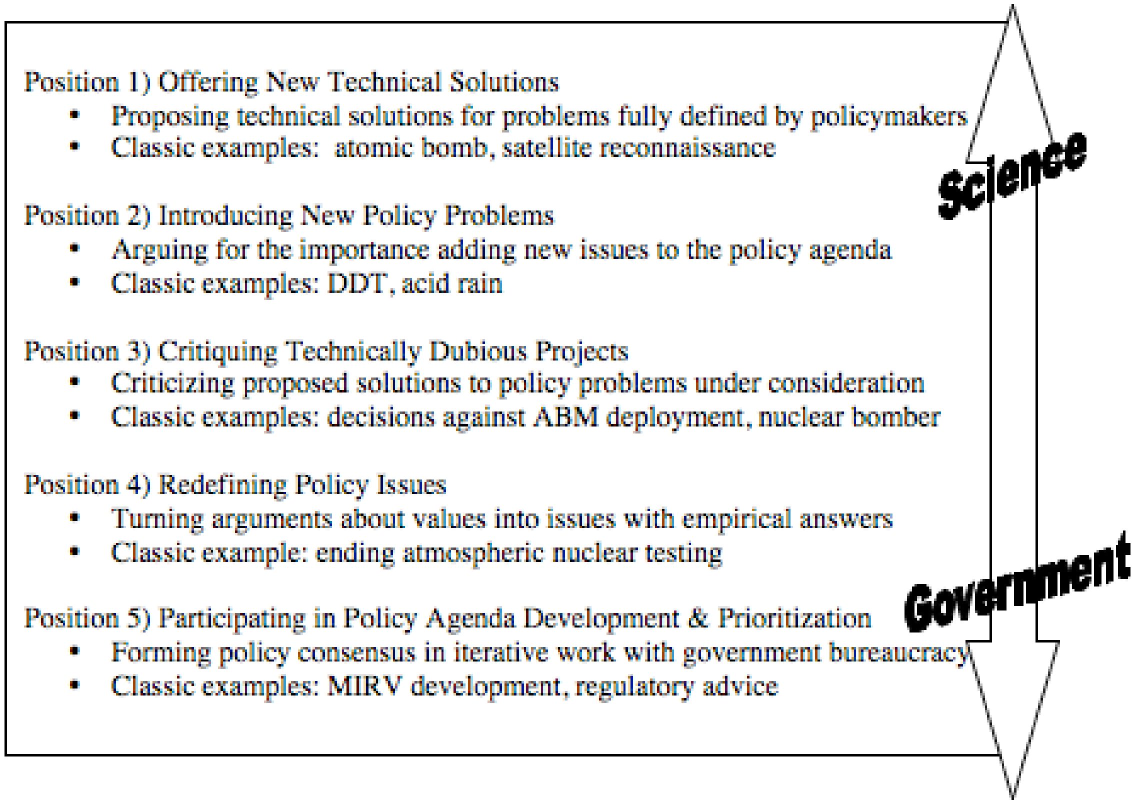


**Figure 4-5. Scale for the Role of Scientists in Influencing a Government Policy Decision**

Cooper's participation in the balance of government priorities was most obvious in the March 22 meeting. The meeting covered the need for action but also discussed freely a range of drawbacks that went well beyond technical issues. The political impact seems to have been heavily debated, since everyone agreed that this would likely be, overall, a losing issue for the President's re-election campaign: the vaccination program would be viewed as a waste of money if no pandemic occurred and likely viewed as insufficient if a major pandemic occurred. The difficulty of mounting a vaccination campaign was addressed, including the likelihood that many people would remain unvaccinated even with the best efforts (Neustadt & Fineberg, 1979, pp. 24-25). While

Cooper was an advocate, he did not present the HEW recommendation as without drawbacks or risks, merely the best option in a potentially bad situation.

For Sencer, the decision was not merely a technical one, but a cost-effectiveness issue. His memo explicitly stated, "The Administration can tolerate unnecessary health expenditures better than unnecessary death and illness." His memo argued for an unprecedented attempt to vaccinate as much of the nation as possible, which he believed would cost around $134 Million (*Memorandum to the Secretary, Subject: Swine Influenza -- ACTION*, 1976, pp. 4, 7, 9). But he believed that it would save far more in averted health costs. Discussions within CDC and among ACIP members quoted a cost benefit analysis by Joel Kavet that assessed the cost of the 1968 influenza epidemic at over $4 Billion. This cost-benefit argument would often be cited by CDC as a justification for the national immunization program (Dehner, 2004, pp. 111-112). The argument satisfied many in the ACIP; even if swine flu did not prove to be a 1918-like virus, it could still be appropriate to support the new vaccination campaign.

Dr. Salk said later that he supported the program because of the risks of a pandemic, but also because it provided an opportunity to educate the public on influenza and vaccination, and to provide a justification for future research. He thought the program was justified on its merits, but was also worth the expense as a step forward in improving the public health system(Neustadt & Fineberg, 1979, p. 27).

The scientific experts consulted generally acknowledged the political risks and impacts to the President if he pursued a massive immunization program and no pandemic emerged, but they concluded that the balance of risks required action. For all the scientists, there was a balancing act with other government needs in making the recommendation, especially in the context of other public health and research needs that would be eclipsed by this program (Dehner, 2004, p. 112). The position taken by the experts eventually was that it would not be acceptable, politically or morally, to say that they had an opportunity to prevent deaths and did nothing (Neustadt & Fineberg, 1979, pp. 12-14).

**Assessing the Variables: Variables on the Type of Expertise.** Table 4-12 summarizes the assessment of the four Type of Expertise variables for President Ford's decision to begin the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **Experts from Outside Government** | **Yes** |
| **Experts other than Advocates** | **Yes** |
| **Best Expertise on this Issue** | **Yes** |
| **Experience with Science Advice** | **Yes** |

**Table 4-12. Assessment for Case 1 regarding the Variables on the Type of Expertise**

***Experts from Outside Government.*** The use of Experts from Outside Government is clear, and was explicitly requested by the President. Of the three most influential scientific experts in Table 4-7, one of them (Dr. Salk) was from outside government. In addition, the *ad hoc* group of experts for the March 24 meeting included at least six participants from outside government.

- Centers for Disease Control
- Food and Drug Administration
- Medical University of South Carolina
- Merck, Sharp and Dohme Research Laboratories
- Mount Sinai School of Medicine
- Salk Institute for Biomedical Sciences
- University of Michigan
- University of Texas

**Table 4-13. Affiliations of the Members of the Blue Ribbon Panel of Scientific Advisers who met with President Ford on March 24, 1976**

Table 4-13 shows the affiliations, at the time of the March 24 meeting, of key persons who were thought of as the Blue Ribbon Panel of scientific experts requested by the President. Although no one used the term at the time, there was clearly a subset of persons in the Cabinet Room to respond to the President's request for scientific experts. This subset has come to be called the Blue Ribbon Panel in some reports. There is some fuzziness about whether other government participants in the meeting were considered part of the Blue Ribbon Panel, versus attending as part of broader government participation. And there is disagreement in the records about the participation of at least one other outside scientist, Russell Alexander from the University of Washington (Kolata, 1999; Neustadt & Fineberg, 1979; Silverstein, 1981). There is no doubt that the eight persons listed in Table 4-7 were identified as key scientific experts (Dehner, 2004; Neustadt & Fineberg, 1979). Inspection of their affiliations makes clear that experts from outside government dominated the President's Blue Ribbon Panel.

***Experts other than Advocates.*** The use of Experts other than Advocates is also demonstrated in the use of the *ad hoc* committee. Dr. Salk was selected as an expert who had not yet given an opinion on the proposed vaccination program, and could not be considered an advocate. Salk and Sabin were professional and personal rivals, and were likely to point out any problems in the points raised by the other. About half of the other participants in the room were either not committed to the program, or at least out of the chain of command that had made the recommendation. Overall, an effort was clearly made to reach beyond the advocates as defined in the operationalization of this variable.

On March 22, Cavanaugh learned he had to quickly get the best scientists to a meeting at the White House. Availability and familiarity with the problem were both important criteria, but Cavanaugh also wanted to ensure that any dissent or unstated problems with the HEW proposal would be brought out in the discussion. Cavanaugh suggested inviting both Dr. Jonas Salk and Dr. Albert Sabin to attend the meeting. Cooper had contacted Sabin for an opinion when the Sencer memo was first circulating within HEW, and Cavanaugh knew that Sabin supported Sencer's proposal. In an attempt to ensure a balance of opinions and increase the credibility of the panel, Cavanaugh asked Salk to participate. Salk and Sabin were bitter rivals over the credit for defeating polio, rarely attended the same meetings, and disagreed whenever possible (Oshinsky, 2005). Cavanaugh and Cooper thought that Salk would raise any reasonable objections to something Sabin supported. Including both Salk and Sabin guaranteed the President a chance to see if there was indeed common ground among experts (Dehner, 2004, p. 141; Neustadt & Fineberg, 1979, p. 27). Salk's position was a mystery until President Ford asked for his opinion in the meeting.

At least four members of the Blue Ribbon Panel were outside the formal chain of advocacy; only Stallones among the non-government experts was currently on the ACIP. All members of the Blue-Ribbon Panel were believed willing to speak their mind if they disagreed, and to disagree with each other. The room also included local and state health officials not yet committed to the vaccination plan, or even very knowledgeable about it. All the public health officials were in the room when the President explicitly asked for anyone to express reservations and concerns (Dehner, 2004, pp. 140-142; Neustadt & Fineberg, 1979, pp. 27-28). Cavanaugh had provided persons not yet committed to the program, and the President did everything possible to tell them he wanted to hear any concerns.

No effort was made to find a devil's advocate, someone who was known to oppose the proposal. The operationalization of this variable does not require engagement of a devil's advocate, merely of an effort to let the President hear from an expert not involved in advocating the program. With this fast-moving process, it would have been hard to find someone already committed to opposition. But there were persons with some concerns, especially about the need to commit to more than vaccine production at this point (Dehner, 2004, pp. 111-112; Neustadt & Fineberg, 1979, pp. 12-13). It would have been useful to bring out those distinctions in the meeting.

Some analysts of the history of the 1976 swine flu decision suggest that the *ad hoc* committee was selected specifically to suppress dissent (Silverstein, 1981). If so, there would have been no effort to seek out unknown voices like Salk. It seems more likely that Cavanaugh's goals were primarily to provide a panel that met the President's request for the best scientists, and to present a full spectrum of scientific views (Neustadt & Fineberg, 1979, pp. 26-27). Cavanaugh sought to bring in the biggest names in the field he could get, some experts outside the existing ACIP orbit, and participants representing some range of thought (Dehner, 2004, p. 141).

***Best Expertise on this Issue.*** The President wanted, asked for, and believed he got the best scientific experts on this issue. A good case can be made that four of the people on his Blue Ribbon panel were the U.S. scientists with the strongest reputations and depth of expertise in immunology.

In a 1977 interview, President Ford said that he remembered asking for the best scientists along with experts on manufacturing vaccines. His advisers gathered such a group, albeit focused on people that were well known and who could be reached quickly for such a meeting.  With the most famous scientists associated with vaccination on-board, with Kilbourne, (who was widely considered the current "great man" in virology), and with Hilleman's reputation in vaccine development and his formal role at Merck providing a connection vaccine production capabilities, the HEW and White House staff all felt they were providing the best expertise possible for such a panel.

Finally, it is clear that the three most influential scientists all had <u>Experience with Science Advice</u>.  Dr. Cooper was in a current position where he not only managed the Public Health Service, but also was also officially charged with providing scientific advice to the Secretary of HEW.   Dr. Cooper, primarily a researcher in cardiology, had spent most of his career at the National Institutes of Health, and held positions where he regularly crossed the boundaries between research and policy.  Earlier in the 1970s, he had been the primary force behind the creation of the National High Blood Pressure Education Program.

Dr. Salk had been on literally dozens of high-level panels and boards designed to provide scientific advice, since his spectacular success with vaccination against polio in 1955.  While he ran a research facility, and continued his own work, it would be fair to say that providing science advice was a major activity for Dr. Salk.

Dr. Sencer was in the tenth year of what is still the longest directorship of CDC in its history, and was perpetually involved in the policy advise on scientific matters.  His period at CDC was one of unprecedented expansion of the mission – the eradication of smallpox, the start of the campaigns against smoking and for enhanced workplace safety. He was very experienced in providing science advice both within his chain of command and as an outside expert on panels.

**Assessing the Variables: Variables on the Type of Decision.** Table 4-14 summarizes the assessment of the four Type of Decision variables for President Ford's decision to begin the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **High Scientificity** | **Yes** |
| **National Security Issues** | **No** |
| **Based on Wide Scientific Consensus** | **Yes** |
| **Led by an Agency with Scientific Culture** | **No** |

**Table 4-14. Assessment for Case 1 regarding the Variables on the Type of Decision**

There is little doubt that President Ford considered this decision one that turned primarily on scientific questions, a decision of High Scientificity. Using the four questions that he raised during the two meetings with his advisers as the operationalization for this variable, the result seems to be Very Scientific (in fact 100%). The four questions below are ones that would be best answered by scientific expertise if it were available:

- What is the likelihood of a pandemic? (100%)
- Can a vaccination program be accomplished in time? (100%)
- Are there any alternatives? (100%)
- Do all of the scientific experts agree? (100%)

Note that, since these were the President's questions, for the evaluation to be less than "Highly Scientific" one has to judge that at least three of these questions require input from someone other than scientific experts. The President could have asked questions about affordability, about impacts to his Presidential campaign, or about organization of the vaccination program. Instead he asked questions about what the scientists thought.

President Ford paid attention to scientific expertise on this decision because he thought that the questions of interest were primarily scientific. His request for a panel of experts reflects that view. His request to the *ad hoc* committee on March 24 reflected a belief that their input was both critical and sufficient: he asked them if they thought a program for national vaccination was the right approach. He acted as if the scientists could answer that question, without inputs from others. As President Ford put it in 1977, "I think you ought to gamble on the side of caution. … unless there were some major technical objection." Having seen this as a need to protect the public health, his only concerns were technical.

By the standards used in this study, the decision was not one of National Security Issues; it was a Domestic decision. While there would be national security implications for a serious influenza pandemic, those implications were not discussed during the President's decision-making deliberations. Moreover, DoD made an independent decision to protect its personnel from swine flu without the issue rising to a Presidential decision.

The President clearly considered that his decision was Based on Wide Scientific Consensus. He raised the question of consensus in the March 22 meeting, and the primary reason for the *ad hoc* committee meeting on March 24 (from the President's perspective) was to determine if that consensus was as complete as his advisers believed. After that meeting, President Ford felt that he had been presented with total scientific consensus about the right response to the discovery of swine flu in in the United States. The consensus mattered to him. In 1977, he remembered thinking "If you've got unanimity, you'd better go with it."

It would be hard to argue that the decision for a national swine flu vaccination program was primarily Led by an Agency with Scientific Culture. From the President's viewpoint, this decision was an HEW initiative. Despite significant responsibilities in health and medicine, a physician or scientist had never led HEW at the time of this decision. As shown in Table 4-15, leadership of HEW From its founding through 1976, the most common background for the Secretary of HEW was that of a lawyer or politician. While the arguments presented during the presentation to the President were based on scientific and medical expertise, that expertise was provided by lower level organizations like CDC and the Public Health Service. Someone with an M.D. and often with other scientific credentials has indeed, usually headed those organizations, but CDC and the PHS were not considered the primary advocates at the Presidential level. Part of the role of the Secretary of HEW in these

| Secretary | Background |
| --- | --- |
| Oveta Culp Hobby | Soldier, Journalist |
| Marion B. Folsom | Soldier, Academic |
| Arthur S. Flemming | Academic, Public Servant |
| Abraham A. Ribicoff | Lawyer, Politician |
| Anthony J. Celebrezze | Lawyer |
| John W. Gardner | Author, Manager |
| Wilbur J. Cohen | Social Scientist |
| Robert Finch | Politician |
| Elliot Richardson | Lawyer |
| Caspar Weinberger | Lawyer |
| David Mathews | Educator, Academic |

**Table 4-15. Backgrounds of the Secretaries of Health Education & Welfare**

deliberations was to make the argument that the issue required a higher priority than HEW could handle within its own resources.

| **Variables Present Case 1** | **Mixed Results Potentially Situation-Dependent** | **Variables Absent in Case 1** |
|---|---|---|
| Committee Created for this Decision<br><br>Committee of Standing Advisory Body<br><br>Direct Report to the President<br><br>Participating in Policy Agenda Development & Prioritization<br><br>Experts from Outside Government<br><br>Experts Other than the Advocates<br><br>Best Expertise on the Issue<br><br>Experience with Science Advice<br><br>High Scientificity<br><br>Based on Wide Scientific Consensus | Policy Advocate<br><br>Reports on Issue Prepared in Advance of Decision<br><br>National Security Issues | Single Strong Science Adviser<br><br>Communication (without a policy recommendation)<br><br>Led by an Agency with Scientific Culture |

**Table 4-16. Summary of Variables Present and Excluded in Case 1**

**Findings: Variable Impacts and Exclusions.** As shown in Table 4-16, many of the proposed variables that would influence a President to use scientific advice were present in the case. Particularly striking is the President's perspective that this decision turned on scientific judgment, that there was a strong consensus among scientists that an immunization program was the right course of action. It is also worth noting that all four of the "Types of Expertise" variables were present. For the advocates of scientists remaining aloof from the policy trade-offs (staying in positions 1-3 on the scale of Role of Scientists), this case provides clear evidence that scientists and physicians can make those trade-offs and still maintain a unique role as experts in supporting the President's decision-making process.

For purposes of this study, the more interesting results are the variables clearly absent from the case: Single Strong Science Adviser, Communication (without a policy recommendation), and Led by an Agency with Scientific Culture. These variables may be present in some cases where scientific expertise becomes important to a Presidential decision, but they are definitely not necessary for a President to pay attention to scientific advice.

President Ford was not hampered by the lack of a Single Strong Science Adviser that could present a single scientific perspective, balancing all uncertainties. There had to be a champion – in this case Mathews or Cooper– for the issue to reach the President. It is also clear that the President had no problem with identifying uncertainties, and likely would have asked for more than one opinion even had there been a single strong science adviser. President Ford was convinced that the issue turned on scientific issues, and he therefore sought more information to determine what scientists knew and believed about the issue. It is unclear how he would have resolved a lack of consensus. But it is clear that he wanted to hear a range of scientific perspectives, and that he had decided that the scientific perspectives mattered. This case challenges the notion that the President is more likely to use science advice if it comes from a single source, empowered to provide a unified scientific perspective.

There is also little doubt President Ford was moved more by clear recommendations for action than he would have been by Communication (without a policy recommendation). The President had reasons and resources (primarily in the OMB and Domestic Policy staff) to question the recommendations made by HEW. But the recommendations in Sencer's memo brought the scientific questions into focus rather than confusing them with a policy taint, as feared by advocates of Communication (without a policy recommendation). Without the recommendation, it is very unlikely this would have been on the President's agenda. The clarity of the CDC recommendation is what led to a Presidential decision less than two months after swine flu was detected.

Finally, the case provides a good example that the organization presenting the case to the President need not be Led by an Agency with Scientific Culture to make an argument that turns primarily on scientific expertise. The President received this issue almost exclusively from HEW advisers, and HEW is not an organization that has been led by scientists.

On the basis of this case alone, it can be said that three variables (Single Strong Science Adviser, Communication (without a policy recommendation), and Led by an Agency with Scientific Culture) are not always necessary for a President to make use of scientific expertise as a major factor in a critical decision.

One of the strengths of the case study approach is that evaluation of the variables using the operational definition can be further explored in the context of the full understanding of the case itself. A researcher should not redefine the variables to address the case, but evaluation of a case study can consider the situation-dependence of the variable. For that reason, this case is not considered sufficient to rule in or out the necessity of Policy Advocate, Reports on Issue Prepared in Advance of Decision, and National Security Issues.

This case was judged as reflecting Presidential acceptance of scientific advice because of the Policy Advocate approach: attempts by the experts to increase the acceptance of a recommended position by structuring the case to play up the preferred option's advantages, minimize its risks and emphasize the problems with other options). It is a problematic case because, while it meets all the operationalization requirements, the relationship to the President's decision doesn't fit well with the theoretical arguments of why Policy Advocacy should work. The concept in the science advice literature is that when experts present their work in the context of clear advocacy of a particular option, the President will be more likely to accept the scientific evidence because it is tied to a course of action. President Ford does not seem to have been influenced by such techniques.

Even on a purely documentary basis, the single policy advocacy position taken by Sencer, Cooper and Salk was challenged in the President's reading package by an OMB-prepared memo titled "Uncertainties Surrounding a Federal Mass Swine Flu Influenza Immunization Program." In any case, President Ford is reported to have brushed aside the written presentations, and asked his own questions (Neustadt & Fineberg, 1979, p. 24). He asked explicitly in the first meeting how likely it was that a pandemic would occur, and was told the likelihood was "unknown." President Ford concluded that this meant there was a possibility of a dangerous influenza (Neustadt & Fineberg, 1979, p. 26). He then decided that a vaccination program would be necessary "unless there was some technical objection" (Neustadt & Fineberg, 1979, p. 25). The lack of certainty, not the claim of certainty, called for action. So long as he could be sure there was scientific consensus on the need for an immunization program, he decided to launch the vaccination program with no illusions that the uncertainties were resolved. In the public statement announcing the plan, the President said “Let me state clearly at this time: no one knows how serious the threat could be. None-the-less, we cannot afford to take a chance with the health of our nation” (*President Gerald R. Ford's Remarks Announcing the National Swine Flu Immunization Program*, 1976). The variable therefore appears not to be critical to the President using scientific advice, at least as envisioned in the science advice literature, even if the scientists actually acted much as the Policy Advocate variable suggested they should.

The influence of Reports on Issue Prepared in Advance of Decision is likewise not present in the case. The extremely short timeframe between the initial discovery of swine flu at Fort Dix and the demand for a Presidential decision may itself be a reason that such reports were not available. The CDC and PHS had conducted studies and developed plans on how to handle a future influenza pandemic. But there were no studies that addressed the difficult issues of a rapid decision under great uncertainty to implement a mass vaccination program. No study had envisioned that combination. Reports on Issue Prepared in Advance of Decision may be a more important variable when a Presidential decision turns on a policy issue with a longer history of discussion and report writing.

Finally, the National Security Issues variable is clearly not in place for this issue, but the importance of that variable will probably require further study on multiple cases. This case alone provides evidence that a President may make a decision primarily on the review of scientific expertise without believing it to be a national security issue. But the contention in the science advice literature that such consideration may be more likely for national security decisions would require comparison of more cases than are studied in this research.

**Findings: Observations.** President Ford was not thinking about mechanisms of science advice during this decision, and did not engage the revived structure of science advice then under construction by Dr. Stever. But he asked good thoughtful questions about the scientific consensus, and sought advice both from the advocates of the vaccination program and from those not involved. Although the argument has been made since that President Ford would have made a different decision with better science advice, it is hard to imagine how a President could have tested the scientific realities any better than Gerald Ford did in March 1976.

The President understood the uncertainties, and fundamentally agreed with the cost-benefit logic of the CDC memo. Ford seems to have sought as much scientific certainty as was available. The idea that swine flu could be a major pandemic was on the national agenda because of the input of scientists, using the best information available at the time. The President went several extra steps to ensure that he understood what science could and could not tell him. While the scientists within HEW may have oversimplified the issues, the President seems to have considered a range of factors, concluded that the scientific ones were key but full of uncertainty, and believed that the potential risk to public health was too great to do anything other than implement the HEW program.

President Ford listened to scientific advice, and in fact largely was driven by the recommendations of scientific experts, when he was presented with:

- a new issue based on a scientific discovery (the isolation of a new form of flu transmissible among humans) on which he had previously not been advised;
- the possibility that the swine flu would be a national catastrophe like the 1918 pandemic;
- an option for a program that would prevent the catastrophe if it occurred,
- a short timeline to make a decision, or else the option for a program would be lost; and
- apparent consensus among the best scientists that the program was the best way to proceed.

It is hard to imagine any President doing otherwise. It is little wonder that participants and science advisers remember this as a classic example of a President acting on scientific advice.

The issue was presented as turning on scientific judgment, and the President had to rely on the scientists for that. As Sencer argued in his memo, it is easier to explain why you erred on the side of caution and wasted money in a government program than to explain why a President had this advice and chose to do nothing.

While this case was selected as one of the strongest cases for a President choosing to go with scientific expertise as the basis for his decision, it is not clear that the degree of consensus on this issue can always be available, or that a single option can be agreed upon as the solution readily by everyone involved.

None-the-less, the case does show that there is little reason to be concerned with the mechanism of advice if the issue is presented as turning on scientific judgment and a consensus about that judgment is available.

**Case 2, President Ford's Decision to Suspend the National Swine Flu Vaccination Program**

**Introduction.** Once President Ford made the decision to pursue an immunization program for everyone in the U.S., he might have expected the program to be implemented without further interaction with him. The departments and agencies of the executive branch usually accomplish implementation without requiring Presidential oversight. But the National Influenza Immunization Program (NIIP) was not a typical program.

The President was eventually involved in questions about protecting industry from liability against claims that the swine flu vaccine had harmed those who took the injection, and about proper distribution of the vaccine, and in defending the program during his re-election campaign. In parallel, he was affected by worldwide research on swine flu and by the media coverage of alleged side effects from the vaccine. The problems of implementation, which were not foreseen when the President initiated the NIIP, were the reason that the swine flu episode is usually referred to as a disaster or debacle.

These trends lead President Ford to accept the recommendation of the CDC Director, on December 16, to suspend the vaccination program with only about 25% of the population vaccinated against swine flu. However, President Ford relied again on scientific experts to guide his decision to suspend the program. The key facts were that the public feared side effects more than the flu, it was credible that one of the side effects occurring was actually related to the vaccinations, and worldwide research indicated that the pandemic was now much less likely. Despite the fully anticipated way that suspension of the vaccination program would affect his reputation, President Ford decided to end the program instead of waiting for his successor to do it.

**Narrative Review of the Case: Vaccine Production and Liability for Damages.** When the program was begun, the primary concern of most participants was whether industry – in this case four pharmaceutical companies – could produce enough vaccine. Two hundred million doses was almost four times the previous maximum production run. But Dr. Kilbourne's genetically engineered virus strain provided exactly what he had predicted: hearty growth once an egg was infected, growth rates comparable to the best vaccine strains, and high vaccine yields. By May 1976, the companies had little doubt they could produce the quantity required. They had also produced sufficient volume of vaccine to begin clinical trials, critical to having a national immunization program that could start before children returned to school. However, the pharmaceutical industry as a whole began to have second thoughts about producing a vaccine to be used on such a scale without clear indemnification against claims that the vaccine caused harm (Dehner, 2004; Neustadt & Fineberg, 1979).

The indemnification issue was not new, and applied across a wide range of vaccines. The CDC had held workshops on vaccine liability issues, and had been exploring options to reduce the liability of pharmaceutical firms for harm from vaccines. There was a virtual certainty that some patients vaccinated by a totally safe vaccine would develop complications unrelated to the vaccine but occurring soon after it was given. Among elderly patients, the very young, or patients with existing health problems, some would die relatively close to the time of receiving a vaccination. Yet such patients were usually the ones that would gain the most from vaccination. No one wanted to protect industry from the consequences of actual mistakes or malfeasance in the production of vaccines. But dealing with the lawsuits from families convinced that vaccination had caused death or other harm could eat up the profit margin that allowed companies to be in the vaccine business. The concern was very real; not many companies were willing to provide vaccines.

Now the government was asking four firms to provide vaccine that would be given to everyone in the U.S.A. The four firms decided that the simmering problem of liability had become urgent (Dehner, 2004; Neustadt & Fineberg, 1979).

CDC and HEW tended to agree that this program, in particular, required that the Federal government take on the duty to warn about side effects, and to inform about both the possibility of unrelated correlations of vaccination with other health problems and the potential to get the flu even if you got a vaccination. So long as the Federal government was insisting on the amount, content, and use of these vaccines but asking industry to produce it, HEW believed that the government would have to relieve industry of some part of the liability.

Merrell, Inc. was one of the two pharmaceutical companies that were expected to produce the largest amounts of vaccine. On May 24, it terminated negotiations on the swine flu contract until government answers to their questions about liability were offered. Legislation that proposed liability relief was introduced in Congress on June 16, with an initial draft from HEW(Dehner, 2004; Neustadt & Fineberg, 1979).

On June 25, the American Insurance Association informed the four pharmaceutical firms and elements of the Public Health Service (PHS) that they would be unwilling to provide liability insurance for swine flu vaccinations at any price. The scale of the program suggested to insurers that the number of lawsuits would be prohibitive. If there were to be any protection for the firms, it would have to come from the government (Dehner, 2004; Neustadt & Fineberg, 1979).

Hearings in the House on the bill, which addressed a full range of issues in authorizing the NIPP, were scheduled for June 28. Industry representatives addressed their proven capability to produce vaccine, and their deference to the government and private researchers on both the need for a nationwide vaccination program and the tests and protocols necessary to ensure a safe and effective vaccine. But they informed the committee that they would be unwilling to distribute the vaccine unless they could be protected from liability. It is not clear what they would have done with the vaccine they were producing without liability protection, since they were well into production and would have had to accept a large loss if they did not sell it to the government. But leaders from all four firms said they would not sign a procurement contract with the government without liability protection. Congressmen were more skeptical of the need for special legislation. For example, Congressman Waxman offered leading questions that suggested he believed that the insurance industry was trying to use a health crisis to raise its rates on liability insurance (Dehner, 2004; Neustadt & Fineberg, 1979).

There were eventually six sets of hearings on the swine flu program in the summer of 1976. While the committee deliberations focused on several issues, including how the government effort would be organized and the mix of federal and state responsibilities, liability protection was the key issue (Dehner, 2004; Neustadt & Fineberg, 1979).

From June 25 forward, the insurance industry maintained the position that they believed swine flu vaccination would be safe, but that they could not afford the costs of inevitable spurious claims of harm when the entire U.S. population would be vaccinated. As contentious Congressional hearings made the public aware of industry's claim that it needed government indemnity against liability, the insurance company position was widely misunderstood as a concern about the safety of such a vaccine.

Congressmen leaned more to suspicion of venal motives, but they too could not understand why industry would not want to provide insurance if they believed the vaccine safe and effective. Yet the potential scale of liability claims, even if the vaccine was totally safe, seems to have been the major concern of the insurance industry. Under great pressure from Congress, in late July three insurance firms presented liability insurance plans with extreme rates and a limit on liability of up to $12.5 million per manufacturer. When the four manufacturers expressed interest in signing up for these plans, firms withdrew them, and the plans were on the street for less than ten days.[9]

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[9] Scientists involved in the decision-making about swine flu seem to blame industry's insistence on liability protection for making the program appear a failure. In a recent article, Sencer states that a crippling blow to the program was when "instead of boxes of bottled vaccine, the vaccine manufacturers delivered an ultimatum—that the federal government indemnify them against claims of adverse reactions as a requirement for release of the vaccines." (Sencer & Millar, 2006, p. 29) It is hard not to read into some of the reminiscences a tendency to feel that industry's decision to seek protection from liability ruined what would otherwise have been a successful implementation of a good scientific recommendation.

So the questions about industry's liability produced a reason for another Presidential meeting on the swine flu program. Mathews prepared a summary of the status of the swine flu program, including coverage of the liability issue, which was sent to the President on July 20. On July 22, the President met with Mathews, Cooper, Cavanaugh, and O'Neil. The President focused first on the question of whether anything had changed in the concerns or consensus expressed on March 24. Hearing that a pandemic was still possible, he listened to a description of the liability issue. President Ford indicated his willingness to meet with leaders of the pharmaceutical and insurance industry, and considered providing public criticism of Congress for failure to act on authorizing legislation. The President chose instead to reach out to his contacts in Congress, beginning with a personal phone call to Congressman Paul Rogers, Chairman of the House Subcommittee Health and the Environment, and he sent letters to others on the need to resolve the liability issue(Dehner, 2004; Neustadt & Fineberg, 1979).

On August 12, the President signed authorizing legislation for the National Influenza Immunization Program. The law included liability protection similar to the original HEW proposal in June, with minor modifications. It provided that the sole recourse for someone who felt they were injured by the NIIP was a suit against the Federal government, assuming no evidence of negligence or malfeasance by the drug companies or malpractice in the administration of vaccine by private health organizations. The companies were largely finished with production, and, with liability taken over by the Federal government, they would now sign contracts to provide vaccine (Dehner, 2004; Neustadt & Fineberg, 1979).

**Narrative Review of the Case: Worldwide Action on Swine Flu?** Although the United States was the only country to embark on a nationwide vaccination program against swine flu in 1976, there was a community of influenza researchers investigating the characteristics of the new strain throughout the summer, in parallel with the vaccine trials. World Health Organization (WHO) officials encouraged all member countries to be aware of the U.S. conclusions on the pandemic potential of swine flu, but its recommendations used the same facts to make a milder recommendation. WHO encouraged member countries to increased surveillance against an outbreak of swine flu, to consider producing swine flu vaccine, and to take preparations for action "if extensive epidemics do occur" (World Health Organization, 1976, p. 123). The WHO research and surveillance stance, which would eventually be the primary position of most countries other than the United States, has been described as a watch-and-wait position, in contrast to the U.S. program of national immunization(Dehner, 2004; Neustadt & Fineberg, 1979).

The most important research done on transmission of the A/NewJersey strain was an effort conducted in April at the Salisbury Common Cold Unit (CCU) of the British Public Health Service. The CCU experiment, with results eventually published in *The Lancet*, would be interpreted quite differently in the U.S. and in Europe. In the CCU experiment, six volunteers were infected with a strain of A/NewJersey derived from the original infection. All six volunteers were experiencing the virus spreading throughout their systems within 3 days of exposure, but only one of them showed symptoms that could be described as moderate discomfort. Three volunteers were unaware of any symptoms, although the infection could be monitored clinically. Everyone agreed that strong conclusions could hardly be based on six subjects, but the report represented almost the only clinical exploration of the effects of this form of swine flu. The U.S. researchers, already committed to an immunization program, thought the most important result was that all six volunteers were infected. Even with direct exposure, most viruses would infect less than half of those exposed. The U.K. researchers, trying to decide whether A/NewJersey should be in their vaccine formulation for 1976-77 focused instead on the lack of a severe reaction among any of the volunteers, and judged that any swine flu outbreak would be mild. As the year went on, the positions of the U.S. and U.K. researchers hardened, and each accused the other of unscientifically extrapolating their results(Dehner, 2004; Neustadt & Fineberg, 1979).

No other country would choose to implement a vaccination program on the scale of the United States NIIP. Differences in approach varied from a British position that eventually disputed the need for swine flu vaccinations (based in part on interpretation of the CCU experiments) to Canada's effort to prepare for a major vaccination program like the U.S. Some experts, at the time and since, have argued that most countries did not have the capacity to produce enough vaccine and were not capable of organizing a national vaccination program like the NIIP. Certainly the U.S. HEW participants in the WHO process concluded that WHO's recommendations were influenced by a recognition that few of its member countries could attempt such an effort (Dehner, 2004; Neustadt & Fineberg, 1979).

By the time inoculations began in October 1976, U.S. and British scientists were criticizing each other for being non-scientific in their approach to swine flu. It is striking that European and U.S. public health and influenza research communities would come to such different conclusions from the same data, even noting how little data was available. In arguing that the U.S. was more focused on a precautionary principle. The Europeans were more concerned about the fairness of preparations not available to all WHO member countries, and on the relative risk to public health of choosing swine flu over other vaccination projects. A recent report argues that the U.S. may have made the wrong decision for the right reasons, and the Europeans made the right decision for the wrong reasons. (Dehner, 2004, p. 233)

At least three countries – Canada, Italy and Mexico – were sufficiently concerned to ask if the U.S would share the swine flu vaccine being produced in our four industrial facilities. Italy had concluded that it should produce swine flu vaccine, but did not believe its own capabilities would be sufficient. Canada and Mexico commonly called on U.S. manufacturers for influenza vaccine, and sought assurances through the State Department that their need for swine flu vaccine would be met as well. Because the U.S. program was straining to produce the largest production run ever of influenza vaccine to meet the goal of inoculating everyone in the U.S., these requests eventually led to a decision by President Ford that Canada and Mexico would be permitted to purchase swine flu vaccine only if the U.S. supplies were sufficient to meet all U.S. demands for the vaccine. If a pandemic had occurred, it is likely that U.S. supplies would have been used only for the population within the U.S. borders (Dehner, 2004; Neustadt & Fineberg, 1979).

**Narrative Review of the Case: Side Effects.** When considering vaccination programs, there is always the potential for side effects of the vaccine. The most common problem in vaccination against viral diseases occurs for is patients who have an allergy to eggs, the medium in which all vaccine for viruses is grown. When considering vaccination programs, it is common for physicians to hope that everyone with an egg allergy will either know that and avoid the vaccine, or will stay around after the shot long enough to be treated if anaphylactic shock reactions threaten the patient's life. There is also some potential for rare side effects or entirely new ones when a new vaccine is introduced. The expectation in starting a mass vaccination program is that significantly more lives will be saved and improved by preventing the disease than would be lost due to side effects. Side effects become an issue in the NIIP. Some of the issues were expected, and others came out of the blue.

Potential side effects were first raised in the press question-and-answer period after President Ford's announcement of the swine flu immunization program. The President had left the Q&A in the hands of Secretary Mathews, and when questions about potential side effects were raised, Mathews deferred to the expertise of Dr. Salk and Dr. Cooper. Dr. Salk emphasized that the major issue would be those with egg allergies, and that such people usually knew better than to take the vaccine. Dr. Cooper pointed out that the vaccine proposed would be a killed-virus vaccine, and that it was therefore impossible to get the flu from the shot. Everyone answering questions emphasized that the impact of side effects would be small if a major pandemic occurred. As Dr. Sabin said "one of those big forest fire things that can take place with a virus for which none of the population has any immunity" (Office of the White House Press Secretary, 1976, p. 5). All participants indicated or implied that they expected side effects to be small and manageable, despite the fact that no clinical trials had yet begun on this vaccine(Dehner, 2004; Neustadt & Fineberg, 1979).

Dr. Cooper also emphasized that there would be full disclosure of all the potential harm from taking the shot. "I would add to that it is part of our intention in the campaign … as part of the necessary awareness activity, to make a full disclosure of the sensitivities, what the expected adverse reaction would be, including the sore arms that the President talked about since it is inevitable as we deal with 207 odd million injections that we have to alert the public to this in a responsible way" (Office of the White House Press Secretary, 1976, p. 2). Dr. Cooper felt this was the crux of the liability issue: the responsibility to inform (Dehner, 2004; Neustadt & Fineberg, 1979).

While the Congress would argue with industry throughout the summer on the need for indemnification against liability, no one at HEW doubted that the government needed to take the responsibility to inform the public about the risks of side effects from the vaccination program. The CDC took responsibility for drafting and printing an informed consent form to be signed by everyone taking the shot. There was a great deal of tussling over the right type of consent form. Senator Kennedy put a provision into the authorizing legislation that the recently created National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, within HEW, should be consulted on the consent forms and would review them for adequacy. CDC appeared to feel that Congress, the Commission, and outside organizations were adding irrelevant issues to a simple consent form. CDC was primarily concerned about the need to agree on text in time to have 200 million forms ready by the start of the school year. Everyone thought that the forms were important, but also that they were pro forma. The vaccine was proving in test trials to produce normal reactions in patients without an egg allergy, so the primary purpose of the forms would be to show that the government was acting responsibly when unrelated health problems appeared correlated with the vaccination. In other words, within HEW it became hard to take the exact wording on the form as critical, since it was now perceived more as an exercise in legal coverage than a medical ethics issue (Dehner, 2004; Neustadt & Fineberg, 1979).

The press coverage from February through August show that it was generally favorable to the program, and public opinion polls showed that the majority of Americans expected to get immunizations. Mass immunizations, organized on a state-by-state basis, began on October 1. Intense coverage of deaths that occurred after vaccination proved to be the turning point in public attitudes towards the program(Dehner, 2004; Neustadt & Fineberg, 1979).

Three elderly patients died shortly after receiving swine flu shots from the same clinic in Pittsburgh on October 11. It is almost certain that the deaths of these patients, all over 70 and with known heart conditions, represent the kind of "spurious" results to be expected when a nationwide campaign of vaccination is underway. But the county coroner, when contacted by CBS news, said that he thought the deaths could mean a bad batch of vaccine. The vaccine used in Pittsburgh was immediately tested to see if the vaccine was contaminated or unusual in any respect. No problem was found with the vaccine. The CDC in Atlanta also released a statement that included a comment that "among people 70-to-74-years of age ... we are seeing people who are dying within a day or so after injection. We expected to see that" (Neustadt & Fineberg, 1979, p. 66).Such an apparently cavalier attitude did nothing to improve public reaction. For a few days, the CDC competed with the news bureaus in reporting how many deaths from unrelated causes were occurring within a few days of flu shots. It was a public relations disaster, even if scientifically correct. Ten states stopped their vaccination efforts. The program never fully recovered(Dehner, 2004; Neustadt & Fineberg, 1979).

A more scientifically credible side effect issue surfaced in November: the risk of an increased incidence of Guillain–Barré syndrome (GBS). GBS is an acute inflammatory demyelinating polyneuropathy that produces a debilitating autoimmune attack on the autonomic nervous system. GBS requires hospitalization, and, when it attacks nerves associated with breathing or cardiac functions it can be fatal. GBS is a rare disease, diagnosed in no more than 2-in-100,000 persons-per-year in the United States. Many U.S. hospitals have never seen a case. While it is clear that GBS is caused when the immune response to a foreign antigen is misdirected at the body's nervous system, it is not clear why some patients have that reaction when exposed to the same environmental factors as others who do not develop GBS. GBS most often occurs after a minor infection, like those caused by influenza or gastrointestinal viruses. There is no cure for GBS. The disease usually presents as ascending paralysis of the entire body. It has a mortality rate of less than four percent. Most patients survive and eventually recover completely after a terrifying but temporary period of paralysis (Dehner, 2004; Neustadt & Fineberg, 1979).

Some researchers had proposed, over the decade leading up to 1976, that vaccinations in general and influenza vaccination in particular might trigger GBS in some patients. Other potential triggers had been proposed, including allergies, viral infections and even being struck by lightning.[10] The data on which to draw the correlations of GBS

[10] In 1976, before Auto Immune Deficiency Syndrome became an epidemic and a major public health issue, immune disorders were obscure diseases. The public had

with any specific trigger were sparse, given the rarity of GBS. With respect to vaccination as a trigger, the limited number of annual influenza vaccinations before 1976 also made statistical correlations suspect. The pre-1976 papers proposed only a slight increased sensitivity, perhaps an additional few cases per million vaccinations.

Papers suggesting a relationship between influenza vaccinations and GBS were available on MEDLINE and known to the CDC. In fact, the NIIP program for enhanced swine flu surveillance for 1976-77 included an effort to look for such rare correlations of vaccination with three neurological disorders, including GBS. The potential for GBS correlation with swine flu vaccinations should not have been a surprise(Dehner, 2004; Neustadt & Fineberg, 1979).

Minnesota was one of the states that actively pursued immunization against swine flu, eventually immunizing about two-thirds of the population. On November 21, 1976, the Minnesota immunization program officer called CDC to report on the likely correlation of a case of GBS with vaccination. He then researched the literature himself, and was sensitized to the possibility that GBS could be a vaccination side effect. Within the next week, he learned of three more cases in Minnesota, two from a single physician. One of the four cases resulted in the death of the patient from GBS. CDC found three more correlated cases of GBS in Alabama and one in New Jersey. These correlations – with a disease where a mechanism might exist for vaccination to trigger the onset of

hardly heard of them, and found them frightening. The medical community understood that they occurred, but had various competing theories about how they were triggered, how they operated, and why some cases were much more serious than others. No work had yet begun on genetic predisposition to some of these syndromes, and almost any explanation seemed to be plausible.

symptoms – was more troubling to CDC than correlation of swine flu vaccinations with heart failures or deaths from emphysema (Dehner, 2004; Neustadt & Fineberg, 1979).

The numbers, however, were difficult to interpret. Did these cases represent an increase in the GBS rate? If so, did it mean that there was an increased risk of GBS from swine flu vaccinations, or just a random fluctuation in the normal incident rate? Intensified surveillance, workshops at CDC and NIH, and discussion among the public health community could not readily answer those questions in a short time. Even in 2011, the increased risk from GBS due to flu vaccinations remains scientifically controversial and difficult to pin down statistically. Over a roughly four-week period in 1977, the PHS investigated 30 cases of GBS that occurred within thirty days of the victims having received swine flu vaccines. Since about 40,000 doses of swine flu vaccine had been given in that same time, there did not seem to be strong relationship between developing GBS and having an injection. But the PHS needed to complete its investigation and to conduct statistical analyses on the very small number of cases. CDC took its responsibility to inform as a requirement to tell local and state health agencies about their investigation into GBS as a side effect. The press began to report on persons dying from GBS a side effect of swine flu vaccination.

After a summer of liability debates and arguments about the responsibility to inform patients, it was clear that GBS would be important. In particular, GBS was not mentioned on the consent form. Liability suits from those who contracted GBS after vaccination were a virtual certainty, and the government would likely lose those judgments. And, whether or not there was a causal link between swine flu vaccination and GBS, there would be more correlated vaccinations and GBS cases as the program continued.

**Narrative Review of the Case: What Happened to the Pandemic?** The two greatest unknowns about the swine flu strain isolated at Fort Dix in 1976 were whether it would spread across the human population, and what virulence it would have if it did so. With deference to limited efforts like the CCU experiment, the only tool that could really answer those questions was the implementation of increased surveillance of influenza and related disorders in the U.S. and throughout the world. In the U.S. this primarily meant surveillance by local and state health organizations, and other reporting through the CDC. In the rest of the world, a variety of surveillance mechanisms, some stronger than others, reported through the WHO. No matter what one thought about a massive immunization campaign, everyone agreed that intensive surveillance was required.

However, it wasn't completely clear what intensive surveillance would entail. Despite careful planning by CDC, the plan largely consisted of asking physicians to take cultures of diseases they thought might be influenza at a higher rate than normal. The basic problem remained that physicians were more interested in treating patients than diagnosing aspects of the disease more relevant to epidemiologists. Knowing that the flu was swine flu, as opposed to an avian-type did not affect treatment. Moreover many other viral infections produced flu-like symptoms. Unless the patient was hospitalized, it was unlikely that a culture would be taken for virus typing. If swine flu were producing relatively mild symptoms, it might be rampant and yet go undiscovered.

Uncertainty about the quality of surveillance was exacerbated in the less-industrialized southern hemisphere. Yet data collected during the southern hemisphere flu season, from April to November, could have been critical for planning the NIIP. If swine flu was to become a pandemic, there was every reason to suspect that it would appear during the southern hemisphere flu season. No swine flu outbreaks were reported.

As it became clear in July and August that swine flu had not been found in the Southern Hemisphere during the height of the flu season there, the CDC offered a number of explanations. It could be that A/NewJersey actually first occurred in the U.S., and had not had opportunity to spread to the southern hemisphere in time for the 1976 flu season there. And there was always the concern that swine flu might have been present in the southern hemisphere but not detected by the more limited surveillance capabilities available to WHO in most of those countries. But it is fair to say that some researchers began to reduce their internal estimates on the likelihood of a swine flu pandemic by late summer 1976. In July, during the liability debates, Mathews told President Ford that nothing had changed about the likelihood of a pandemic. If he had polled the U.S. influenza community on that specific question, he might have obtained a different answer.

The public health community in the U.S was still committed to the program as vaccinations began on October 1. They still believed that there was some unknown risk of a pandemic, and that we were better off beginning the vaccinations. Surveillance for swine flu outbreaks continued throughout the vaccination program. In November and December, swine flu was confirmed in some hospitalized patients in Mississippi and Wisconsin; and it looked like the beginning of an outbreak in Mississippi. But subsequent work, reported by December 13, showed that all of these cases could be explained by close association with hogs on rural farms, and were not clear cases of human-to-human transmission.

By early December, public opinion polls showed that over 90% of persons who had not yet had their swine flu immunization were aware of the national effort to get them vaccinated. Perhaps a third of the U.S. population had been vaccinated – over 40 million by the NIIP and another 20 million by the Department of Defense and other federal agencies. But over half of the remaining people told pollsters that they weren't planning to get the shots, and didn't think them necessary.

**Narrative Review of the Case: The President's Agenda Through November.** As the summaries above suggest, President Ford was not given the opportunity to initiate the NIIP and step away from it completely. And he was hardly ever given a chance to hear an update on the program without a request for action on his part. He was asked to reach out to industry and Congress about liability issues, address the desire of friendly countries to have some of the swine flu vaccine, and help with public relations as the vaccination effort began. It seems fair to conclude that he entered fall 1976 with an understanding that the program had been troubled, but that it was still necessary and still roughly on-track.

President Ford was running for re-election. While his nomination had seemed assured during the process leading up to the decision to start the NIIP, his path to the nomination was much more rocky than expected. Ronald Reagan challenged him throughout the spring and summer, and President Ford was still shy of the magic number of delegates required for nomination when the convention met in August. It was a hard-fought and uncertain campaign, even though President Ford was eventually nominated on the first ballot. The campaign undoubtedly took up his time and his attention.

The swine flu program was not a major issue in the nomination process, even though some press reports on the NIIP referred to it as a program driven by a desire to show Presidential leadership during the campaign. Ironically, the concern in March by Administration officials had been that the swine flu might impact the President's re-election campaign by being a damned-if-you-do, damned-if-you-don't choice. Instead, the President's re-election campaign may have harmed the NIIP more than it harmed his campaign. Some press organizations, most notably CBS, always included questions about political motives for the program in their coverage of the NIIP, in part because it was announced on the day after Ronald Reagan won his first primary in the nomination process. Reagan did not use it as an issue, and never really addressed it during the nomination battle. Neither did President Ford address it in a political context, as an argument for his re-nomination.

Nor was it a major issue in the Presidential campaign that Fall. It could have been, since this was a time of trouble for the NIIP. The vaccination program was at least a month late in getting started, although vaccine became available by the start of flu season. The first press flurry about side effects occurred at a critical time in the Presidential campaign, the last two weeks in October. Carter publicly indicated that he did not plan on getting a swine flu vaccination, but, in response to a question, only said that he didn't know for sure if the program had been necessary or fully informed by the best expertise.

Ford lost the election on November 2, 1976, but he was not through with the swine flu problem.

**Narrative Review of the Case: The Final Ford Decision.** By mid-December, two issues were pressing on the scientific experts who supported and implemented the NIIP. First, absolutely no swine flu cases based on human-to-human transmission of A/NewJersey had been uncovered in the 1976-77 flu season. The question of GBS correlation with influenza vaccine was worrisome, and still under investigation. In a conference call with outside experts on December 13, the consensus recommendation to Dr. Sencer was that the vaccination programs continue.

The next day, the CDC completed its review of U.S. GBS cases since the start of swine flu vaccinations on October 1. There had been 54 cases of GBS, 30 of which had occurred within thirty days of vaccination. On average about 50 cases of GBS would be expected in the U.S. every seven days. That only 54 cases had occurred in a little over four weeks represented a relatively low incidence of GBS, not a strong indication that the vaccine was increasing the incidence. Historical data on GBS suggested that there would be several hundred more cases of GBS occurring before the end of the flu season. By random chance, many of them would occur in people who had received swine flu shots.

The consent form did not warn of a potential danger from GBS, despite existing literature that suggested that influenza injections might be a contributing factor to slightly raising the risk of contracting GBS. CDC had insisted on maintaining control of the consent form, and had ignored some of the suggestions it received. Everyone knew that any problems with the consent form would come back to Dr. Sencer, who had declared

“I’ll consult if they tell me I have to, and then I’ll do just what I want” (Neustadt & Fineberg, 1979, p. 63).

On December 15, Sencer began a series of calls to other government officials and outside experts. There are no records of the calls, and Sencer has not reported his own thoughts, but participants in the calls have been interviewed at various times since 1977. Sencer discussed the low incidence of swine flu, and the risk of government liability for GBS. He suggested that the vaccination program might be suspended until the CDC had completed a broader review of the potential risk from GBS, and more data was available on the incidence rates of GBS related to vaccinations. Participants seem to have believed that President Ford would resist ending a program he had put his prestige behind. On December 16, Sencer called Cooper and recommended suspending the immunization program, pending more research on the link with GBS.

Cooper conferred with Mathews and Cavanaugh. He called other experts to get a sense of whether the leaders in health research would agree with ending the program. Cavanaugh, Cooper and Mathews walked to the Oval Office and presented the proposal to suspend the program to the President. President Ford seems to have asked only one question, whether this was what Dr. Cooper believed was the right course. Neustadt reported that President Ford sighed and said to “get on with it” (Neustadt & Fineberg, 1979, p. 78). With relatively little discussion, the President agreed to essentially end the swine flu vaccination program to which he had committed his prestige in March.

- President Ford came to accept that the NIIP should be suspended because of GBS side effects. This was the prudent thing to do, since there seemed to have been a peak in GBS.
- President Ford was not really focused on lack of outbreak. After all 1918 had its worst outbreak in the spring. But Mathews acknowledged the whole conversation would have been different if there had been an outbreak of swine flu already.
- The decision was taken to a Presidential decision because "It was his program, you had to let him know."
- President Ford didn't really ask questions during the meeting, as he had when the program started. He wanted to understand, but he seemed to accept that if we thought the NIIP should be suspended until you could find out about GBS, then it should be suspended.
- President Ford placed much reliance on Ted Cooper. Cooper was a very cautious and careful scientist. Cooper really made the recommendation, and that was why Ford accepted it.
- The President didn't ask about unanimity or consensus, or about other experts or non-advocates. He didn't need to because Mathews and Cooper had been in several times on swine flu issues and he knew by now that you could count on Cooper to have checked it out.
    - That Cooper was recommending suspension meant that those things had already been checked.
- This was not really a teeth-gnashing decision for President Ford. Given the uncertainty about the existence of side effects, it was right to stop the injections until we understood if there were a GBS problem.
    - President Ford emphasized that this was a "suspension," reminding us that an outbreak could occur at any time.
    - Dr. Mathews pointed out that swine flu vaccinations began under the Carter administration within a few months (albeit only for high-risk individuals) because the risk from influenza was judged greater than the risk of GBS for most people.
- On the other hand, President Ford was very engaged in this decision. It was clear that he considered this decision his responsibility
    - Dr. Mathews emphasized Ford's military background; he felt that President Ford felt he was on duty until his relief arrived.
- Dr. Mathews strongly disputed any impression that President Ford had a sense of weariness about the issue. The President treated this decision as clearly as he had the decision to start.
- Dr. Mathews felt this was definitely a good example of a President relying on experts he has come to trust.
- Dr. Mathews has no idea why Sencer chose that day to recommend suspension.

**Table 4-17. Major Observations about the Meeting Where President Ford Decided to Suspend the NIIP, Based on Interview with Dr. David Mathews on April 7, 2011**

Because this decision meeting was the most important moment in the assessment of Case 2, I contacted the two remaining participants in the meeting. Dr. David Mathews agreed to be interviewed by telephone on April 7, 2011. A transcription of the interview is provided in Appendix 2. Dr. Mathews was able to provide insights on the meeting, and to answer questions directly related to my variables. Table 4-17 captures the major comments by Dr. Mathews about the meeting. His perspective was that the President made his decision relying mainly on the advice and expertise of Dr. Cooper, and mainly because of the risk of GBS. Given the uncertainty about the impact of this side effect, the President felt this was the prudent course of action. The President emphasized that this was a suspension, since there could still be an outbreak in the winter just beginning. The President did not explicitly question about a consensus of experts, but this was likely, according to Mathews, because he knew Cooper would have already reviewed expert opinion before making the recommendation. The President didn't find this decision difficult if Dr. Cooper was recommending it.

Could President Ford have made different choice? In retrospect, it seems clear that there was no pandemic to prevent with a national immunization program, and that the risk from side-effects might have been greater than the risk of flu that year. But there are several alternatives he could have taken that would have been understandable.

First, he could have simply refused to back down and appear mistaken on what had become a Presidential initiative. Presidents have been known to take that view, and Sencer appears to have been concerned that personal prestige might lead him to take that position. Lest that sound like a petty position to take, consider that the consensus among Sencer, Cooper and Salk was that it was unlikely that GBS was being caused by the vaccinations and that a nationwide immunization program was still justified. The same arguments that led him to initiate the program could have been brought to bear to argue against ending it.

Second, a more petty position would have been justifiable. He could have argued that the experts had told him that the program was necessary and safe, and that they could take their lumps for problems that occurred in implementation. If Sencer was worried about limits in the consent forms, whose fault was that?

Finally, he could easily have taken the position that it would be someone else's problem in just another month, and that President Carter could make the decision to shut the program down. President Ford was interested in the possibility of running again in 1980 and he might have preferred to describe the program as one that was necessary but stymied by the actions of his successor. He could have tried to leave the administration out of it, and let the CDC make this decision on their own without an administration position.

He did none of those things. Dr. Mathews believed that the President naturally took the responsibility for a decision that needed to be made. And he relied on scientific experts, just as he did in initiating the program.

Cavanaugh called Sencer, and said that the President had approved the suspension. Later that day the suspension of the program was announced by Cooper in Washington and by Sencer in Atlanta. Both releases implied the program would resume at some time in the future, but the NIIP was essentially over at that point. No more vaccinations were done after December 16, 1976. Ironically, there was less recorded incidence of flu during he 1976-77 flu season than any year since records had been kept.

**Abstracting the Case: Timelines.** Figure 4-6 presents the Presidential Decision Timeline for President Ford's decision to suspend the National Influenza Immunization Program. Over the course of 1976, President Ford would make four decisions about the swine flu program: to begin an unprecedented program to immunize every American against swine flu, to ask Congress to provide liability protection to industry for the production of the vaccine, to turn down requests from our Allies for swine flu vaccine to supplement their own production, and to suspend the program of vaccination. Case 2 deals only with the time period, shown within the dashed box, between (1) the Presidential decision on March 24 to initiate the National Influenza Immunization Program (2) the Presidential decision on December 16 to suspend the vaccinations.

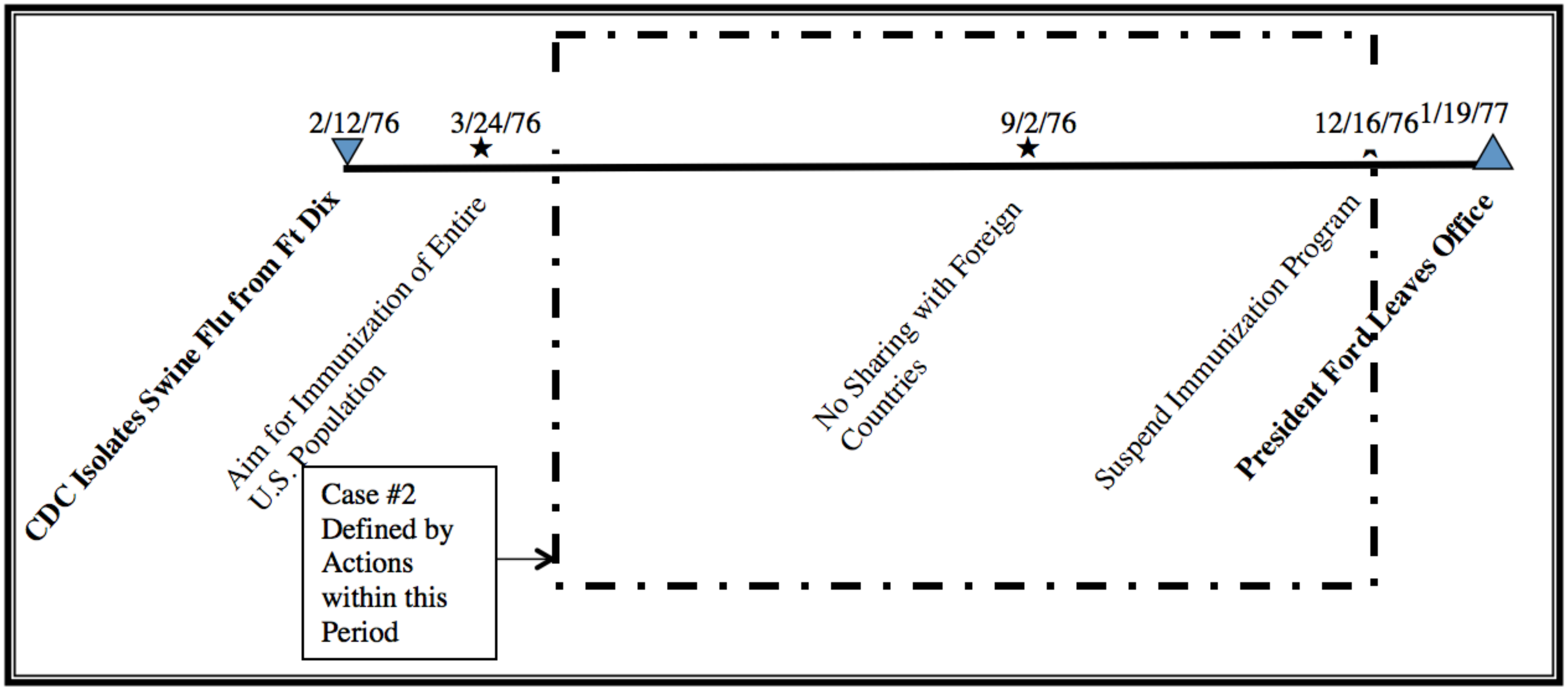


**Figure 4-6 Presidential Context Timeline for President Ford's Decision to Suspend the National Influenza Immunization Program (★denotes Presidential Decision)**

Figure 4-7 shows the Decision Analysis Timeline from the perspective of President Ford (the DAT-P). The dashed vertical lines break the 266 days of the NIPP into months. Unlike the decision to initiate the program, President Ford was engaged and aware of the progress and problems of the NIIP throughout its operation. Several times he took action to keep the program on track for vaccine production and immunization. The upper area in Figure 4-7 shows that he had a meeting almost every month about the program, because problems occurred. First he had to take personal interest in getting the supplemental appropriation from Congress. Then he was called on to make a decision about whether other countries could purchase swine flu vaccine from U.S. industry, and personally approved the statement for use with the governments of Canada and Mexico. He had a meeting on July 22 regarding the evolving liability problems, and considered several ways he might engage personally in resolving the issue. In August he signed the authorizing legislation including the indemnification of the four companies for any damages from swine flu vaccine. The President called the September 2 meeting himself to raise his concerns about the delay in vaccine availability with Secretary Mathews and receive assurances that the program would be implemented in time. That was his last meeting on the program until he was asked to suspend the vaccinations in December. Between March and December, none of the meetings involved a scientific expert as defined in this study. Most meetings were with Secretary Mathews.

The middle area of Figure 4-7 shows the major events in the Presidential election of 1976. These events must have been major impacts on the President's

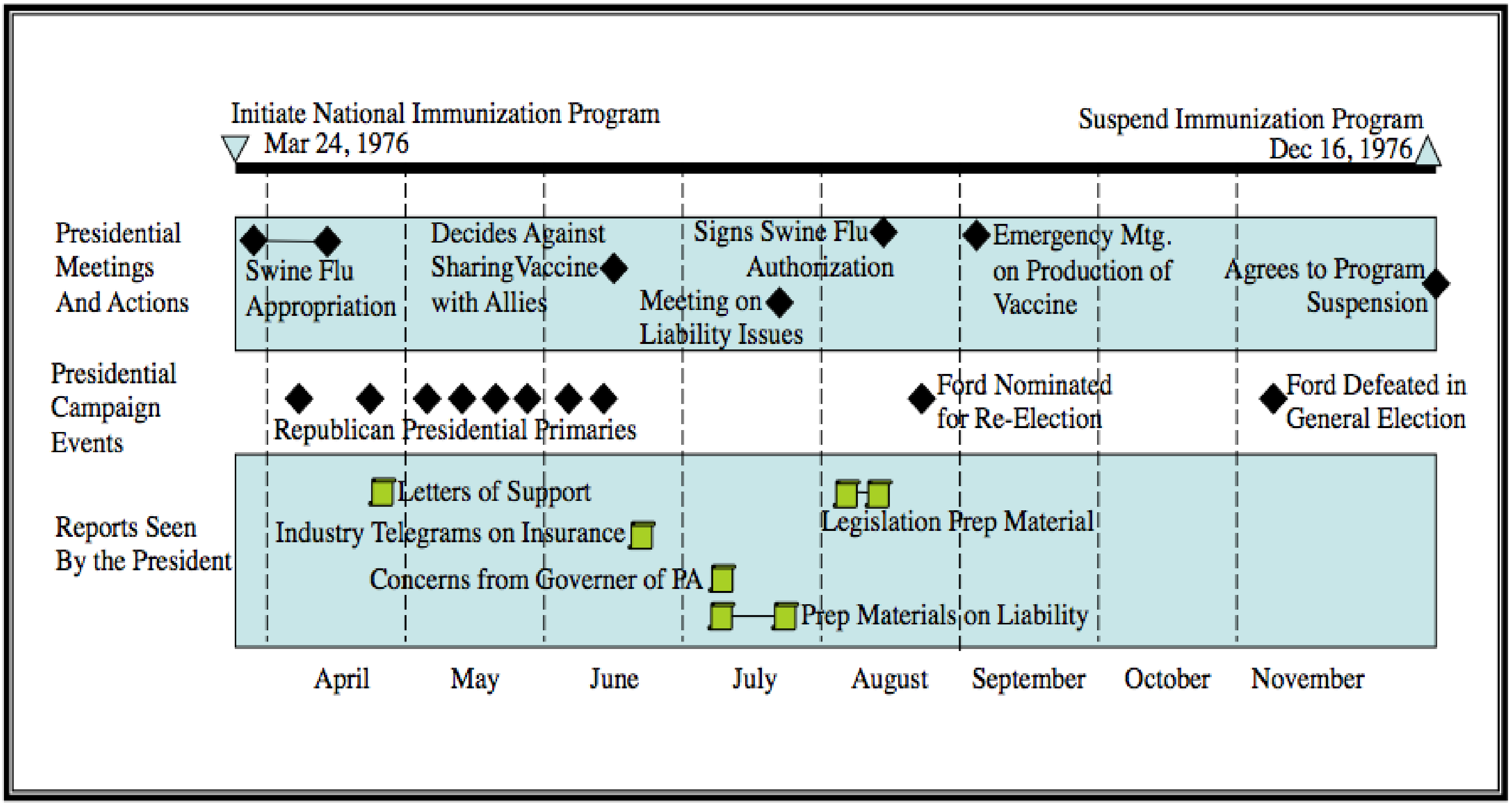


**Figure 4-7 Decision Analysis Timeline for the President (DAT-P) regarding the Decision to Suspend the National Influenza Immunization Program**

time and attention during the year. Both the Republican nomination and the general election were hard-fought campaigns, with much uncertainty about how they would turn out. None of the documentation shows evidence that the campaign was a major influence on President Ford's swine flu decisions, but it was an important part of the backdrop for everything he would do during 1976.

The lower area of Figure 4-7 shows the written reports seen by the President about the swine flu program. The only documents included are the ones marked in the archives of the Ford Library as part of President Ford's files as "seen by the President". Also excluded are routine status reports and statements prepared for the President to use. The remaining material falls into three categories: (a) letters of support in the early days of the campaign[11], (b) a July letter of concern about the implementation of the program by the Democratic Governor of Pennsylvania, Milton Shapp, asking that the President take a more personal role in ensuring that the program be successfully implemented (written with a certain skepticism that suggested he thought the Administration might be having second thoughts about the NIIP), and (c) a large collection of materials about the liability issue (including material from within the Administration, from Congress, and from industry). Once the legislation was signed that resolved the liability issue, President Ford received only routine reports on the vaccination program.

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[11] One letter was from a survivor of the 1918 flu pandemic, thanking the President for an effort to protect his family and citing his experience with the swine flu as a child of eleven in 1918. Since the White House receives hundreds of letters on every subject, I suspect that the preservation of this letter means that President Ford was especially meaningful to him.

Figure 4-8, the DAT-S, shows a very active period of work fro the scientific experts, even if most of them never again met with the President. The top area of the DAT-S probably underrepresents the number of major meetings underway in implementing the NIIP. It is limited to technical reviews and technical program meetings, and excludes the large number of meetings about legal, contract and operational matters. The Bureau of Biologics led a series of five major meetings to define and monitor the development of vaccine. The ACIP held three reviews of the program as vaccine development occurred. By May, CDC had developed joint plans with DoD to ensure that the large production run would include government requirements for swine flu immunizations (and for the other two strains prevalent at the time). The meetings labeled Children's Dose Reviews represent the meetings held to develop an expert's agreement on children's dosage for swine flu vaccines, since the field trial design provided insufficient guidance for a safe and effective children's dose. Technical meetings, other than on the children's dose issue, began to fade as the focus turned to the vaccination program itself in October and November. As side effects became a major issue, and a consensus was required on GBS, Sencer led a series of daily telephone conferences to ensure that everyone had up-to-date data and develop consensus opinions.

The organizational focus of work was now on the CDC, with supporting work at the Bureau of Biologics, the Food and Drug Administration, and the National Institutes of Health. All of these were HEW organizations, but with their own

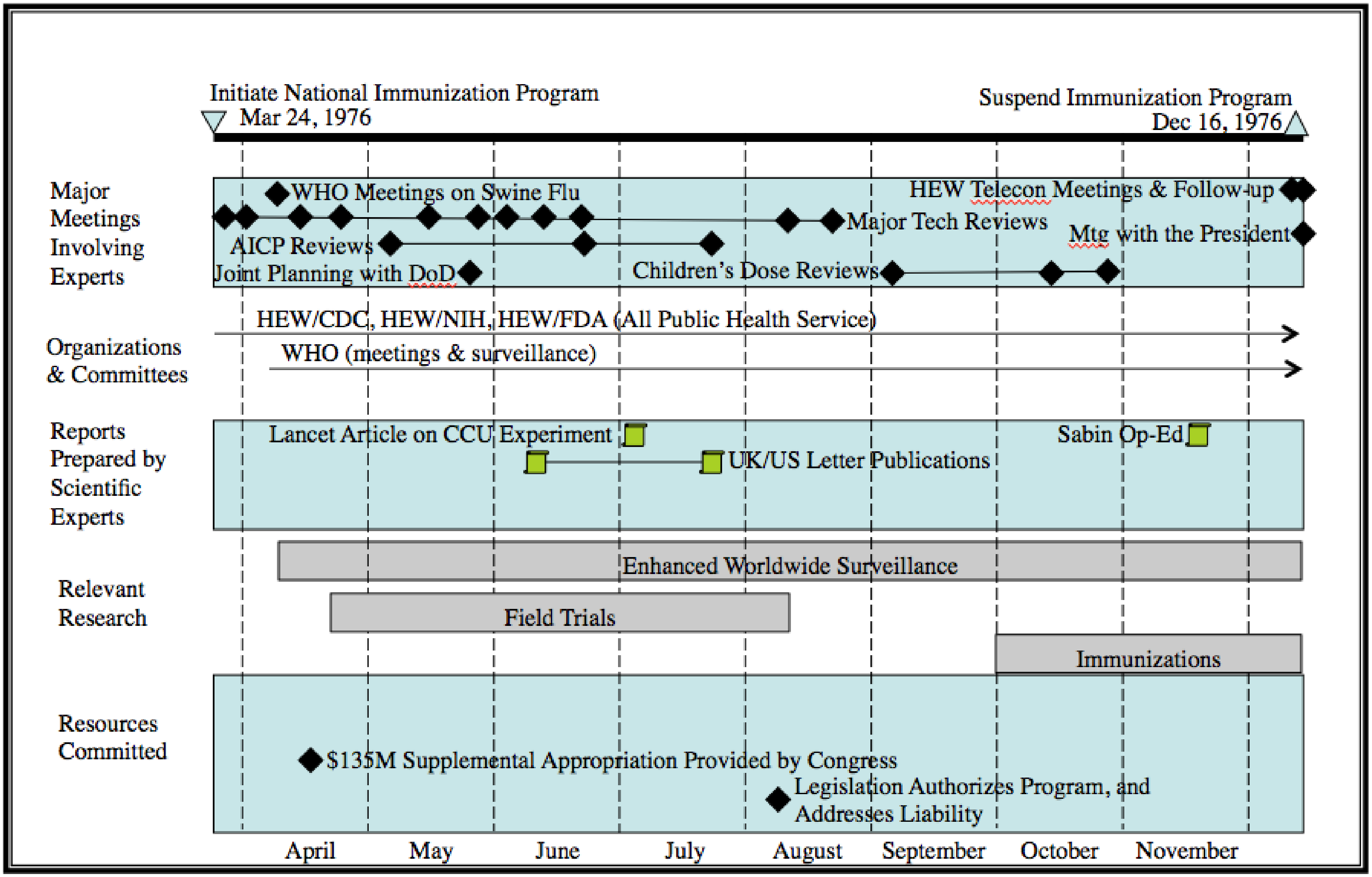


**Figure 4-8. Decision Analysis TimeLine for the Scientists (DAT-S) Regarding the Decision to Suspend the National Influenza Immunization Program**

cultures, responsibilities and operational procedures. Despite an effort by Mathews and Cooper to manage the NIIP headquarters, the actual work in the U.S. NIIP over this period was decentralized. The new player in the operation was the addition of WHO in a program of enhanced surveillance for swine flu outbreaks throughout the world.

The middle area in Figure 4-8 addresses the reports of importance to the eventual decision on suspending the program. There were, of course, almost daily reports on manufacturing of vaccine, specific technical questions and even the production of air guns for speeding vaccination. But reports done by experts on the major issues were rather scarce, perhaps because the U.S. community believed the major issues had already been addressed.

The most important of these to the overall history of the swine flu story was the publication of the Lancet article about the British CCU experiment with swine flu infection, on July. The experiment was conducted in late March, and was discussed during the major WHO review of the potential impact of swine flu in early April. But its major impact was through the sequence of letter publications by U.S. and U.K. experts debating the meaning of the experiments. This exchange, which occurred in both scientific journals and in newspaper pieces in both countries, eventually hardened the positions of experts in each country. The other report shown in the DAT-S is an op-ed piece written by Sabin after the reports of side effects had changed the atmosphere towards the program. Sabin, initially a strong supporter of the vaccination program, had come to feel that it was better to wait for more evidence of a pandemic break-out before vaccinating the entire population. There is no evidence that President Ford saw any of these articles, but they formed part of the environment in which experts in the critical middle days of December discussed the program.

The major periods of research activity are shown in the DAT-S as well. In this case, the major activities are the field trials of the vaccine (which occurred despite the arguments about liability and production rates were resolved in August), the enhanced worldwide surveillance for swine flu outbreaks, and actual immunization program beginning in October (which included an active program seeking evidence for effectiveness and side effects from the vaccine).

The final section of the DAT-S shows the major resource commitments to the program. Congress appropriated an additional $135 million dollars in April to conduct the program, and that proved sufficient to execute everything required. In addition, the legislation signed in August provided the authority necessary to implement the vaccination program. The legislation guaranteed that the government would indemnify the vaccine producers from any claims of harm. It also provided the basis for the development of consent forms for a nationwide vaccination program, and defined the relationship between federal and state responsibilities to implement the program.

**Abstracting the Case: Presidential Decision Decomposition.** Figure 4-9 shows the relatively simple question that appears to have been on President Ford's mind when he met with his advisers on their request that he suspend the NIIP. Dr. Mathews, in my April interview with him, indicates that the President listened to their concerns about GBS, and had no explicit questions.

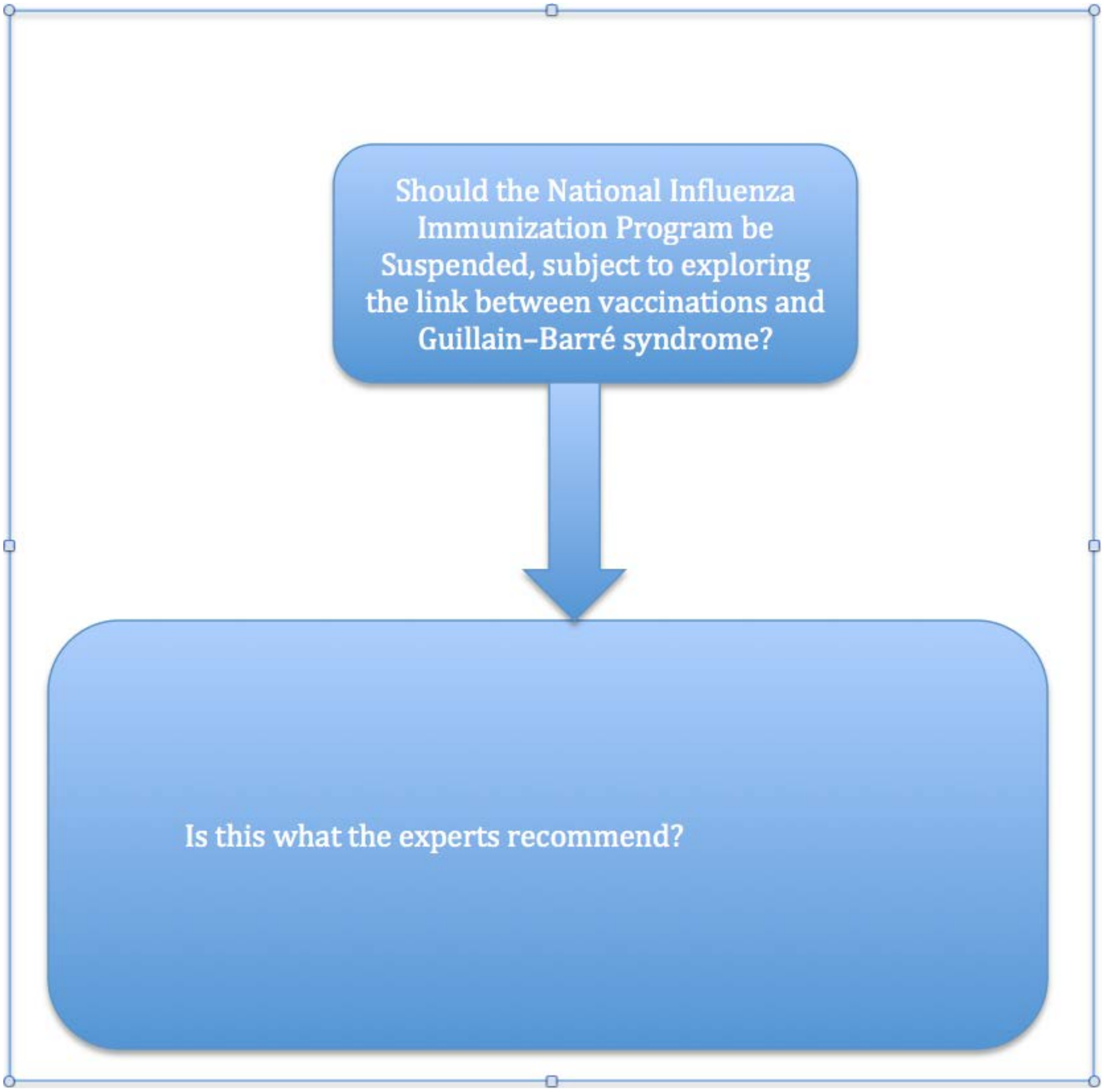


**Figure 4-9. Presidential Decision Decomposition for President Ford's Decision to Suspend the National Influenza Immunization Program**

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There were only four people in the room at the time of the meeting (Neustadt & Fineberg, 1979, p. 70). My interview with Dr. Mathews provides the only recorded information on what happened there. President Ford was concerned that there still might be an outbreak, and wanted to emphasize that this was a suspension, and could be changed if a large-scale swine flu outbreak occurred. He felt that the decision was important, and a balance of risks. But he did not assume that he could balance the risks between a potential winter pandemic and the unknown risk that GBS might be a growing problem. So he relied on Dr. Cooper's recommendation, and went with expert advice.

We have good data on the preparation and rationale developed among Mathews, Cavanaugh and Cooper, including their consultations with Dr. Salk and Dr. Sencer. They tried to balance the unknown risk from GBS with the equally unknown risk that a pandemic might still break out. Sencer was worried about liability, but the three policy advisers were more concerned about the public health risks. So was Dr. Salk. The decision was presented as a suspension of the vaccination program, rather than as termination, because they knew that the relative risks would appear different if an outbreak still occurred in the remaining flu season. Once again, President Ford went with the experts.

**Abstracting the Case: Tables of Key Advisers.** Table 4-18 identifies the key advisers that the President relied on to make his decision. In this case, it is very easy to determine who were the key advisers. Before December 16, no one had come to the President with any discussion of suspending the NIIP, although Secretary Mathews had kept him up-to-date on the program implemenation. When he was, for the first time, presented with information saying that the program should be suspended, the only advisers in the room with him were Dr. Mathews, Dr. Cooper and Dr. Cavanaugh. In many ways that was a good choice, since these were the advisers the President relied on most throughout the swine flu program. Two of the three key advisers are the same as the ones relied on for starting the swine flu vaccination program. But it is also true that they were the only people in the room, and the only ones that the President could turn to for advice at that moment, and he chose to rely on their knowledge, perspectives and expertise rather than delaying the decision further.

| Adviser | Impact on Decision | Scientific Expertise |
|---|---|---|
| **Dr. F. David Mathews, Secretary of Health, Education and Welfare, 1975-1977** | Trusted by President as an expert with no ulterior motives and good judgment. | PhD. in history, primary writings on effectiveness in higher education. President of University of Alabama during a period when improving preventative medicine was a major initiative, just before joining the Ford Administration. |
| **Dr. Theodore Cooper, Assistant Secretary for Health, HEW, 1975-1977** | Canvassed wide range of experts, advisers and made recommendation that Cavanaugh ask the President to suspend program. | Physician, M.D. and Ph.D., cardiac surgeon, director of the Public Health Service. Over a decade of research and leadership on medical and public health issues, mostly at NIH. |
| **Dr. James H. Cavanaugh, Deputy Director of the Domestic Policy Council 1976-77; Deputy Chief of Staff, 1976 (August) – 1977 (January)** | Made formal recommendation for suspension of the program. Also provided access to the President for a rapid decision because he was acting White House Chief of Staff | PhD in Public Administration. Ten Years of experience on health policy issues in HEW and the White House. |

**Table 4-18. Key Advisers on President Ford's Decision to Suspend the National Influenza Immunization Program**

The three scientific experts relied on by President Ford for the decision to suspend the national swine flu vaccination program are the same three he relied on to begin the program: Cooper, Salk and Sencer. Table 4-19 shows their impact on this decision, and how their expertise was relayed to the President. The only real difference was that Salk was not speaking to the President directly (Cooper called him for input) and that Dr. Sencer did not have an opportunity to present to the President. Once again, however, Dr. Sencer was the driving force behind the need for a decision. His actions on the morning

| Scientific Expert | Impact on Decision | How Expertise Presented to the President |
|---|---|---|
| **Dr. Theodore Cooper, Assistant Secretary for Health, HEW, 1975-1977** | Primary person relied on by the President in making the decision to suspend | Cited by Cavanaugh as the source of the recommendation. |
| **Dr. Jonas E. Salk, Founding Director, The Salk Institute for Biomedical Sciences, 1960-1995** | Primary outside expert associated, by December, with continuing the program. Key adviser contacted by Cooper before deciding to go with decision to suspend the program. | Called by Cooper for consultation before approaching the President |
| **Dr. David J. Sencer, Director, Centers for Disease Control, 1966-1977** | Primary implementer of the NIIP, he also was the person to initiate the proposal to suspend the program pending study of the potential link between swine flu vaccinations and GBS. | Through Cooper to Cavanaugh. |

**Table 4-19. Key Scientific Experts Relied on by President Ford in his Decision to Suspend the National Influenza Immunization Program**

of December 16 initiated the need for a Presidential decision, and his concern about the liability implications of GBS provided the motivation for a quick decision.

**Assessing the Variables: Variables on the Advisory Mechanism.** Table 4-20 summarizes the assessment of the seven Advisory Mechanism variables for President Ford's decision to suspend the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **Single Strong Adviser** | **Yes** |
| **Policy Advocate** | **Yes** |
| **Committee Created for this Decision** | **No** |
| **Committee of Standing Advisory Body** | **Yes** |
| **Reports on Issue Prepared in Advance of Decision** | **No** |
| **Direct Report to the President** | **Yes** |
| **Communication (without a policy recommendation)** | **No** |

**Table 4-20. Assessment for Case 2 regarding the Variables on the Advisory Mechanism**

***Single Strong Adviser.*** In the decision to suspend the NIIP, President Ford primarily relied on Dr. Theodore Cooper as a single strong scientific adviser to summarize the evidence, provide him with a perspective on the consensus across the scientific community, and make a recommendation based on the best science available.

The candidates for a Single Strong Adviser, as shown in Table 4-19, are Dr. Theodore Cooper, Dr. Jonas Salk, and Dr. David Sencer. They are the three persons who meet this study's criteria for a scientific expert and have the most impact on the President. Of the three, only Dr. Cooper had direct access to the President in the critical three days leading up to the decision. The other criteria required for acting as a strong science adviser would be to act as the only expert summarizing the science for the President, and whether the President bases his perspective on the science solely on that summary (rather than seeking additional scientific perspectives).

Before going to meet the President, Dr. Cooper sought outside opinions by telephone. The most dramatic of these attempts to poll the experts was having the White House switchboard track down Dr. Salk in Paris and get his opinion, but that wasn't the only person with whom he checked. On the whole, Salk felt that there was little public risk from GBS, but he also thought that the lack of any swine flu outbreaks made ending the vaccination program also an acceptable risk. Pressed, he reluctantly said he would back Sencer's recommendation (Neustadt & Fineberg, 1979, pp. 70-71). Dr. Sabin, on whose opinion Cooper had relied in advocating the NIIP, had independently come to the conclusion that vaccination should be suspended until an outbreak of swine flu was detected (Dehner, 2004; Neustadt & Fineberg, 1979, pp. 70-71, 141).

While we don't know much of what happened in the Oval Office discussion of December 16, it is clear that Dr. Cooper was the only one in the room who could offer any broad scientific perspective. We know that in previous meetings Mathews and Cavanaugh, neither of who were physicians, had deferred to Dr. Cooper on scientific issues. And we know that Dr. Cooper had reviewed the scientific consensus, providing a balance to Sencer as the only source of scientific input; Cavanaugh and others were suspicious of Sencer. Officially, Dr. Cooper was supposed to the senior scientific adviser to Secretary Mathews on public health issues. That is why the Assistant Secretary for Health was almost always a physician, while the Secretary was rarely a technical specialist. Finally, we know that the President based his decision on trust of the information provided by these three advisers. Among the three, Cooper was counted on to state the science.

In the case of suspending the NIIP, however, it is likely that Dr. Cooper acted as a single science adviser. Dr. Sencer and Dr. Salk do not qualify because they did not have direct access to the President to make their case. Dr. Cooper made their case his own after talking with both of them and with others involved in the decision. Dr. Cooper summarized the state of scientific knowledge for the President. If other meetings involving Cavanaugh, Mathews and Cooper are a good guide, the other two participants would have deferred to Dr. Cooper on scientific matters. Finally, the President seems to have accepted the views presented in the meeting as a consensus, and did not feel the need to seek other advice. By the three criteria used in the operationalization of this variable, Dr. Cooper seems to have acted as a single strong science adviser in this decision. Officially, Dr. Cooper had a science advisory role to the Secretary of HEW, and he seems to have taken the role seriously in this decision. Rather than relying on Sencer alone, Dr. Cooper phoned several people for consultation (even tracking down Dr. Salk in Paris). Moreover he contacted Cavanaugh and Mathews, discussed the entire issue, and drove the issue to decision by the President.

The argument for the importance of the Policy Advocate position is that science expertise is more effective if presented as a strong argument for a specific action, and therefore uncertainties and disagreements about the proposals are minimized. The operationalization of this variable in Chapter 3 focuses on presenting the issue as a policy recommendation instead of acting as an honest broker on the facts. While I'm sure that Cavanaugh, Cooper and Mathews would have seen themselves as honest brokers, they were meeting with the President to urge immediate action, rather than to lead him through a range of options. Having concluded that suspension was the best option, the three advisers met with the President to tell him so.

There was no Committee Created for this Decision. The President did not ask for a review of the evidence, and no one in the HEW chain felt a need for one.

There was also no impact from a Committee of Standing Advisory Body. This action was taken entirely on the basis of internal Administration members. In fact, it is not clear that an advisory body of experts with no responsibility for government liability would have made this recommendation. As recently as two days earlier, Sencer had canvassed a range of state, federal and outside scientific opinion and the consensus was for continuing the program.

There were no Reports on Issue Prepared in Advance of Decision prepared before the Decision Analysis Timeline that influenced the President's decision. The decision came on very quickly. The President may have been influenced by press reports. His own involvement would have created a sense that the program's implementation was a problem, but there is no evidence that the President was relying on the impartiality of reports prepared in the calmness of academic speculation as a guide to the current decision

This decision clearly involved scientific experts providing Direct Report to the President. Dr. Cooper – who was officially the primary adviser in the U.S. Government on public health issues – was present in the critical meeting with the President, was the person who represented an expert position on the issue, and the person who was recommending that, on balance, it was time to stop vaccinations. The President probably considered Dr. Mathews and Dr. Cavanaugh experts as well, even if they do not meet the criteria established for this study.

Finally, there was no Communication (without a policy recommendation) on this issue. In this case, the context was one of recommending a change to the program. In fact, the rationale for raising the issue to the Presidential decision was the need to get his concurrence on a change to a program with which he was closely associated. If the group were not recommending such action, there would have been no point in coming the President.

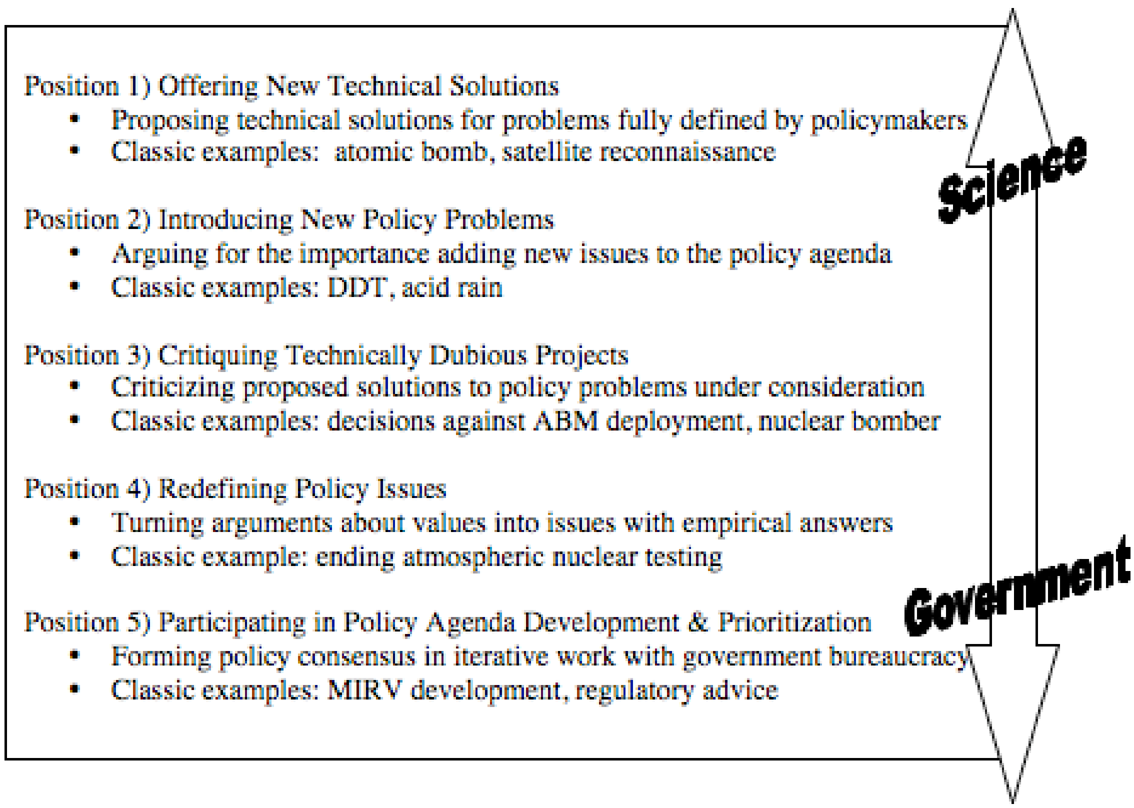


**Figure 4-10 Scale for the Role of Scientists in Influencing a Government Policy Decision**

**Assessing the Variables: Variable on the Role of Scientists.** On the scale of potential roles for scientists in the policy process, as presented in Figure 4-10, the scientists in this decision acted in Position 5: Participating in the Policy Agenda Development & Prioritization.

The critical question here is "Do scientists claim to be addressing the balance of government priorities as well as scientific questions?" There is no doubt that the three scientific advisers did a balancing act between science, scientific uncertainties and other government needs in making the recommendation. In particular, they were concerned about the potential liability claims against the government if the program went on, whether or not GBS turned out to be caused by vaccinations. They were also concerned about the impact on future vaccination programs, both about the public developing a fear that the vaccination was more dangerous than the disease and about the potential lack of faith instilled by stopping the program only halfway through the flu season. These are concerns of government programming and priority, and clearly affected their decisions. Although now very aware of how much they did not know about influenza, Sencer, Cooper and Salk all came slowly and with reluctance to the conclusion that the program should stop.

**Assessing the Variables: Variables on the Type of Expertise.** Table 4-21 summarizes the assessment of the four Type of Expertise variables for President Ford's decision to begin the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **Experts from Outside Government** | **Yes** |
| **Experts other than Advocates** | **No** |
| **Best Expertise on this Issue** | **No** |
| **Experience with Science Advice** | **Yes** |

**Table 4-21. Assessment for Case 2 regarding the Variables on the Type of Expertise**

The use of Experts from Outside Government is clear from the outreach to Dr. Salk before making the presentation to the President. While there is no record of the conversation in the Oval Office that day, it seems likely that Dr. Cooper would have mentioned Dr. Salk's opinion after tracking him down in Paris to get it. And Dr. Cooper wanted that outside opinion, perhaps concerned that his own interest in government liability might outweigh the continuing risk of a pandemic.

On the other hand, in the decision to end the NIIP there was no outreach to Experts other than Advocates. Only the three advisers in Table 4-18 met with the President, and he did not seek any other opinions. There could be several reasons for this other than a Presidential tendency to seek such advice. Unlike the March decision, there was now an extensive range of sources that provided the arguments for stopping. By the beginning of vaccinations in October, Sabin had written on his belief that stockpiling vaccine would be sufficient given the lack of swine flu cases through summer. The President might have been aware of the exchange of letters in the Lancet about the differing U.S. and U.K. perspectives on the swine flu virus, since the New York Times had covered the controversy, and used the British position to argue in editorials that the U.S. had overreacted. The press coverage, while still supportive in the main, certainly provided a basis for understanding that there were alternative opinions. But, unlike the decision to start the program, President Ford did not directly seek the opinions of experts who were not advocates for stopping the program.

As defined in Chapter 3, there was no attempt to provide The Best Expertise on this Issue. Again there may be reasons for this. In March, the President had been assured that he received the best science advice possible on the subject. Now the same persons were telling him to stop. In particular, he may have thought of Salk and Sabin as the best scientists on vaccination because of the way they were presented in March. Both were now advocating stopping the NIIP. And he clearly relied on Dr. Cooper as the key science advisor by this time, and believed that he had always kept him up-to-date on the evolving issue. He did not explicitly ask for a review of the issue from the best experts available, but he may have believed that he was getting the input of the best experts without asking.

Finally it is clear that the three most influential scientists all had Experience with Science Advice. These are the same three scientists who were listed as science advisers in Case #1, and the same reasons given in that write-up – demonstrating their extensive experience with science advice – apply for this case. Cooper, Salk and Sencer were all experienced in giving science advice, and understood how to present scientific facts and uncertainties in an effective way for the use of policymakers. The experience of each of them in providing science advice was discussed in Section 4C.

**Assessing the Variables: Variables on the Type of Decision.** Table 4-22 summarizes the assessment of the four Type of Decision variables for President Ford's decision to suspend the National Influenza Immunization Program.

| Variable | Assessment |
|---|---|
| **High Scientificity** | **Yes** |
| **National Security Issues** | **No** |
| **Based on Wide Scientific Consensus** | **Yes** |
| **Led by an Agency with Scientific Culture** | **No** |

**Table 4-22. Assessment for Case 2 regarding the Variables on the Type of Decision**

There is little doubt that President Ford considered this decision one that turned on primarily scientific questions, a decision of High Scientificity. He seems to have asked only about whether Dr. Cooper personally recommended the suspension of the program, but the interview with Dr. Mathews makes clear that he knew that he could count on Dr. Cooper to ensure that he was hearing the best scientific opinion. He could have asked about the scale of liability for damages, or fault for the problems. Instead his thoughts were apparently about the remaining possibility of a pandemic, does the consensus recommend suspension of the program, and why a suspension was prudent. While the answer was still that the likelihood was unknown, it was clear that the scientific consensus had now moved to stopping the program despite that uncertainty. Once again, he asked questions about what the scientists thought.

By the standards used in this study, the decision was not one of National Security Issues; it was a Domestic decision. While there would be national security implications for a serious influenza pandemic, they were not discussed during the President's decision-making. DoD had already completed their vaccination program by this time, and had inoculated all relevant parts of the armed forces against swine flu (together with the other two major strains of flu), as an issue of maintaining full operational capability. They continued to give some injections after December 16. The national security parts of the decision were not made by the President, but followed normal military operational procedures.

The President likely considered that his decision was Based on Wide Scientific Consensus. While he did not go to the lengths that he did in March to test for scientific consensus, his limited questions on December 16 suggested that he was still relying on consensus as expressed by Dr. Cooper and Dr. Mathews. The difference was that the consensus had now moved to stopping the program.

The decision to end the national swine flu vaccination program was led by the same HEW leadership that called for the initiation of the program. Since it was argued in Section 4C that HEW was not an organization Led by an Agency with Scientific Culture, that remains true for the stopping of the program. A physician or scientist had never led HEW, despite significant responsibilities in health and medicine, at the time of this decision.

| Variables Present in this Case | Mixed Results Potentially Situation-Dependent | Variables Absent in this Case |
|---|---|---|
| Single Strong Science Adviser<br><br>Policy Advocate<br><br>Direct Report to the President<br><br>Participating in Policy Agenda Development & Prioritization<br><br>Experts from Outside Government<br><br>Experience with Science Advice<br><br>High Scientificity<br><br>Based on Wide Scientific Consensus | Reports on Issue Prepared in Advance of Decision<br><br>National Security Issues<br><br>Committee of Standing Advisory Body<br><br>Experts Other than the Advocates<br><br>Best Expertise on the Issue | Communication (without a policy recommendation)<br><br>Led by an Agency with Scientific Culture<br><br>Committee Created for this Decision |

**Table 4-23. Summary of Variables Present and Excluded in Case 2**

**Findings: Variable Impacts and Exclusions.** Table 4-23 summarizes the presence and absence of the variables in President Ford's decision to suspend the NIIP vaccination program. As shown in the table many of the proposed variables that would influence a President to use scientific advice are present in the case. Particularly striking is the President's perspective that this decision turned on science, and that there was a strong consensus among scientists. Once again, this case provides clear evidence that scientists and physicians can make trade-offs among government needs and limitations while still maintaining a unique role as experts supporting the President's decision-making process. Having an opportunity for scientific experts to speak directly to the

President was once again important in this case, as was outreach to at least one important outside expert.

For purposes of this study, the more interesting results are the variables clearly absent from the case: Communication (without a policy recommendation), and Led by an Agency with Scientific Culture, and Committee Created for this Decision. These variables may be present in some cases where scientific expertise becomes important to a Presidential decision, but they are definitely not necessary for a President to pay attention to scientific advice.

There is also little doubt President Ford was moved more by clear recommendations for action than he would have been by Communication (without a policy recommendation). The President had reasons to question the recommendations made by HEW. A clear recommendation, brought by both the scientific and administrative leadership, brought the scientific questions into focus rather than confusing them with a policy perspective as feared by advocates of Communication (without a policy recommendation). Without the recommendation, it is very unlikely this would have been on the President's agenda, and certainly would not have lead to a Presidential decision to suspend the program only halfway through the flu season.

And the case provides a good example that the organization presenting the case to the President need not be Led by an Agency with Scientific Culture to make an argument that turns primarily on scientific expertise. The President received this issue almost exclusively from HEW advisers, and HEW is an organization that has always been led by non-scientists.

The President could have created another committee – with or without his personal involvement – to ensure that there was a scientific and programmatic consensus about suspending vaccinations. One can make the case that there was, in fact, less reason to rush about this decision than the initiation of the program, when the timetable for vaccine production required a very rapid decision. At this point, however, the President was willing to rely on his internal advisers, and perhaps to accept that they had sufficiently canvassed the external expertise.

On the basis of this case alone, it can be said that these three variables (Single Strong Science Adviser, Communication (without a policy recommendation), and Led by an Agency with Scientific Culture, Committee Created for this Decision.) are not necessary for a President to make use of scientific expertise as a major factor in a critical decision.

This case is not considered sufficient to rule out the necessity of Reports on Issue Prepared in Advance of Decision, and National Security Issues, Committee of a Standing Advisory Body, Experts Other than the Advocates and Best Expertise on the Issue.

The influence of Reports on Issue Prepared in Advance of Decision is not strongly addressed by the case. The extremely short timeframe between the initial concerns about a correlation between increased rates of GBS with vaccination and the demand for a Presidential decision are sufficient reason that such reports were not available. Reports on Issue Prepared in Advance of Decision may be a more important variable when a Presidential decision turns on an area with a longer history of discussion and report writing.

The National Security Issues variable is clearly not in place for this issue, but the importance of that variable will probably require further study on multiple cases. This case alone provides evidence that a President may make a decision primarily on the review of scientific expertise without believing it to be a national security issue. But the contention in the science advice literature that such consideration may be more likely for national security decisions would require comparison of more cases than are studied here.

There was no Committee of a Standing Advisory Body that made a recommendation on the decision to suspend vaccinations. But there was no obvious standing committee with a role to play in such implementation decisions. Public Health Campaigns are not usually subject to expert committee review during the course of implementation, although they may be reviewed from year to year to see if they are meeting the original goals. With little reason to know what equivalent of the ACIP or AFEB would have provided a recommendation, this case is not considered to have ruled out the need for such an approach.

The case is not considered to rule out Experts other than Advocates because the President was probably aware through other means of the opinions of a wide range of experts and pundits on the swine flu vaccination program by December 1976. The experts other than advocates in this case would involve people who had not concluded that it was time to suspend the vaccination program. There were such individuals, who felt that the value of increasing the herd immunity to swine flu viruses was a worthwhile goal in case swine flu returned the next year or later, and who viewed the risk from increased rates of GBS as likely a spurious correlation. But the President may have felt that he was sufficiently aware of the range of opinions at this time to not seek contrarian opinions. He may have felt that the test for consensus was already met by the conclusion that it was time to suspend the program coming from the people who had been the major advocates for the vaccination program.

This case is not considered sufficient to rule out Best Expertise. The President made no effort to ask if the best expertise had been consulted, as he did in the March decision. But he may well have felt that the best expertise had been consulted based on their continued involvement in program, on his reliance on Dr. Cooper to provide him with a complete view of what was taking place, and on the last-minute consultation by Dr. Cooper with Dr. Salk. He may have not felt the need to ask for such Best Expertise because the program implementation between March and December had convinced him that the best were always involved in providing advice to Dr. Cooper.

**Findings: Observations.** President Ford likely made the decision to suspend the swine flu program due to a combination of (a) trusting his experts that, on balance, the risks of a pandemic were now less than other risks and (b) a weariness of the program's implementation problems and press attacks, exacerbated by the malaise from losing the Presidency.

The President trusted his experts, particularly Dr. Cooper, because he had learned to rely on them through the program, because he believed they were providing him with a consensus of the best expertise, and because they provided him with a clear program of action backed up by that consensus. There is also a certain amount of context: he had trusted them when he started the program and felt just as comfortable trusting their judgment when they said it should end.

What drove the experts within the government may have been different than how they presented their concerns. Sencer, and to a certain extent Cooper seem to have been concerned about the blame that would accrue as liability for GBS was assigned to them, due to complete absence of such a risk from the consent forms. There is no transcript of what was said in the Oval Office on December 16, but it seems likely that his advisers emphasized the potential side effects and the press coverage of them, rather than who might be to blame for eventual government liability costs.

After looking at the case in detail, it is hard to ignore the weariness factor in addition to the recommendations of experts as a point in the decision. The President was at the end of his term, and the issue was in the news as a problem program. President Ford must have also seen the program as troubled, with one issue after another. The only time the President became upset about the program – to Secretary Mathews on September 2 – was when he first sensed that the implementation of the program might not be as smooth as promised, since there were no vaccinations available at the start of the school year.

There are some differences from Case 1 in the factors that led the President to rely on expertise. In particular, there is a better case here for someone (Cooper) acting as a single strong science adviser, and the policy advocate role for Cooper and the other scientific experts is clearly evident. And there are two factors that seem equally strong between the two cases: the President's tendency to think that the questions were ones for experts to decide (high scientificity) and the influence from a belief that there was a scientific consensus about the course of action.

Does President Ford represent merely a President who goes along with his advisers? Some science advice writers have said that the most important factor in getting a President to listen to science advice is getting a President who listens to advice; while that seems disturbingly circular reasoning as a policy prescription, it does raise the question of whether President Ford is such a President. But in other areas, like the controversial Nixon pardon, President Ford bucked otherwise-trusted advisers for his own perspective. Even within the context of swine flu, he rejected the State Department's preference for sharing U.S. vaccine production with Canada and Mexico, when HEW was studiously neutral on the right answer to that question. So the interesting emphasis put on consensus and scientific issues seem to be relevant to why, on this decision, President Ford listened to scientific advice.

Finally, although it is mainly an issue for Chapter 5, it is worth reflecting on the perspective that the swine flu decisions – both to start and to stop the program – are viewed as a public policy fiasco. For purposes of this study, it doesn't matter if following the experts' advice led to good policy or bad policy. The science advice literature, and common sense, suggests that, under some circumstances, following expert advice is the way to bet, even if it sometimes turns out wrong.

There should be no doubt that fiasco was the perspective at the time. Editorials about the program in December and January were scathing, accusing the Ford Administration of everything from political chicanery, through being in the pockets of drug companies, to (inevitably) not paying enough attention to scientific advice. One reason President Ford's decision on December 16 was difficult was that he must have known that stopping the vaccinations would provide ammunition to those who wanted to have a last run at criticizing his Presidency, as well as giving the appearance of guilt to the juries that would decide government liability for side effects. (Goetz, 2006)

But before leaving the case, note that the success or failure of this policy may not be best judged at the moment when a pandemic, whose likelihood was truly unknown, did not occur. Many of those involved maintain to this day that they would make the same choice today, if faced with the same unknowns. But, more importantly, because of the 1976 NIIP no public health official will be faced with exactly the same unknowns. The NIIP began several things that we now take for granted. We now routinely vaccinate a large part of the healthy population against influenza strains every year. Vaccinations routinely include a well-thought-out consent form, and such forms provide a good discussion of the uncertainties associated with vaccination-triggered autoimmune syndromes including GBS. Production of vaccine still relies on egg growth, but recombinant DNA techniques to speed production are in common use. Annual worldwide production of influenza vaccine is at least four times what it was in 1976, and most of that vaccine is used. Worldwide surveillance and communication of influenza outbreaks has dramatically improved, albeit still limited to the more severe outbreaks. Overall, is not clear that the legacy of the swine flu decisions is entirely bad.

**Case 3, President Reagan's Decision to Sign an International Agreement Binding the U.S. to Ban Production of Ozone Depleting Chemicals**

**Introduction.** In September 1987, 46 industrial nations, led by the United States, signed the Montreal Protocol on Substances that Deplete the Ozone Layer, a treaty that committed the signatory nations to freeze the production of chemicals believed to affect the ozone layer, and plan the eventual end of production for such compounds. This was an unprecedented step for the international community, establishing for the first time that an environmental problem required a common and united action to reverse an existing problem. Kofi Annan has described the treaty as "perhaps the single most effective international treaty to date."

The development of an international commitment to eventually ban a set of economically useful chemicals was led by the United States, by scientists, diplomats and bureaucrats within the Reagan Administration. Reagan's decision to negotiate a binding international agreement was critical to the success of the negotiations and to the ratification in the Senate. The Congressional agreement to a treaty that would constrain U.S. industry would have been impossible without the support of the Reagan Administration, since the main doubters in Congress were Republicans.

The Montreal Protocol is often cited by admirers of President Reagan as a good example of how his governance was not driven by ideological concerns, and how he supported environmental regulation when it was based on good scientific evidence. And it is surprising that an Administration that was skeptical of both environmental regulation and international treaties would take the lead. This case study provides a review of the process by which the decision was made to negotiate a binding restriction the production of chemicals that could affect the ozone layer, and how scientific expertise was communicated to the key decision-makers and to those that influenced the President to make that decision.

**Narrative Review of the Case: Why do We Care About Ozone?** Ozone is an unstable compound of three oxygen atoms bound together, rather than the usual two oxygen atoms used in respiration. Ozone is created by a combination of energy absorption and interaction with other chemicals. In the earth's multi-chemical dynamic atmosphere, ozone is continually created and destroyed.

In the lower atmosphere, ozone can be created directly in industrial processes or indirectly when sunlight interacts with other gases. One of the major reasons that automobile fumes are dangerous to human health is that they can combine in sunlight to produce high concentrations of ozone. Since ozone is highly reactive with tissues, it causes burns and lesions within the lungs as well as other damage to humans, animals and materials. Humans smell ozone when it is present at a few parts per billion, and it becomes dangerous to their health when inhaled for a sustained period at a few hundred parts per billion.

In the upper atmosphere, stratospheric ozone is also continuously created and destroyed by interactions of atmospheric gases and incoming solar radiation. But ozone plays a bigger role in atmospheric chemistry at altitudes of 10-50 kilometers. Concentrations in this so-called ozone layer can rise to more than ten parts per *million*, although there are significant daily, seasonal, and situational variations. The continual absorption of ultraviolet wavelengths of sunlight maintains the high concentration of ozone in this region of the atmosphere and thereby attenuates ultraviolet radiation reaching the earth's surface.  At these concentrations, the ozone layer absorbs all of the shortest wavelengths of ultraviolet light (out to 295 nanometers), and attenuates the longer ultraviolet wavelengths.

The absorption of shorter wavelengths of ultraviolet light from the sun (roughly 200 to 320 nanometers in wavelength) is particularly important to living things.  Single-cell organisms are easily killed by short-wavelength ultraviolet light.  It is a reasonable supposition that the existence of life on earth depended on the formation of an ozone layer that protected early life from too much exposure to ultraviolet radiation.  The protection is still needed today.

In humans, the most noticeable effects of increased exposure to short wavelength ultraviolet radiation is increased incidence of skin cancers and cataracts.  Animals suffer similar effects, including most sea life since the ocean is transparent to these wavelengths.  Algae and plankton, the basis for the ocean's food chain, would reproduce more slowly under higher intensities of ultraviolet light. Plants would suffer from other cellular damage, leading to reduced crop yields and lower forest growth rates.

In addition to the effects on nature, many man-made materials such as plastics and other polymers degrade at a much faster rate with ultraviolet exposure.  Exposure to sunlight is the major life limitation in many applications of man-made materials, even with the significant attenuation provided by the stratospheric ozone layer.  Enhanced levels of ultraviolet radiation would speed such degradation.

**Narrative Review of the Case: Environmental Regulation on Ozone Before President Reagan.** Ozone had been an area of professional interest for the Environmental Protection Agency (EPA) since it's founding in 1970. Ground-level ozone formation is a major contribution to health problems from air pollution. The legislation that guides the EPA, dating from the 1960s, directed strict control of ozone-related chemicals. But that requirement was put in because of the need to reduce ozone concentrations in the lower atmosphere. Stratospheric ozone, which is created primarily by absorption of ultraviolet solar radiation, was originally thought unaffected by human activities. (*Clean Air Act of 1963*, 1963).

A sequence of studies in the 1970s showed that human activities in the stratosphere – via rockets and high-flying aircraft -- could affect the dynamic balance that ensures that dangerous ultraviolet radiation does not reach the lower levels of the atmosphere. But the amount of human activity in the stratosphere is small, and no regulation was thought necessary. The potential for ozone depletion was one of many reasons given for the U.S. decision not to develop commercial supersonic passenger aircraft (Johnston, 1971). But European decisions to pursue a supersonic Concorde were not judged a significant threat to the ozone layer's ability to protect human health.

In 1974, Sherwood Rowland and Mario Molina, in work that would eventually win them a Nobel Prize in chemistry, developed sophisticated models of stratospheric chemistry. The chemists had not originally been interested in industrial use of CFCs, pollution control, or health impacts of ultraviolet radiation. But their models suggested that that release of certain gases used in industry – the chlorofluorocarbons (CFCs) and halons – could lead to a depletion of the ozone layer. The models were complex and the results surprising. Most chemicals released into the atmosphere interact with other parts of the environment to combine or break down within the first 5 kilometers of the atmosphere. In contrast, CFCs and halons remain stable and migrate into the stratosphere unchanged. In the stratosphere, they are broken down by radiation to become a new source of halogens (primarily chlorine) that can significantly change the balance of reactions that sustain the ozone layer (Molina & Rowland, 1974).

Molina and Rowland's work immediately spawned a call by environmental groups for reduction in CFC production. In their initial estimates, Rowland and Molina suggested that, if these chemicals continued to be released at current rates, the ozone layer could be depleted by as much as 15% by the middle of the twenty-first century. Such a drastic decrease in ozone would significantly increase the penetration of ultraviolet radiation to earth. The amount of ultraviolet enhancement depended on many factors, but was predictable, just as the effects on human activities were predictable. Environmental groups quickly pointed out that that increased ultraviolet radiation would mean increased skin cancer for humans, harm to wildlife populations, and other effects. EPA projections of impacts on the U.S. from a 9% increase in ultraviolet radiation included 3 million additional deaths from cancer and 18 million additional cases of blindness in the 21$^{st}$ century (Benedick, 1998, p. 21).

Industry resisted the implication that the use of these gases should be restricted, and began a campaign to demonstrate that their use was not proven dangerous to human health and the ecosystem. As they pointed out, CFCs were of increasing use precisely because they were stable in the lower atmosphere and therefore contributed little to air pollution. For human safety, CFCs often represented the best option where a working fluid needed to be nonflammable, non-corrosive and non-toxic over a wide range of temperatures. CFCs were also cheap to produce, and had been the basis of very profitable products as refrigerants, propellants, insulators and solvents. By 1974, the worldwide production of CFCs was almost 800,000 metric tons; use had quadrupled between 1964 and 1974. DuPont Chemicals, the inventor of CFCs, was particularly active in early response to the environmental challenge. Industry argued that speculative modeling by atmospheric chemists was hardly a reason to restrict a growing, profitable, and environmentally friendly chemical business.(Molina & Rowland, 1974; Mullin, 2002; Reitze, 2001)

During the Carter Administration, industry lost part of the battle. Congress passed an explicit ban on the use of CFCs as propellants in aerosol cans. Congress reasoned that aerosol propellants were a non-essential use for CFCs, while other uses such as in refrigerants (Freon) and fire extinguishers (Halon), could be more critical to human welfare. Legislation committed the EPA to continue research and develop plans to protect the ozone layer from damage caused by industrial production, and to explore with industry the potential for less harmful substitute chemicals. (Reitze, 2001, p. 388)

Only the U.S. banned so-called non-essential uses of CFCs. European countries had not banned the use of CFCs as propellants in 1974, and, at the time, aerosol propellants represented about half the worldwide use of CFCs. Therefore, industry encouraged the government to negotiate international controls that would put U.S. industry on an equal footing with European production. Despite their skepticism about the harmful effects of CFCs on the ozone layer, industrial groups encouraged negotiation of international controls because they saw the loss of a significant part of their business to European firms. (Reitze, 2001, pp. 387-389)

**Narrative Review of the Case: Environmental Policy in the Reagan Administration.** When the Reagan Administration took charge in 1981, environmental policymaking became focused on getting regulations off the back of industry. Environmental regulation was seen as just one more area where government was placing costly constraints on U.S. productivity, based on limited scientific evidence and misguided priorities of Democratic leadership. As a candidate, Ronald Reagan gave only one speech on the environment, and he chose to cast aside the middle-of-the-road text provided by his staff and made off-the-cuff statements that suggested he thought the entire environmental movement was misguided. The campaign had outlined no environmental goals for the administration, other than a rollback of whatever regulations could be addressed by administrative action. For environmental and resource posts, President Reagan appointed to key posts Republican loyalists known to be enemies of environmental regulation. EPA Administrator Anne M. Gorsuch, and President Reagan's first Secretary of the Interior James G. Watt, has been called the most blatantly anti-environmental appointees in U.S. history (Cooper, 2009).

The EPA leadership under Gorsuch focused on reducing the staff and capabilities of the EPA, minimizing new regulation, limiting enforcement of existing legislation, and following the lead of industry and the Office of Management and Budget (OMB) on all activities. She viewed herself at odds with Congressional legal requirements to conduct activities that she thought were either unnecessary, or should be delegated to the states. She indicated that she viewed OMB as the lead organization for determining the value of regulations of all types, including environmental regulations. She deferred to OMB and other White House staff for conducting the newly required cost-benefit analysis of proposed and existing regulation, and relied more on industry contacts for information than on EPA staff (Golden, 2000).

Ozone issues were not really a front-burner issue, even for the scientists, during the Gorsuch period at EPA. Congress had already banned the use of CFCs as aerosols, and research during the period did not yet suggest the need for new regulation. In addition, industry was focused on seeking parity through an international ban on non-essential uses of these chemicals, so EPA scientists working on ozone depletion research were largely viewed as positive assets to industry in seeking European agreement.

The early 1980s was a time of extreme argumentation and debate among researchers about the scale and rate of ozone depletion that could come from CFCs and other chemicals. As the complicated atmospheric chemistry was modeled in increasing detail, estimates of ozone depletion varied from a high of 20% over the next century to as little as 2%. The larger estimate might have supported banning such chemicals, but the smaller estimate would suggest it was more important only to constrain growth in areas where no substitute was obvious.

Eventually, the Administration's approach to environmental regulations led to scandals that forced the resignation of EPA Administrator Gorsuch and others. In 1982, the House Committee on Energy and Commerce held hearings on what it believed to be political manipulation of the $1.6 billion Superfund that had been authorized in 1980 to handle cleanup of toxic dump areas starting with the Love Canal. Congress asked for documentation on EPA actions, and Administrator Gorsuch refused to provide them.

This led to her becoming the first Agency Director in U.S. history to be cited for contempt of Congress, and she resigned on March 10, 1983.

President Reagan appointed William Ruckelshaus, the founding Administrator of EPA, to lead the Agency for the remainder of his first term. Ruckelshaus was given maximum autonomy in hiring personnel, and had a great deal of credibility with both the EPA staff and Congress. In appointing Ruckelshaus, President Reagan said that he was providing a better manager, and ending a fight with Congress. But he also made the point that he would change nothing about how Administrator Gorsuch had implemented his policies, and did not expect the EPA to change direction under Ruckelshaus (Harris & M.Milkis, 1996).

**Narrative Review of the Case: The Move Towards Ozone Negotiations in the Second Reagan Administration.** Three factors led to an increased interest in negotiation of international controls on CFCs and halons during 1985. First, the EPA, now led by a team of managers brought in to respond to the scandals, began to make a strong case for broader controls. Second, U.S. industry and the federal government supported continuing international workshops, research, and negotiations about establishing non-binding goals for future international action; the goals became the basis for the Vienna Convention for the Protection of the Ozone Layer. Third, the discovery of seasonal ozone depletion in the Antarctic made the threat of ozone depletion more credible to industry and the public.

The EPA was much more active in developing and enforcing environmental control legislation under Lee Thomas, the Administrator for the entire second Reagan Administration. Thomas was one of the managers brought in by Ruckelshaus after he was charged with improving EPA performance in 1983. Although Thomas was not a scientific expert in environmental science, he was a talented public administrator committed to meeting Congressional mandates. He relied heavily on the professional expertise within EPA in determining the risks from industrial activity and the best course of action to minimize those risks. While he was loyal to Administration goals of minimizing regulation impacts on industry, and of basing new regulations on a formal benefit-cost assessment, he also saw creation and enforcement of justified environmental regulations as his primary responsibility. EPA employees felt included and empowered under Thomas, in contrast to being under attack during under Gorsuch.

Research on stratospheric ozone depletion within EPA had reached a high level of maturity, resulting in EPA leadership's interest in the search for international controls. They had become experts on the models, on data collection by spacecraft and land-based instruments, and had built a strong network of relationships with U.S. and international scientists across the full range of academic, government and industrial organizations. They provided Administrator Thomas with a basis for understanding the strengths and limitations of the existing data, and for interpreting the large uncertainties about projecting the future of stratospheric ozone depletion under various scenarios for production of CFCs.

From 1984 to 1985, a comprehensive scientific report on the risks of stratospheric ozone depletion was developed under the auspices of the United Nations Environmental Program (UNEP) and the World Meteorological Organization (WMO). The development of this report[12] brought together the best information from the wide variety of fields and organizations necessary to address the scientific complexities. It also gathered the best measurements of atmospheric chemical compositions over the last decade. The report offered estimates of effects on stratospheric ozone from specific scenarios about industrial production and use of CFCs, was over 1100 pages long and had many specific recommendations for future research. It suggested alternative possible approaches to limiting industrial production of CFCs, and addressed the likely impact of each. Even before it was published, the report became widely accepted among industry, scientists and policymakers as the baseline for future discussions about stratospheric ozone depletion. Table 4-24 presents the three major conclusions from the study that influenced subsequent discussions on control of CFCs.

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12 The report, *Atmospheric Ozone 1985:Assessment of our Understanding of the Processes Controlling Its Present Distribution and Change*, was published in 1986, but its major impact on the scientific and policy community came in 1985.

1. The amount of CFCs in the atmosphere had nearly doubled between 1975 and 1985, even though the production of CFCs had been constant. This was taken as demonstration that CFCs accumulate in the atmosphere rather than disperse through some mechanism, and that future CFC production would be in the atmosphere for a long time.

2. The best models suggested that current production rates of CFCs would lead to a 9% reduction in the ozone layer by the last half of the twenty-first century. This would imply a significant increase in damaging ultraviolet radiation to the entire planet, including the heavily populated subtropical regions. The report pointed out that the models still contained major uncertainties, and different models results included significant disagreements about details and spread of ozone depletion.

3. On the other hand, confident data showing actual ozone depletion or increased ultraviolet radiation remained lacking, and some models suggested that it might be decades before such depletion was measurable.

**Table 4-24. Summary of Critical Points from the WMO/UNEP Report on Atmospheric Ozone**

U.S. industry, led by DuPont, had strongly supported the development of the WMO/UNEP report. Industry felt that long-term planning required the best understanding of the effects of these chemicals. Industry organizations created an Alliance for Responsible CFC Policy. The Alliance was both a lobbying organization for their interests and a clearing-house for research. Through 1985, industry continued to argue that the data allowed many interpretations, and that further research might demonstrate that CFCs and halons were not a danger to the environment. But after the report, the Alliance stopped arguing that CFC regulation was based only on speculation, and instead argued that the range of uncertainty called for a careful balancing of appropriate legislation. Such a conclusion was consistent with industry's desire to seek a worldwide level playing field. Industry continued to support international controls that would place common constraints on all chemical producers.

International resistance to controls remained high through 1984, led by European governments. European industry suspected the entire issue was a U.S. effort to recapture chemical industry market share since Europe was competitive in CFC production. European media and public opinion had not focused on ozone depletion as much as in the U.S. Europe had, after all, gone ahead with a commercial supersonic transport when this issue had first been in the news. Led by the United Kingdom, European countries suggested waiting on regulation until the evidence of harm from CFCs was demonstrated. European industry continued to produce and use CFCs as aerosol propellants, even after the U.S. had converted to an affordable substitute.

Then some new science was added to the mix. The discovery in 1985 of the so-called ozone hole over Antarctica – a regional and seasonal thinning of the ozone layer to about two-thirds of its normal concentration – was a critical element in changing views about the potential threat to stratospheric ozone.

The WMO/UNEP report relied heavily on satellite measurements to determine worldwide ozone concentrations, and that data had shown no significant changes over the last decade. But ground-based measurements in late 1984, by the British Antarctic Survey, showed reductions in ozone concentrations by as much as a third below 1975 levels during the Antarctic springtime of September to December. The data were published in 1985, and received immediate press coverage. Despite that, the WMO/UNEP report did not address these findings, since the results seemed so new, so inconsistent with predictions about how the ozone depletion would occur, and seemed to be contradicted by spaceborne measurements[13]. Stratospheric ozone models, after all, had only predicted a few percent changes in ozone concentration over decades, and researchers were looking for the beginning of such a trend. And it was unclear how such a regional sharp change could occur, since all the models had focused on global effects. On the whole, the scientists took a conservative view and advocating waiting for confirmation, and being sure to not risk claiming an ozone depletion that might later be proven either incorrect, or based on a mechanism having nothing to do with CFC interactions.

However, the ozone hole data were important and lead to increased public and media concern about the potential dangers from depletion of stratospheric ozone. Now there was evidence of real ozone change, and the press emphasized that this was exactly what ten years of discussion had warned about. There was even limited human impact; when the hole broke up in January, New Zealand and Argentina experienced short periods of enhanced ultraviolet radiation. The facts that such regional change was unpredicted by the stratospheric chemistry models, and that the role of CFCs and halons in the Antarctic ozone hole was still unclear, were not an impediment to press coverage of the hole. Clear evidence of recent, possibly human-induced changes in a major part of the atmosphere made for a good story. The fact that small science had found what big science had failed to discover added an element that kept the story alive throughout the world. For many Europeans, this was the first time they saw extended coverage of an

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[13] By late 1986, too late for the WMO/UNEP report, scientists would learn that this large regional ozone depletion was present in the NASA data, but had been unreported due to assumptions by human researchers and pre-programmed data processing algorithms that rejected such large changes in ozone concentrations as likely measurement error.

apparent environmental crisis that might be caused by CFCs. Press coverage would come to have a greater impact in 1986-87, as the science of the Antarctic ozone hole became better understood.

In 1985, however, the science reflected in the evolving WMO/UNEP report was sufficient for the State Department and EPA to begin arguments for international regulations that went beyond U.S. legal restrictions on non-essential use of CFCs, and to seek a structured reduction in production of such chemicals over time. The WMO/UNEP report made clear that such chemicals were long-lived and did reach the upper atmosphere. Interactions with their U.S. industry counterparts made clear that substitutes could be developed, and that reduction in CFC production were not inherently industry-crushing. The key point for industry, as well as for most scientists, was that reductions only made sense (economically and environmentally) if they were applied worldwide.

As early as 1983, a group of northern countries (Canada, Norway, Finland and Sweden) had joined with Switzerland to form what was called the Toronto Group within diplomatic negotiations on CFCs.[14] This group advocated a complete ban on CFC production, and made many suggestions for protocols and treaties to move in that direction via caps on production, production capability, and release from existing stocks of chemicals. After Ruckelshaus replaced Anne Gorsuch as EPA administrator, the U.S. EPA led efforts to align the U.S. diplomatic approach to one that generally supported the Toronto Group, at least so far as it would lead to worldwide controls equivalent to internal U.S. controls. The U.S. Department of State approved that approach, since it

[14] Countries nearer the poles would see greater impacts from ultraviolet enhancement after ozone depletion, no matter what global average level of problems were predicted by the climate models.

allowed negotiations to be led by countries not associated with the economic contest between U.S. and European industries.

Discussions on the potential of ozone depletion were conducted under what was called the *Ad Hoc* Group, led by UNEP. Meetings of the Ad Hoc group had been underway since 1977. Generally the meetings consisted of presentations, proposals, and plans for action that were usually vetoed by European participants. U.S. commitment to action, and the support of the Toronto Group, led to the agreement in 1984 to consolidate the scientific understanding in the WMO/UNEP report, and to negotiate a protocol in 1985 that would clarify at least the international commitment to protect the ozone layer. Formal negotiations under UNEP leadership led to the Vienna Convention for the Protection of the Ozone Layer in March 1985. By itself, the Vienna Convention did nothing to control ozone-depleting chemicals. It laid out a framework for future international work, and identified a number of chemicals that might have effects on the ozone layer.

Led by pressure from the U.S., most countries and industries in Vienna agreed publicly that they would be in favor of controlling chemicals that were shown to cause damage to the ozone layer. However, many U.S. and European representatives were unwilling in 1985 to accept that such damage had been demonstrated, based on the science reflected in the WMO/UNEP report. The U.S. did not get its desired agreement to limit non-essential uses of CFCs. Key U.S. industry leaders indicated to Congress and to Administration leadership their support of the Vienna convention as a tool to encourage research and move towards leveling the playing field. Industry's involvement was key to convincing Administration leadership that this was not a step towards increased national or international regulation of U.S. industry.

With the Vienna Convention signed, some members of the Administration hoped that nothing more needed to be done on industrial controls of CFCs and halons during the Reagan Administration. In fact, the international and scientific elements of the Administration were moving towards more international regulation, while the domestic federal agencies were dead set against such restrictions.

**Narrative Review of the Case: Formalizing a Position for Strong Controls.** The Vienna Convention called for a series of international workshops on the scientific and practical aspects of controlling the risk of stratospheric ozone depletion. During 1986, the Department of State organized U.S. participation in these workshops, and thereby created a working alliance that would advocate within the U.S. government for negotiating strong international controls on CFCs and halons. The UNEP, using the Vienna Convention as a basis, called for the negotiation in 1987 of an interim protocol that would include limitations on future production of the chemicals of concern. In order to participate in those negotiations, the Department of State sought approval for a U.S. government position that included freezing production at 1986 levels, near-automatic reductions to 50% of that production rate within five years, and reductions by 95% as substitutes were developed. By November 1986, the authority to negotiate that agreement was formally approved within the U.S. government through the normal documentation process, and without the issue rising to a Presidential decision.

Key events in 1986 that would lead to the development and signing of the Montreal Protocol included:

- January: Release of the WMO/UNEP Scientific report *Atmospheric Ozone 1985*, the basic summary of scientific understanding;
- May: Workshop led by the European Community, in Rome, on CFC production and use trends, effects of existing regulations and possible alternatives to CFCs;
- June: Multiple articles in *Nature*, based on both ground and space measurements, confirming seasonal Antarctic ozone depletion;
- September, Workshop led by the United States, in Leesburg, on potential regulatory options and their effects on both atmospheric ozone and industrial needs;
- November, finalization of the U.S. negotiating position; and
- December, beginning of preliminary negotiations, in Geneva, on an interim protocol to control ozone-depleting chemicals.

Publication of the WMO/UNEP report laid the groundwork for a different perspective among industry leadership, researchers and mid-level policymakers about ozone depleting chemicals. The very limited nature of its conclusions demonstrated clearly that there was consensus about a few issues after almost a decade of scientific debate. Chlorine-bearing chemicals that were highly stable in the lower atmosphere clearly did make their way to the stratosphere, and were building up there. Models agreed that such chemicals would lead to ozone depletion, even if there were wide disparity about how much depletion could be expected. U.S. industry, as represented by the Alliance for Responsible CFC Policy, stopped their public relations campaign, arguing that there was no reason to worry. The WMO/UNEP report itself received press attention in the U.S. and Europe, emphasizing the elements of agreement across the board.

For the public, this seemed to be scientific consensus supporting the 1985 reports about an Antarctic ozone hole, even though the WMO/UNEP report was silent on that issue. The press covered multiple scientific publications over 1986 that documented and confirmed a seasonal recurrence of the Antarctic ozone depletion in 1985. Press provided worldwide coverage of the Australian government's warnings to its citizens to minimize sun exposure during January 1986. The erroneous sense that the U.N. was leading an effort to address the ozone hole problem became even more pronounced as the press covered meetings of the *Ad Hoc* Group meetings in Vienna every few months. Public interest in international controls on ozone-depleting chemicals began to be heard in European parliaments for the first time.

The two workshops were watershed events for building an international consensus that some level of control of these chemicals was possible. The U.S. worked very hard to ensure that the workshops were exchanges about facts and options. No proposals for action could be made, and statements on national positions were discouraged. Private sector participants from industry, academia and non-governmental organizations were encouraged to participate. The first workshop, in Rome, focused on CFC production trends and possible alternatives to CFCs. While a great deal of information was exchanged, the European countries concluded that there were no useful statements that could be made about such trends. The second workshop, in Leesburg, Virginia, focused on options for increased regulation and how such regulation could be implemented with minimum impact on economic growth. Most non-European countries felt that a good case was made that some reduction in CFC production was possible.[15]

Equally important, preparation for the workshops developed a partnership among State, the EPA, NASA, and the National Oceanic and Atmospheric Administration (NOAA). These organizations would become the internal advocates for strong controls.

The Antarctic ozone depletion story became big news in the summer of 1986, and stimulated increased public pressure for governments to act. Those involved in the negotiation of the Montreal Protocol downplayed the role of the ozone hole issue, emphasizing how preliminary the data seemed in 1985-1987.

After the September workshop, the U.S. Alliance for Responsible CFC Policy issued a statement calling for robust controls and significant worldwide reductions in production of CFCs and halons. The U.S. Department of State followed the normal bureaucratic process in developing a formal negotiating position for the December start of diplomatic discussions on an interim protocol. So by November, without a formal Presidential decision, the U.S. government had established a negotiating position of seeking immediate and increasing constraints on the production of CFCs and halons.

Regulation of CFCs could have remained a normal government action, not rising to the level of formal Presidential decision, except that senior members of the

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[15] The Soviet Union participated in the *Ad Hoc* Group, and in the workshops, but was largely silent. The Soviet Ministry of Foreign Affairs probably enjoyed watching a fight between Western Europeans and North American countries over the management of capitalist market shares.

administration chose to challenge the need for such constraints after the negotiations had begun.

**Narrative Review of the Case: Backlash in the Administration.** The major challenge within the Administration to strong international controls on ozone-depleting chemicals began after the bureaucratic approval for negotiating such an agreement had been completed. Between January and June of 1987, while the international negotiations for the Montreal Protocol were underway, a group led by OMB, the President's Science Adviser, and the Secretary of the Interior sought to reverse the U.S. position. The group was ideologically opposed to international constraints on U.S. industrial activity, as well as skeptical of the need for any further regulation of the production rates of ozone-depleting chemicals. The contrarian group found allies in Congress and industry. They also held the balance of power in the Domestic Policy Council (DPC), and used that body to develop a memorandum for the President detailing alternative policies and comparing those to the formal negotiating position. The attack from within the Administration on the U.S. negotiating position was very public, and led to confusion among other countries about U.S. intentions in negotiating the emerging protocol.

December 1986 press reports on the Geneva negotiations suggested, for the first time, that the negotiations might led to an international agreement to constrain and reduce production of specific chemicals. The press reports made clear that the U.S. was leading a group of like-minded nations in driving for stronger controls. In response, the Domestic Policy Council tasked development of a memorandum for the President on the negotiating position. In March 1987, David Gibbons of OMB and the President's Science Adviser William Graham established a working group explicitly tasked to reexamine the U.S. position. At first, the working group challenged the science behind the need for ozone depletion.

Despite independent experts and marathon sessions of discussion that showed that the scientific basis for danger from these chemicals was sound, the working group could not be persuaded that the U.S. position was sound and so, developed a new strategy. They sought an internal and international policy limiting regulation to existing U.S. constraints on these chemicals, and they questioned the science on which any claim of environmental harm was based. The group made a very public attack on the U.S. negotiating position and the persons who led U.S. policy development to that point, claiming that the State leadership had excluded the Administration from policy development, and that the negotiators had personal and professional motives that conflicted with U.S. national interests. They also suggested that the U.S. should not sign any constraints that were not equally applied to the U.S., Europe and the developing world, and that the U.S. should actually be less constrained because it had already cut the use of CFCs for aerosol propellants. Finally, they suggested that any constraints be limited to the initial cutback of 20% from production levels in 1986, since the U.S. had already achieved that level of reduction.

At the formal Domestic Policy Council meetings, State and EPA led a counter-attack the working group's proposals, largely citing the scientific evidence for the need to act, the public interest in the issue, and U.S. industrial support for international controls that went beyond existing U.S. regulations.

In the meantime, Secretary of Interior Hodel had become increasingly public with his criticism of both the U.S. Department of State effort at negotiations, and at the need for any constraints on ozone-depleting chemicals. Hodel's statements contributed to the U.S. position in Montreal, and made the argument that any increase in ultraviolet radiation could be easily handled by adjustments in lifestyle and industrial technique.

**Narrative Review of the Case: The Showdown.** In June 1987, all of these bureaucratic, political and scientific threads came together, with the Domestic Council's memorandum laying out the need for a Presidential decision. The scientific data, especially the continuing evidence of Antarctic ozone depletion, provided context for Congressional and industrial positions in favor of a Protocol with strong reductions in production of CFCs. EPA Administrator Thomas made the case that the scientific evidence required strong action, but he was reduced to making his arguments on paper. Secretary of State Shultz was the personal advocate for maintaining U.S. policy of negotiating international constraints on these chemicals. On June 20 President Reagan provided guidance to the U.S. government calling for negation of the strong reductions previously approved in November 1986. The degree to which the scientific data moved him is unclear, since there is no record of the final discussions. But the development of a strong consensus on the science provided a critical context for his decision.

On June 18, the DPC held a formal meeting to review the information. The focus was a DPC staff memo that summarized the conclusions of the Gibbons panel. All agencies had provided inputs to the memo, but the DPC staff had written a final version. The draft memo suggested that the President could choose among three directions: endorsing the existing U.S. position in which State called for proposing a binding agreement for a 50% reduction in emissions, directing against signing any protocol that called for international constraints, or modifying the U.S. position to call for only 20%

cut-backs. The memo presented pros and cons for each of these proposals (Benedick, 1998).

During the June 18 meeting, EPA Administrator Thomas and the State Department (represented at the meeting by Deputy Secretary of State Whitehead in the absence of Secretary Shultz) defended the CIRC 175 position to seek a strong reduction. They acknowledged that a 50% reduction might not be acceptable to all countries, but should be taken as a starting point for negotiations. They argued that the science was settled, and that there was no doubt that something had to be done to stem CFC emissions. Moreover, they argued that an international agreement was a positive factor for industry, ensuring that there would be a balanced playing field as industry sought to replace CFCs with less risky chemicals (Doniger, 1988).

Secretary of the Interior Hodel led the argument against any international constraints. In addition to his skepticism of accepting international constraints on U.S. decisions, he likely argued that there was no reason to believe that government action of any kind was necessary to buffer the impacts of ozone depletion. In particular, he argued that no international agreement should be made unless virtually all nations would sign on, an approach that would virtually ensure no Montreal Protocol (since success would depend on the major manufacturing nations agreeing to go first). The staff memo also argued for a limited option, designed to suggest compromise but also reflecting reductions in production that were close to those achievable with cut-back on so-called non-essential uses of CFCs (Parsons, 2003).

The staff memo was approved at the meeting as representing the DPC recommendations to the President. Although the memo did not make a selection among the options, it provided arguments for each to be a credible policy for the U.S. in negotiating on ozone depleting chemicals in Montreal.

After the meeting, Deputy Secretary of State Whitehead felt that the memo, in its final form, distorted the options and the arguments for them in a way that would support rescinding the CIRC 175 negotiating instructions. On the same day, June 18, Whitehead created and sent a letter to White House Chief of Staff Howard Baker that criticized the DPC memo, and made three points in favor of continuing with the negotiation of strong worldwide cuts in CFCs. The three arguments in favor of supporting the existing State department position were:

- Over the last five years, the U.S. had led the case, against European resistance, for reductions and an eventual ban on CFC production. If the U.S. backed down now, that would raise questions about the U.S. as a negotiating partner in all aspects diplomacy, including ones unrelated to the environment.
- It was likely that existing legislation and Congressional action would require the EPA to implement reduction regulations on U.S. firms, given the confidence the scientific results. It would be better to have international standards.
- Taking the lead in completing such a precedent-setting agreement for environmental protection would be a diplomatic and policy success with high visibility, and would generate significant political capital.

The Department of State representatives felt that such a letter was necessary because Whitehead felt that the tone of the DPC memo leaned against the State plans for negotiation, and that it increased the risk that the President would overturn those plans.

The process becomes murky at this point. Chief of Staff Baker received both memos, and either presented them to the President or summarized them. Secretary of State Shultz apparently spoke with the President about the issue. Neither of them has recorded the discussion.[16] President Reagan doesn't mention any of this in diaries, although he does note with apparent approval the successful negotiation of the Montreal Protocol in a diary entry on September 18 (Reagan, 1987).

On June 20, Chief of Staff Baker sent an Eyes Only cable to Richard Benedick, Deputy Assistant Secretary of State for Environment, Health and Natural Resources, and the lead negotiator for the upcoming Montreal Negotiations. The cable provided Presidential guidance to continue with the plans for a negotiation focused on seeking a 50% reduction in CFC production over a short period, to seek a planned sequence of reductions of which the first would be at least 30%, and aim towards a complete ban on production of these chemicals in the long run. This was a complete Presidential endorsement of State's CIRC 175 position (Benedick, 2004).

Two questions remain relevant for this study. First, why did President Reagan decide to support the State position, and not the preferences of the Domestic Policy Council? There is little doubt that the Reagan Administration tended towards the skepticism of environmental regulation that the DPC positions reflected. Second, did the scientific advice really matter to the decision? Certainly President Reagan's admirers laud him now for listening to his science advisers and making what is widely considered as a very important decision protecting the environment and human health.

[16] As part of this research , I wrote to both Shultz and Baker, asking for a chance to interview them over this point, but neither responded.

Without a clear statement from the persons most involved, there is no clear indication of the primary rationale used by President Reagan to make this decision. Previous analysts have suggested a range of reason from inertia (an unwillingness to challenge the path that EPA and State had been on for over five years) through insightful understanding that this was an environmental issue that did not fit the normal pattern of harmful regulation. There has even been a suggestion that his recent experience with removal of a surface skin cancer might have made the risk from ozone depletion more personal and credible than other environmental concerns (Benedick, 1998).

One explanation that has not been emphasized in other studies is the impact of Secretary of State George Shultz weighing in on the issue. President Reagan's relationship with Shultz was close, trusting, and pragmatic. Secretary Shultz was the only person in the Administration who was able to get President Reagan to accept that the Administration actions in the Iran-Contra affair had eventually involved trading arms for hostages, even if that had not been the President's intention. They could be blunt with one another (Schultz, 1993, p. 877). Secretary of the Interior Hodel might suggest, as he did publicly, that the State Department leadership had conflicting motives and a lack of understanding of conservative principles, but President Reagan would not have any doubts about Secretary Shultz's loyalty to the Administration or his conservative *bone fides*. It may be that Secretary Shultz telling the President that there was a clear need to establish an international agreement to ban CFCs was sufficient for the President to make a decision.

Did the science advice matter in this case? Yes, but in a more indirect way than some writers have suggested. The expertise mattered mainly in preparing Shultz and

EPA Administrator Thomas.  And expertise mattered in responding to the skepticism expressed through the DPC call for a final review before negotiations began.

If the scientific experts had not formed a consensus that led State and EPA leaders to believe that an international ban on CFCs was necessary, it would have never made it onto the President's agenda.  The large number of scientific expert panels convened in 1985 and 1986 established a basis for consensus on both the effects of CFCs and the potential for their replacement.   If there had been no structured process for the input of scientific expert advice leading up to 1986, there would never have been a CIRC 175 calling for negotiating a ban.  Experienced scientific experts like Dr. Daniel Albritton, who was asked by the Gibbon IWG to lead an independent review of the science, facilitated a rapid clear conclusion that the scientific basis for a ban on CFCs, including the health impacts likely from ozone depletion, was on firm ground.  The use of skilled scientific experts inside and outside of government made a significant difference in the final stages of this decision.  If there had not been scientific expertise to confirm the scientific basis for State's negotiating position, there is little doubt that the arguments in the DPC staff memo would have taken on a more combative character.

Reagan's decision on CFCs presents a good case of scientific expertise making a difference in a Presidential decision.  The difference between this case and the cases involving President Ford is that the scientific expertise in this case was primarily used to prepare the key advisors who really influenced the President's decision.

**Abstracting the Case: Timelines.** Figure 4-11 presents the Presidential Decision Timeline for President Reagan's decision to negotiate binding international controls on the production of CFCs. The timeline shows the issue as it evolved from the signing of the Vienna protocol by the U.S. through the signing of the Montreal protocol for scale and context. But the period of interest, the definition of the case, is identified clearly as the period between the signature of the Circular 175, giving State authority to negotiate actual reductions on CFCs, and the June 20, 1987, decision by President Reagan to direct State to seek binding international constraints, including rapid progress towards a 30% reduction in emissions. This is the critical time period, and the only period where the Executive Office of the President (EOP) and the President himself were involved in this decision. The Circular 175 provided State with direction and flexibility to seek constraints and reductions, but may have skated through without much scrutiny at the EOP. For whatever reason, the Domestic Policy Council made the new protocol an issue requiring a Presidential decision, insisting on the need to provide explicit Presidential direction. They also made the incipient protocol a matter of public and Congressional debate during the time. For the Presidential decision, the seven months in 1987 are the time of interest.

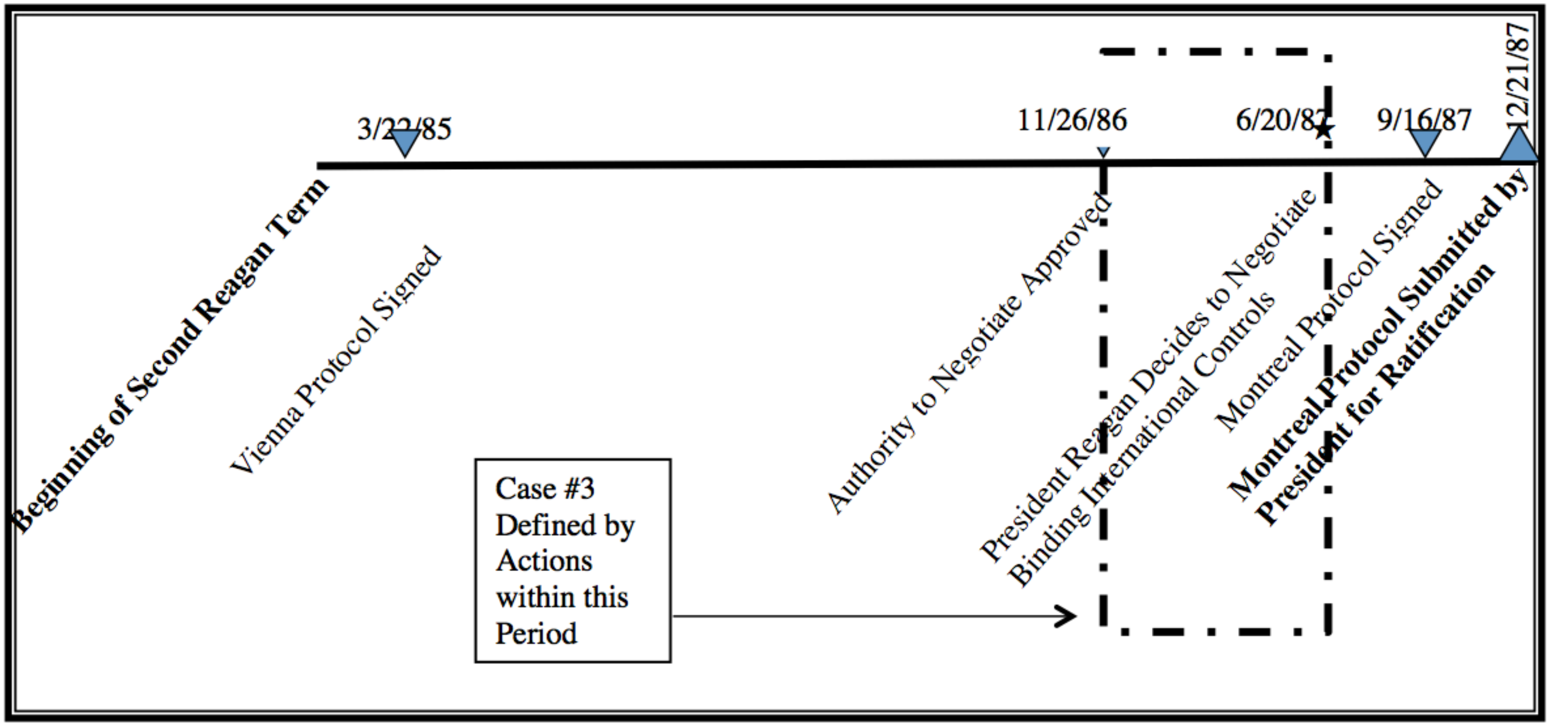


**Figure 4-11 Presidential Context Timeline for President Reagan's Decision to Negotiate Binding International Controls on CFC Production**

Figure 4-12 shows the Decision Analysis Timeline from the perspective of President Reagan (the DAT-P for this case). The dashed vertical lines break the timeline into months. This is a very sparse DAT-P compared to the earlier cases. This may reflect the style of President Reagan, allowing the debates to reach conclusion before becoming engaged, but in any case, the President was not brought into the debate formally until the Domestic Policy Council had completed its review and sent him a memo recommending very limited negotiation authority. The DAT-P shows that the memo, and the State Department reclama were sent to Chief of Staff Baker on the same day. Two days later, after conversations with Baker and with Secretary Shultz, the President made his decision to go with a position closer to the State perspective.

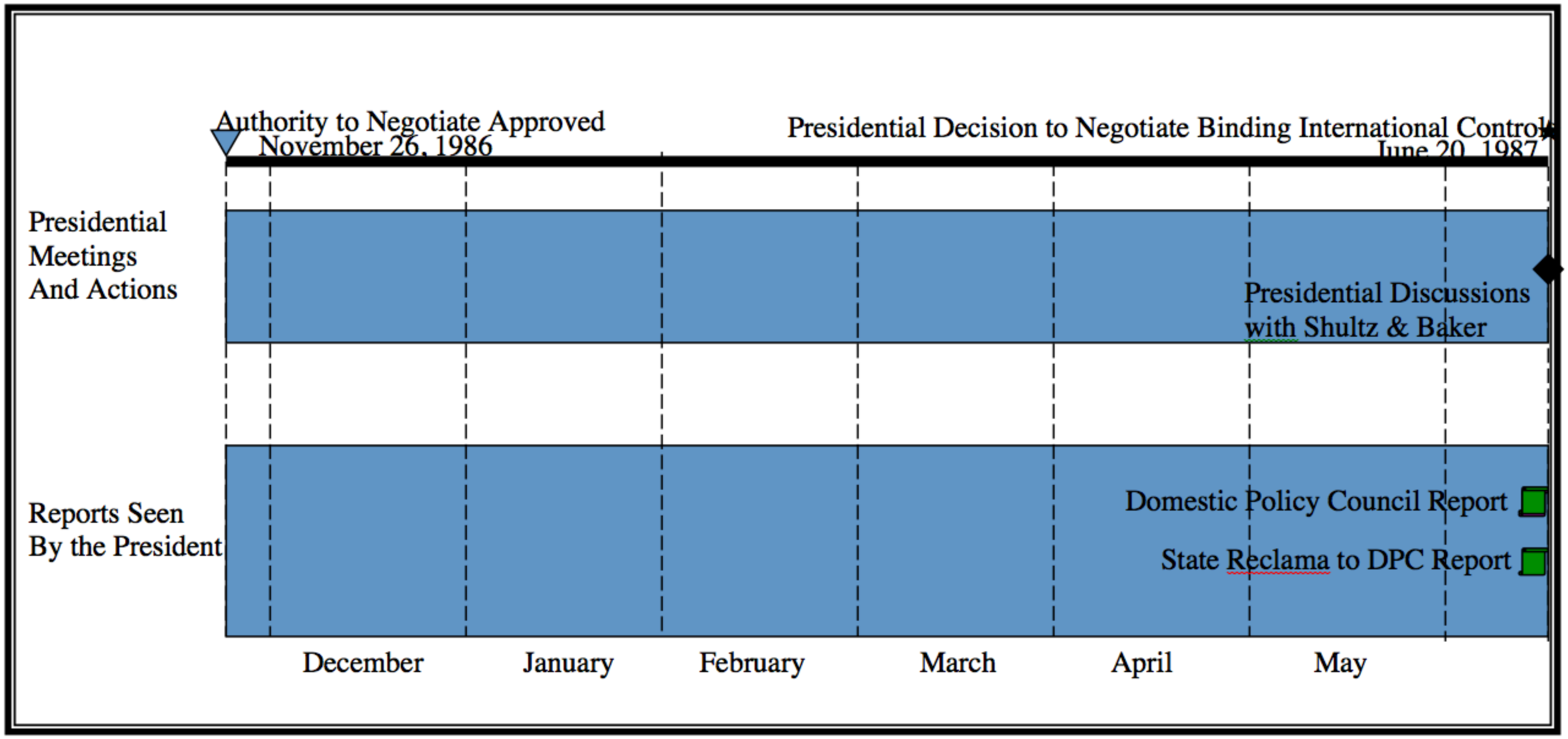


**Figure 4-12. Decision Analysis Timeline for the President (DAT-P) Regarding the Decision to Negotiate Binding International Controls on CFC Production**

Figure 4-13, the DAT-S, shows, in contrast to the DAT-P, a very active period of work for the scientific experts, even if most of them never met with the President. The top line shows that only one formal meeting of the Domestic Policy Council (DPC) about the decision was ever held. At that meeting, the scientific expertise was represented second-hand, although apparently ably, by Deputy Secretary of State Whitehead and EPA Administrator Thomas. This was the meeting that established a DPC staff position that argued for no binding controls, and created the need for a final appeal to the President from State. It was the culmination of the work of the Gibbons Special IWG, tasked by the DPC, as shown on the timeline from March to June.

As shown in the middle of the DAT-S, there were several reports prepared in the period leading up to the DPC, and supporting the Gibbons IWG. One report, the EPA Cost-Benefit Analysis, was developed as part of the normal staff process in supporting negotiation preparations. All the other reports shown here were developed as input to the Gibbons IWG. The net effect of all these reports was to reinforce three points:

- CFCs would, over the long run, produce reductions in the ozone level, which would have impacts for human health, and
- the economic impacts of regulation were small compared to the likely costs of just the human health problems likely if depletion of the ozone layer was significant.

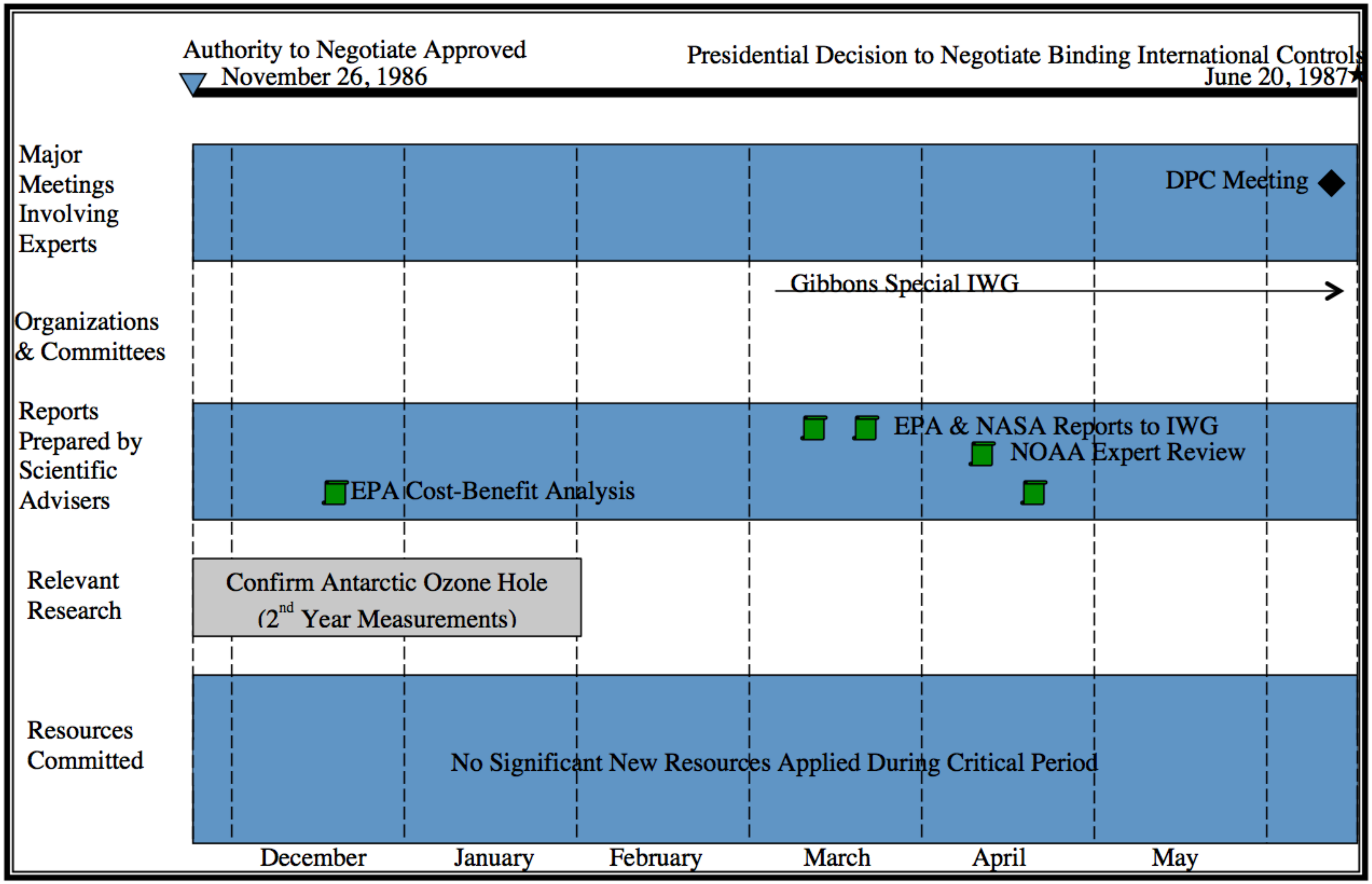


**Figure 4-13. Decision Analysis Timeline for the Scientists (DAT-S) Regarding the Decision to Negotiate Binding International Controls on CFC Production**

The fourth section of the DAT-S points out that there were significant new research results during the analysis period. The British Antarctic Survey completed and published the results of the second set of measurements of the ozone hole in the Antarctic spring. The impact of this research on the overall discussion of the ozone problem was significant. Among scientists, a confirming second year of measurements of this seasonal depletion was significant. For the public, the ozone hole measurements provided a more pressing basis for concern than the results of scientific models. And the results would stimulate a review by NASA of worldwide ozone data, which would be presented to the Gibbons IWG. While there are debates about how much the new Antarctic results had on the international negotiations in Montreal, there is no doubt that the research, and in particular the confirmation that the effect was continuing, was part of the discussion relevant to Reagan's decision throughout the critical decision period.

The final section of the DAT-S does not show significant new resources being applied during the critical period. There is no evidence for priorities in new funding, nor constraints on research caused by a lack of funding. Since the CFC and ozone debate had been a part of the U.S. diplomatic and research plan for several years, the work required to support the decision was built into existing budgets.

**Abstracting the Case: Presidential Decision Composition.** Figure 4-14 provides the Presidential Decision Composition for this decision, based on the memos seeking a Presidential decision in their favor. Unlike the cases with President Ford, we don't really know what questions President Reagan asked about this decision. The President received two pieces of paper, one memo from the DPC

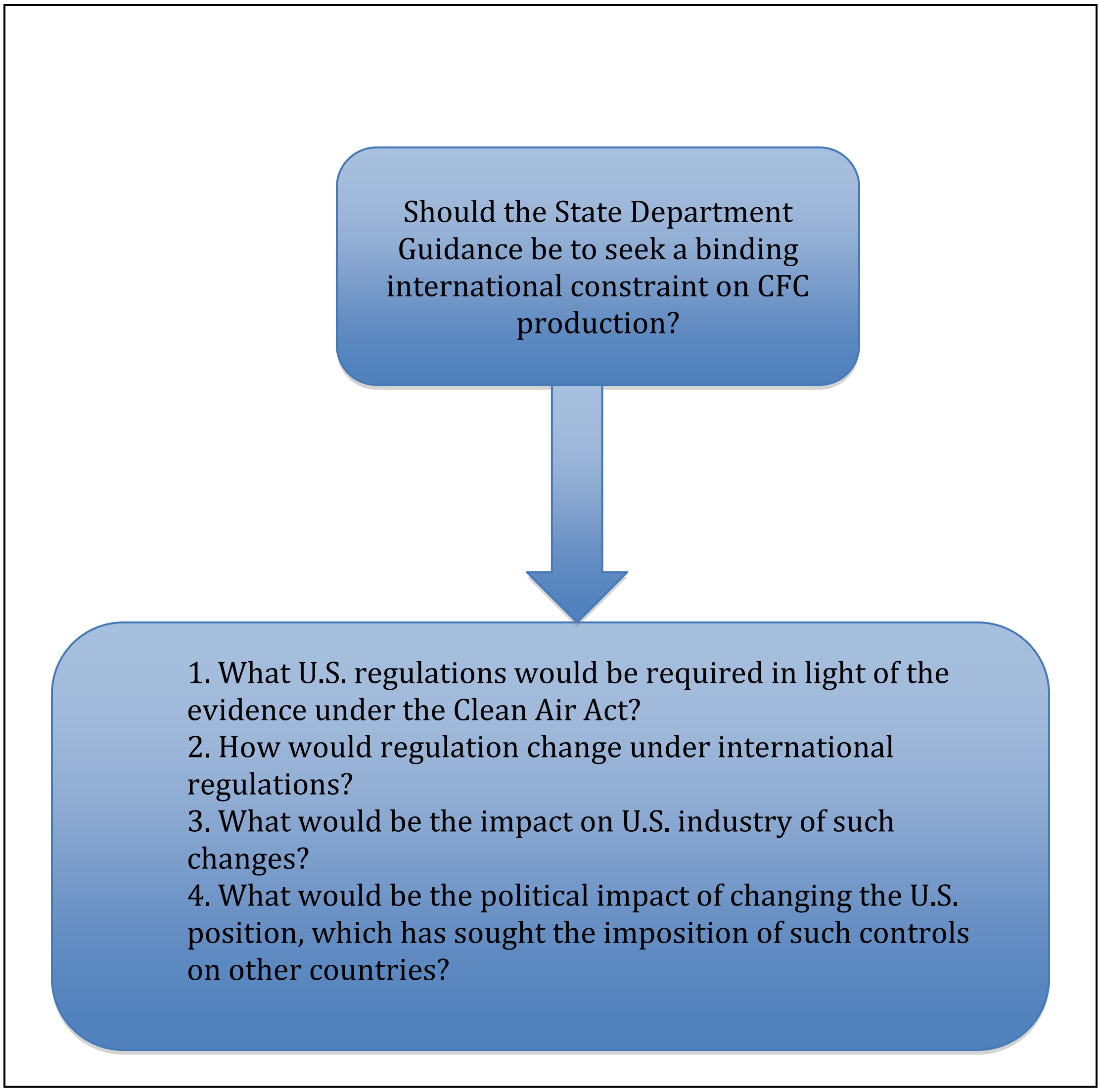


**Figure 4-14. Presidential Decision Decomposition for Questions for President Reagan's Decision to Negotiate Binding International Controls on CFC Production**

recommending that no binding commitment to constraints be negotiated (from the DPC) and one from State arguing that binding constraints should be negotiated. The four points included in the Presidential Decision Composition reflect the issues emphasized in those papers: State emphasized the first and last points, while the DPC staff paper emphasized the middle two points. Presumably the President and his Chief of Staff were interested in those points, since the Secretary of State and the Secretary of the Interior presumably knew what issues mattered to the President in forming the memos.

A better source for the President's questions would be interviews with the President before his death, or with the other two people involved in the final discussions on June 20. Without such confirmations, the Presidential Decision Composition has to rely on inference from the written memos.

**Abstracting the Case: Tables of Key Advisers.** Table 4-25 identifies the key Advisers that President Reagan relied on to make this decision. For two of these Advisers, there is no doubt that they were key. Secretary Shultz held a phone conversation with the President and the Chief of Staff to discuss the issue, and received approval directly to negotiate binding constraints. As the Chief of Staff, Howard Baker was involved in resolving the contradictory recommendations, and in providing formal White House guidance on the decision. It is less clear who had a direct impact on the President; no one else was involved directly with him at the time of the decision. I have included Lee Thomas, Director of the EPA, as the third influence on the decision. Given the decision the President made, and Thomas' conviction that some form of ozone regulation was inevitable, it seems likely that Thomas' discussions with the President on this issue over the 1986-87 timeframe probably had some influence.

| Adviser | Impact on Decision | Scientific Expertise |
|---|---|---|
| **George P. Shultz, Secretary of State 1982-1989** | Primary advocate for negotiating strong controls on ozone-depleting chemicals. Participated in final discussions with the President. | None, by the standards of this research. Ph.D. in industrial economics from M.I.T. Academic professor and public official. |
| **Howard Baker, President's Chief of Staff 1987-1988** | Advocate for maintaining U.S. negotiating position for strong controls on ozone-depleting chemicals during final discussions with the President | None, by the standards of this research. Lawyer, politician and public official. |
| **Lee M. Thomas, Director of the Environmental Protection Agency 1985-1989** | Strong advocate for the scientific and policy necessity of strong controls on ozone-depleting chemicals. His positions were communicated to the President in 1986 & 1987, but he was not in the final discussion with the President. | None, by the standards of this research. M.S. in Education, B.S. in psychology. Public official and business executive. |

**Table 4-25. Key Advisers for President Reagan's Decision to Negotiate Binding International Constraints on CFC Production**

Table 4-26 shows the three scientific experts most relied on for President Reagan's decision to negotiate binding controls on CFC emmissions. Unlike the two cases of decisions by President Ford, none of these scientists influenced President Reagan through personal interaction. Their work was presented as part of the summary arguments made in the DPC preparations, and likely cited by Secretary Shultz and EPA Adminstrator Thomas in their discussions with the President. Dr. Albritton and Dr. Watson provided a strong basis for both of those key advisers to argue that the science of ozone depletion by CFCs was a settled issue. During the decision analysis timeline considered here, both scientists developed new assessments of the science for the

Gibbons IWG, both were undoubted scientific experts, and neither had the bureaucratic stakes in CFC regulation that were charged as influencing State and EPA positions.

| Scientific Expert | Impact on Decision | How Expertise Presented to the President |
|---|---|---|
| **Dr. Daniel L. Albritton, Directory of the NOAA Aeronomy Laboratory.** | Never communicated with the President, but his review of the science, as an outside expert from the Department of Commerce, largely reduced the debate about the science of ozone depletion in the Gibbons IWG | Largely as an example of scientific consensus, especially since he was brought in for independent review of the data |
| **Dr. Robert T. Watson, Director of the Science Division and Chief Scientist for the Office of the Mission to Planet Earth at NASA** | Made major presentations on the science of ozone depletion and the observations of the Antarctic Ozone Hole to the Gibbons IWG, as well as to many other groups working on the problem | Largely cited as an example of scientific positions and consensus |
| **The British Antarctic Survey research team (Dr. Joseph Farman, Dr. Brian Gardiner and Dr. Jon Shanklin)** | Published articles in 1985, 1986 and 1987 on the existence and scope of the Antarctic Ozone Hole. It is hard to imagine that the need for action would have been sufficient without this evidence of existing damage to the ozone. | Discussed only as background, but also available in news coverage of the issue |

**Table 4-26. Key Scientific Experts Relied on for President Reagan's Decision to Negotiate Binding International Constraints on CFC Production**

The review undertaken by these scientists likely provided a basis for arguing that the science was not in question, and that scientists agreed that some action would need to be taken. State argued in its final memo to the President that scientific consensus provided a basis for EPA action to regulate CFCs, and would likely lead to Congressional demands for such regulation, independent of international actions. The likelihood of U.S.

regulation, in turn, was key to State's position that mandatory controls on all countries was preferable to constraints only on U.S. manufacturers. It is not clear that there is a third scientific expert with comparable influence on the President's decision. For completeness, I have included the lead scientists of the British Antarctic Survey in 1986. Although it is doubtful that Shultz, Baker or Thomas brought up their work as part of their final discussions, the publicity of their January confirmation of continuing ozone depletion in Antarctica was part of the background for this decision. In 1987 it was hard for any discussion of ozone depletion to occur without some recognition that ozone depletion had now been conclusively measured.

**Assessing the Variables: Variables about the Advisory Mechanism.** Table 4-27 summarizes the assessment of the seven Advisory Mechanism variables for President Reagan's decision to direct negotiation of mandatory limits on CFC emissions.

| Variable | Assessment |
|---|---|
| **Single Strong Science Adviser** | **No** |
| **Policy Advocate** | **Yes** |
| **Committee Created for this Decision** | **Yes** |
| **Committee of Standing Advisory Body** | **No** |
| **Reports on Issue Prepared in Advance of Decision** | **No** |
| **Direct Report to the President** | **No** |
| **Communication (without a policy recommendation)** | **No** |

**Table 4-27. Assessment for Case 3 regarding the Variables on the Advisory Mechanism**

The evidence for a single strong science advisor clearly indicates "no" for this case. As shown in Table 4-25, the major influencers of the President's decision were not scientists. Schultz and Thomas were not scientists, although they were strong defenders of the science on the need to regulate CFCs to minimize ozone depletion. The scientists who had the most influence (Albritton and Watson) were only influential through being cited by the actual advisors who won the day. To complicate matters, there was the official Presidential Science Advisor, William Graham. But he can hardly be considered critical to the decision, since he used his position to argue for the negotiating position that the President eventually rejected.

The argument for the importance of the Policy Advocate variable is that science expertise is more effective if presented as a strong argument for a specific action, and therefore uncertainties and disagreements about the proposals are minimized. In this case, there is little doubt that Schultz and Thomas, both trusted advisors to the president, emphasized the consensus among scientists, and the movement of industry towards conviction on the scientific basis. While we are not privileged to the final conversation, we know that the final memo to the White House from the State Department emphasized the relatively low threshold for action that the Clean Air Act provided on protection of the ozone layer. That was an argument for minimizing the uncertainty that William Graham would have wanted to emphasize. However, it would be unfair to argue that the State and EPA positions were mainly, by the end, about science, but rather strong arguments for a specific action bolstered mainly by precedent and by the diplomatic and policy advantages of continued action, and only referenced the science. That seems to be an excellent match to the Policy Advocate variable as defined in this study.

There certainly was a Committee Created for this Decision. Originally, State had argued that the normal process of certifying an issue as ready for negotiation (the CIRC 175 process) was sufficient to negotiate binding constraints on ozone production. But as the backlash built up around this position among the anti-regulation portions of the administration, the Domestic Policy Committee called for a special Interagency Working Group to address the issue specifically. This group, headed by OMB's Dave Gibbon, provided the focus of the debate about the U.S. position. As noted above, it brought together the advocates and opponents of regulating ozone-depleting chemicals. The Working Group heard all the evidence, scientific and economic, for regulation, and generated much of the case against such regulation. The Group was, in fact, the source of a memo to the President that argued that any international agreement should be limited in scope (which in turn stimulated a quick response from State before the decision was made). The results may not have been what the Working Group's organizers had hoped for, but it was certainly a very high-level committee created to consider this decision.

There was no Committee of Standing Advisory Body that provided input on this decision. To be clear, there was a standing committee, the Domestic Policy Committee that considered the issue and forwarded recommendations to the President. It created the Gibbons IWG that was focused on the decision. But the variable, as operationalized in Chapter 3, is about the role of standing scientific advisory boards, like The Advisory Committee on Immunization Practices discussed in the swine flu cases. The DPC, in contrast, was a standing part of the Executive Office of the President, intended to form policy decisions. Its deliberations, unlike those of the IWG, were not focused on the science of the issue at hand.

There were no Reports on Issue Prepared in Advance of Decision prepared before the Decision Analysis Timeline that influenced the President's decision. Of course, there were many reports and studies on the topic of ozone depletion potential from the 1970s forward, and a number of critical reports that were created in 1985-1986 were used to consider the scientific and economic arguments for and against regulating CFCs. But there are two reasons to discount the variable, which was operationalized as reports created before the controversy and influencing the President. First, we know of only two short memos that were actually reviewed by the President on this issue; it is unlikely that the President read any of the more specific reports. Second, the review ordered by the DPC essentially assumed that all previous work was questionable, so it is unlikely that such reports would directly be fed to the President. In contrast, there were several reports *developed during the Decision Analysis Timeline* that probably influenced the advisors significantly (the President's Council on Economics Advisors' cost-benefit analysis, and the NOAA review of the evidence). Such reports are significant, and are shown in Figure 4-12. But they do not change this variable because they were, in fact, developed as part of the decision process. The variable is measured as "No."

This decision did not involve scientific experts providing a Direct Report to the President. Of the three advisors having the most impact on the President's decision, none are scientific experts by the definitions used in this study. Of these advisors, the one who provided the most scientific input to the President (Director Thomas of the EPA) was not engaged in the final decision cycle, and he had last summarized the science for the President in 1986.

Finally, there was no Communication (without a policy recommendation) on this issue. In this case, the documentation provided and the presentations made to the President were in the context of recommending specific, albeit competing, policy steps in light of the upcoming international negotiations.

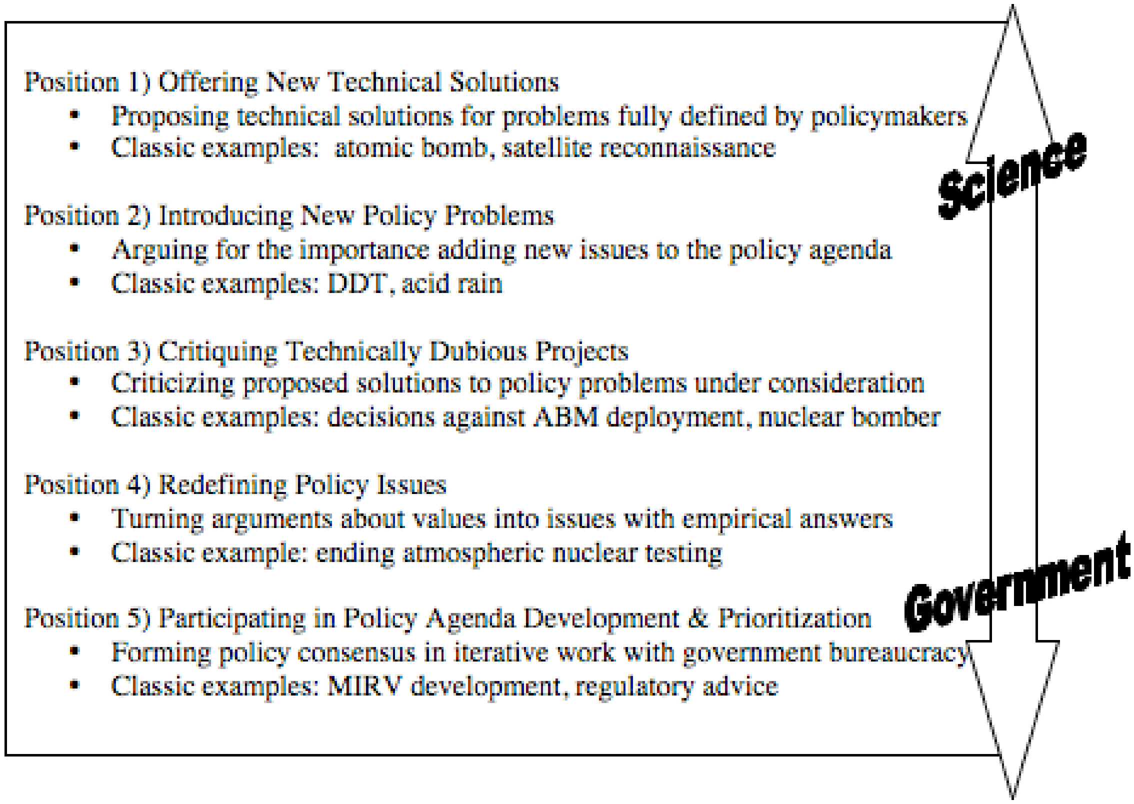


**Figure 4-15. Scale for the Role of Scientists in Influencing a Government Policy Decision**

**Assessing the Variables: Variable on the Role of Scientists.** On the scale of potential roles for scientists in the policy process, as presented in Figure 3-5 (and repeated above for reference as Figure 4-15) the scientists in this decision acted in Position 5: Participating the Policy Agenda Development & Prioritization.

The critical question here is "Do scientists claim to be addressing the balance of government priorities as well as scientific questions?" In the period of this Decision Analysis Timeline, the answer to that question is clearly "yes," and the scientists involved clearly participated in the debates within the administration, operating on the terms of the policy process. This is illustrated particularly in the emphasis given to cost-benefit analyses within EPA and in Gibbon's IWG. Moreover, most of the scientists involved were actually members of government organizations, and, especially for those supporting State and EPA inputs, believed they were operating within the bounds of their organizational requirements and processes. Note for example the scientists at EPA acceptance of both the CIRC 175 process as the venue for a decision, and the acceptance of the Gibbons IWG as a legitimate forum for review of their work. Even when outside scientists are brought in, they respond in terms of best policy options, rather than science alone. For example, one of the most well known experts on skin cancer, Dr. Margret Krike, was invited and questioned by the Gibbons IWG. She was troubled by the panel's emphasis on their perception that ozone-depletion-related cancer risks were of a voluntary nature, i.e. that such risks could be avoided at the level of personal responsibility rather than requiring regulation of industry. She wrote a letter to the IWG to indicate that she felt that such voluntary options, e.g., reducing sun exposure through lifestyle choices, were not an adequate policy response, since many in the world have no choice but to work in the sun. She did not challenge their understanding of the science.

**Assessing the Variables: Variables about the Type of Expertise.** Table 4-28 summarizes the assessment of the four Type of Expertise variables for President Reagan's decision to direct negotiation of mandatory limits on CFC emissions.

| Variable | Assessment |
|---|---|
| **Experts from Outside Government** | **Yes** |
| **Experts other than Advocates** | **Yes** |
| **Best Expertise on this Issue** | **No** |
| **Experience with Science Advice** | **No** |

**Table 4-28. Assessment for Case 3 regarding the Variables on the Type of Expertise**

The use of Experts from Outside Government was present, although it is much less clear that this was emphasized to the President as it was in the swine flu cases. The example above of the Gibbons IWG bringing in Dr. Margaret Kripke (at that time Chairman of Immunology at the University of Texas, and an acknowledged discoverer of the relationship between ultraviolet interactions and cancer development) indicates the willingness of those involved with the decision to bring in expertise from outside the government. The EPA and State had many interactions with researchers outside of the U.S. government as part of their work on developing negotiating positions. There is no doubt that this variable is scored "yes."

The use of Experts other than Advocates is also demonstrated in the work of Gibbon's IWG. The point of that committee was to see if there wasn't an alternative interpretation of the data that would support deferring regulation. While they sought the opinions of many outside experts, the most striking step they took in this direction was the request for an independent review of the data by Dr. Daniel Albritton. Gibbon's IWG, as executed, provides clear evidence that this variable should be scored "yes."

There is no evidence that President Reagan was concerned about whether this issue was addressed by The Best Expertise on this Issue. President Reagan heard this issue only in the most summarized fashion. By the operationalization of this variable defined in Chapter 3, the value of this variable is "no." But a fair reading of the record indicates that this is a much more mixed situation. While the President may not have ever asked about the issue explicitly, he may have assumed that an issue with years of debate within the government would have reflected discussions with the best experts available. And he would have been correct in most cases. State and EPA were insistent on bringing a broad range of expertise into this issue over the two years before the decision period, and the Gibbons IWG brought in persons who were regarded as the most knowledgeable on some subjects. So this variable will be scored as a "no" but will also be addressed as a mixed answer in the summary.

Finally it is clear that the two most influential scientists had Experience with Science Advice. Both Dr. Albritton and Dr. Watson already held positions that required them to act as spokesmen for their scientific colleagues, and to make recommendations on policy for science, as well as consulting on issues related to weather and climate predictions. As noted above, the third most influential scientists were those whose research into the Antarctic ozone hole made the issue of ozone depletion more relevant and critical, but they were working level scientists not as directly involved in science advice or policy development. By the operational definition used in Chapter 3, the evaluation of this variable will be "no." Once again, though, it is clear that the situation is more complex. It may be unfair to disqualify the expertise of the two scientists most closely associated with providing information on the decision based on the need, in this study, to identify a third expert. On the other hand, none of the scientific experts, as defined in this study, had direct input on the decision, so their experience with science advice may be a moot point. While the evaluation of the variable based on the rules of Chapter 3 will remain "no," I will summarize this variable in the "mixed" category when summarizing the case below.

**Assessing the Variables: Variables about the Type of Decision.** Table 4-29 summarizes the assessment of the four Type of Decision variables for President Reagan's decision to direct negotiation of mandatory limits on CFC emissions.

| Variable | Assessment |
|---|---|
| **High Scientificity** | **No** |
| **National Security Issues** | **Yes** |
| **Based on Wide Scientific Consensus** | **Yes** |
| **Led by an Agency with Scientific Culture** | **No** |

**Table 4-29. Assessment for Case 3 regarding the Variables on the Type of Decision**

We have no evidence that President Reagan was thinking of the CFC decision as one of High Scientificity. The points raised in the final memo that carried the day were focused on policy matters where it is unlikely that scientific expertise would be critical. Although we don't have a set of key questions that the President asked, we know that the arguments made to him addressed three issues of low scientific content:

- the impact of a policy reversal on U.S. international standing (0%)
- the very low threshold for independent action under the Clean Air Act (50%)
- the political capital from a major policy success (0%).

Assuming that the State Department correctly judged the questions that would matter to the President, this implies an average of 16% for Presidential concerns turning on scientific questions. By the standards for evaluation in this study, the assessment of the variable would be "no." On the other hand, there are some reasons to question whether the President thought that this was mainly a question of science, or merely believed that the science was settled. Relying on Secretary Schultz for advice may well have led him to conclude that the science was resolved, and that the other issues were the more critical ones.

By the standards used in this study, the decision was a National Security Issues. There is no doubt that the topic was presented and advocated to the President primarily by the Secretary of State. In the methodology defined for this study, such a decision is judged as "critical" to national security. However, there are reasons to consider this result as more complicated than the operationalization developed for this study. While the decision was clearly in the State Department's lane as a foreign policy issue, it was argued as an environmental and health priority, not as a national security issue. And the Administration's Domestic Policy Council, not the National Security Council, managed the major policy discussions. The difference between the operationalization and the context require that in the summary of the case, I will treat the evidence for this variable as mixed.

The President must have seen this decision as Based on Wide Scientific Consensus. Unlike the swine flu case, there are no specific presidential statements about the level of consensus. But there is little doubt that both memos he received in the final two days before the decision acknowledged the scientific consensus. The effort by the Gibbons IWG to demonstrate that the science was still contentious had failed, since the outside experts they had consulted supported both the ozone-depletion role of CFCs and the need for some sort of government action. In the end, the memo developed by the Domestic Policy Council was reduced to arguing for alternative approaches that would limit the degree of commitment to regulation, rather than arguing against the science. The State arguments did not emphasize scientific consensus, but assumed it in the argument that the low bar for EPA action had already been reached. The value of this variable is assessed as "yes."

It would be hard to argue that the decision for a national swine flu vaccination program was primarily Led by an Agency with Scientific Culture. From the President's viewpoint, this decision was argued mainly by the State Department. No one would argue that State is an agency with a scientific culture. In fact State only added a science advisor for the Secretary of State in 2000, after being challenged by the National Research Council on the relatively small role for scientific expertise in Department activities. By the evaluation standards of this study, in particular, there has never been a Secretary of State whose primary degrees have been in the physical sciences, medicine or engineering. So the evaluation of this variable will be "no." However, there is once again a reason to argue that the situation is more complex than my operationalization suggested. Long before the immediate Decision Analysis Timeline, State had partnered with the EPA to determine the negotiating positions, and had worked with EPA, the U.S. Geological Survey, and NASA to develop an international understanding of the science of ozone depleting chemicals. The lead negotiator argued that the international consensus could not have been achieved without the scientific participation of American scientists from these U.S. government agencies, and such a consensus formed the background for the final debates within the decision analysis timeline. Therefore, in assessing the overall case, this variable will be placed in the mixed category.

| Variables Present in this Case | Mixed Results Potentially Situation-Dependent | Variables Absent in this Case |
|---|---|---|
| Committee Created for this Decision | Reports on Issue Prepared in Advance of Decision | Single Strong Science Adviser |
| Policy Advocate | Best Expertise on the Issue | Committee of Standing Advisory Body |
| Participating in Policy Agenda Development & Prioritization | Experience with Science Advice | Direct Report to the President |
| Experts from Outside Government | High Scientificity | Communication (without a policy recommendation) |
| Experts Other than the Advocates | National Security Issues | |
| Based on Wide Scientific Consensus | Led by an Agency with Scientific Culture | |

**Table 4-30. Summary of Variables Present and Excluded in Case 3**

**Findings: Variable Impacts and Exclusions**. As shown in Table 4-30, many of the proposed variables that would influence a President to use scientific advice are present in the case. Particularly striking is the Committee Created for this Decision, the strong Policy Advocate position of the State Department, the seeking of experts from outside government and other than advocates, and the presence (by the decision point) of a sense of scientific consensus.

For purposes of this study, the more interesting results are the variables clearly absent from the case: Single Strong Science Adviser, Committee of a Standing Advisory Body, Direct Report to the President, and Communication (without a policy recommendation). These variables may be present in some cases where scientific expertise becomes important to a Presidential decision, but they are definitely not necessary for a President to pay attention to scientific advice based on their absence from this case.

Having or not having a Single Strong Science Adviser to present a single scientific perspective, balancing all uncertainties, did not affect President Reagan's decision. In fact, William Graham did attempt to act as a strong science advisor, and to challenge the scientific consensus by bringing in additional outside experts. But he was not a player in the critical decision-making, and his influence was muted through combination with other members of the Gibbons IWG and the Domestic Policy Council staff. In fact, his efforts to find outside experts may even have backfired, since the evolving consensus among outside experts contributed to an overall belief that the science was settled.

There is also little doubt President Reagan was moved by clear recommendations for action – in fact, by two somewhat different recommendations for action -- than he would have been by Communication (without a policy recommendation). Without the conflicting recommendations, it is very unlikely this would have been on the President's agenda, and certainly would not have lead to a clear Presidential decision.

In contrast to the two decisions by President Ford, this decision represents an example where there was no direct report of scientists to the President. This may be an example of where the time leading up to the decision resolved any differences about a scientific consensus, and removed the need for such direct presentation of the science to the President. But it certainly provides an example of a President making a decision without hearing from the scientific experts directly. It is not necessary, apparently, for all

Presidents to hear from the scientists directly even when science matters on the issue at hand.

Finally, there was no standing committee engaged to provide recommendations on this issue within the Decision Analysis Timeline. There were many EPA and National Research Council bodies that could have been engaged to provide advice or reports for the President. Again, it may be that these bodies had already established positions by the time of the critical Presidential decision, but the creation of the Gibbons IWG indicates that the Administration did consider their inputs as complete and comprehensive when the decision loomed. And their nature as a standing advisory body – a point emphasized in the science advice literature about the value of such bodies – doesn't seem to have provided extra weight to the positions they provided prior to the CIRC 175 implementation.

As in the other cases considered, there are several variables that, while included or excluded by the operationalization of the variables in Chapter 3, have actually been judged more mixed in the actual case when reviewed in detail. In evaluating the variables shown in the middle column of Table 4-30, reasons were provided above on why the operationalization was insufficient to truly exclude the variable, or why the strong yes was insufficient for comfortable endorsement as making a difference in this case. It seems likely that these would require more research on more cases, especially before excluding them as important variables.

**Integrating the Impact of the Variables Across the Three Cases**

The three cases have been reviewed for the presence or absence of 16 key variables that might influence whether a President uses science advice to make a decision. Table 4-31 below shows how many times the variable was present, absent, or judged as mixed in the three cases. In the remainder of this penultimate section of Chapter 4, the three cases will be compared in terms of the five variables that were clearly absent in at least one case, the three variables that were present in all the cases, and some final observations on the relationship between the variables and the cases.

**Variables Absent from all Three Cases.** The original postulate of this research was that if there was a variable proposed in the science advice literature that was clearly not present in the cases analyzed here, it would be excluded from consideration as necessary for a President to pay attention to scientific expertise. Across the three cases, five variables fit that rule:

- Single Strong Science Advisor;
- Committee Created for this Decision;
- Committee of Standing Advisory Body;
- Direct Report to the President; and
- Communication (without a policy recommendation).

One of these variables was absent from all three cases (Communication without a policy recommendation); three were absent from the CFC case; and one from the decision to end the swine flu vaccination program. Each of these cases was judged a very clear example of a decision where scientific expertise played a significant role in the Presidential decision.

| Variable | Present | Mixed | Absent |
|---|---|---|---|
| **Single Strong Science Adviser** | 2 | 0 | 1 |
| **Policy Advocate** | 2 | 1 | 0 |
| **Committee Created for this Decision** | 2 | 0 | 1 |
| **Committee of Standing Advisory Body** | 1 | 1 | 1 |
| **Reports on Issue Prepared in Advance of Decision** | 0 | 3 | 0 |
| **Direct Report to the President** | 2 | 0 | 1 |
| **Communication (without a Policy Recommendation)** | 0 | 0 | 3 |
| **Role of Scientists** | 3 times "Participating in Policy Agenda Development & Prioritization" | | |
| **Experts from Outside Government** | 3 | 0 | 0 |
| **Experts other than Advocates** | 2 | 1 | 0 |
| **Best Expertise on this Issue** | 1 | 2 | 0 |
| **Experience with Science Advice** | 2 | 1 | |
| **High Scientificity** | 2 | 1 | 0 |
| **National Security Issues** | 0 | 3 | 0 |
| **Based on Wide Scientific Consensus** | 3 | 0 | 0 |
| **Led by an Agency with Scientific Culture** | 0 | 3 | 0 |

**Table 4-31. Assessment of the Variables Across All Three Cases**

Therefore, five of the variables were not critical to the President's decision and his use of science advice. It seems logical to conclude they are not *necessary* for the effective use of science advice.

Three of the five variables not relevant in any of the three cases are variables from the category "Variables about the Advisory Mechanism." The science advice literature often cites two of these particular variables –a strong science advisor who can present the science to the President, and direct contact by the scientists with the President –as being critical to improving the use of unbiased science in making policy decisions. Not always, apparently.

The result also raises the question of whether the actual mechanism of the advice is the most critical factor to focus on in improving science advice. A great deal of writing in the science advice literature implies that if we could improve the mechanism by which the President and other key decision-makers get science advice, then decisions would be improved. These three cases suggest, in contrast, that if scientific issues are important, and require a Presidential decision, the existing policymaking structure may be sufficient ensure that the science will be discussed in the lead-up to a Presidential decision. That doesn't mean that the mechanisms are unimportant, but it may be that the improvement of mechanisms for science advice have reached the point of diminishing returns.

The variable "Communication (without a policy recommendation)" was absent in all three cases. In some sense this is very understandable. Presidents are not interested in the science, but only in how the science informs their policy decisions. However, the proposal that science advice could work best if the experts avoided making a policy recommendation is very appealing to scientific experts and committees. A position that "we will tell you the science and you decide on the policy" appeals to the image that science is policy-neutral, and that scientists can stay out of political decisions. These cases suggest that such a stance is equivalent to not having a role in the decision.

**Variables Present in all Three Cases.** While this study does not claim that appearing in all three cases is sufficient to indicate necessary and sufficient conditions for a President to consider science advice in his decisions, it is intriguing that three variables are common in all three cases:

- "Participating in Policy Agenda Development & Prioritization";
- Experts from Outside Government; and
- Wide Scientific Consensus.

It is possible that these three are actually critical for a President to consider scientific advice as both sufficiently mature and relevant to his decisions. Father research on the role of these in other Presidential decisions could yield valuable insights.

"Participating in Policy Agenda Development & Prioritization" was one of the five values for the variable on the Role of Scientists in the policy process. As noted in each case and in Chapter 3, there are several ways in which scientists see themselves providing scientific advice. It is striking that all three of the cases studied here represented cases where the three most critical scientific experts saw themselves as participants in a process designed to develop policy, complete with trade-offs, acknowledgement of limitations of knowledge, and consideration of issues beyond the science itself. Shelia Jasanoff's research and writing about science advice in the regulatory process strongly argued that scientists could only make an impact if they engaged as part of policy formulation; these cases suggest that the same is true at the level of advice for Presidential decisions. Taking a view that providing the science, without considering the policy options explicitly, can lead to both unrealistic expectations by the science advisors, and lack of interest in their input by the decision-maker.

Seeking "Experts from Outside Government" is an interesting tool in the three cases of Presidential decisions studied here. It provides a balance to the major advisors being engaged in the policy process. President Ford wanted to know what the outside scientific community believed before beginning the National Influenza Program and he was provided an outside perspective (Salk's) before the decision to end the program. President Reagan's advisors sought outside expertise to determine if there really was a consensus on the health impacts of ozone-depleting chemicals. At lower levels of decision-making in government, it is common to seek scientific advice from outside government on topics where such expertise is relevant. It appears that such a search for outside opinions may also occur naturally in Presidential decisions.

Finally, it is clear that, in all three cases, a scientific consensus was something the President considered in his decision. This is a particularly interesting variable because scientists themselves do not emphasize consensus as an important scientific value, and the science advice literature is relatively cautious about seeking consensus. But when making a decision where they know that their own expertise is lacking, Presidents clearly want to know if they are embarking on a course that scientists generally agree on. President Ford explicitly stated his reliance on consensus in initiating the swine flu vaccination program, and relied on HEW experts to reflect consensus when ending the program. The CFC decision could not have been made without the development of a rough consensus among scientists over the two years before Reagan made a decision, and yet the Gibbons IWG tested the consensus. Consensus matters. But the President may have an interesting desire for consensus that may actually enable more consensus than scientists usually expect. President Ford and President Reagan wanted scientific consensus over whether they should implement a particular approach, not over all the details of the science. Scientists may be able to reach a stronger consensus on such an operational issue more easily than on the likelihood of a particular pandemic outbreak or the scale of devastation from ozone depletion. For such a consensus they need only agree that something needs to be done, and consider the practical options available in the policy process.

**Other Observations on the Relationship between Variables and the Acceptance of Science Advice.** This research project suggests that there would be little value in further work to characterize the following variables:

- Policy Advocate;
- Reports on Issue Prepared in Advance of Decision;
- High Scientificity
- National Security Decision; and
- Led by an Agency with a Scientific Culture.

Although all of these variables have been discussed in the science advice literature as potentially making a difference, the three cases studied here suggest reasons why these variables are unlikely to be areas that would reward investigation with policy-relevant mechanisms to improve science advice.

The Policy Advocate mechanism for providing advice is generally raised as a contrast to the "communication (without a policy recommendation)". The argument is that to be heard in the policy community, the scientific advisors must not only have a policy, but advocate for it strongly. The most extreme position has been that the advisors should perhaps even downplay uncertainties and alternatives to make their point known.

While some support was found for Mathews and Cooper acting in this manner in the two swine flu decisions by President Ford, it is clear from both cases that a Presidential decision will never turn on the advice of a single advisor, and that any attempt to downplay uncertainty will likely be overcome within the process. There were several opportunities for conflicting information to reach President Ford if Mathews and Cooper had not been playing fair with the facts, and, as seen, White House staff in OMB and elsewhere looked for evidence of overselling on both decisions. In the CFC case, most of the clarification about the decision came from a concern by some members of the Domestic Policy Council that the science had been oversold.

A pure policy advocate position is unlikely to carry the day given the range of organizations involved in a Presidential decision, and scientist experts are largely forced to operate in a mode of "Participating in Policy Agenda Development & Prioritization" if they start as advocates. While it will always remain true that there must be a policy advocate if a decision is to make it onto the President's agenda, scientists will be more effective if they make a case that addresses the uncertainties and alternatives. Better still, they can enlist an advocate who may not be a scientific expert by the standards of this study, but who has the ear of the President and is used to the trade-offs involved in senior-level policymaking. In the cases here, Secretary Mathews played that role with President Ford and Secretary Schultz did so for President Reagan.

The concept behind "Reports Prepared in Advance of the Decision" as a variable was that the non-technical administration officials would trust the experts' reports more than something prepared in the heat of a critical decision. While an interesting concept, these cases here provided no real support for that idea, even though the role of such reports was judged as "mixed" in all cases. All cases involved reports that had been developed along the way, but all of those reports were used only as background during the actual decision process. Instead of having greater weight, the reports were used only as background for a new review at the time of decision. Previous work on pandemic planning by the CDC was assumed as background, but was not emphasized as a plan was developed for dealing with the swine flu issue. The existing consensus papers and studies on CFC effects on ozone were taken by the Gibbons IWG as a basis for review, but were certainly not treated as less biased because they were developed at a more leisurely pace. No matter what is done in advance, it seems likely that when an issue rises to the level of a Presidential decision there will be a need to bring together experts and information to judge the issue. Planning for improvements in scientific advice to policy should not overly emphasize preparing papers for contingencies, even though such work may be useful as background.

"High Scientificity" was addressed as the postulate that the more the President feels the question turns on science, the more he would rely on an expert. Two of the cases supported that notion, while the CFC ban decision by President Reagan was not couched to the President in terms of primarily scientific questions. After seeing these cases in practice, however, it seems more likely that this is a pre-requisite for a "good case" where the President listens to science advisors rather than a condition for him using that advice. The main reason that President Reagan had no reason to ask about the science was that it had been debated again in the months leading up to this decision, and his advisors, while they might differ about the science, no longer challenged the scientific consensus that might have provoked Presidential questions. Asking, as this study did, what questions the President asked and whether or not they were about the science is probably more a statement about whether his advisors have had time to work that out. It will always be necessary for scientific experts to show that the science matters, and that it is sound. When making a decision, the President will decide whether the science overwhelms other factors.

While all three cases were judged "mixed" on the national security variable, there are several problems with continuing to focus on the question of whether national security issues are "more likely" to be the basis for the President seeking scientific expertise. First, of course, three cases cannot address the "more likely" aspect of this proposal in the scientific literature. It is clear from these cases that scientific expertise can be sought and can be determinant, even when the issue is not about national security. But a consideration of all the issues where scientific expertise mattered would be needed to assess whether National Security issues are the more common cases. Second, it is unclear how one could use the knowledge that National Security issues are more likely to call for a scientific expert role. The cases studied here make clear that there are national security implications for many issues – hence the "mixed" assessment on the variable for each case – but that it would be difficult to claim that an issue rises above partisan politics because of national security. While the proposal that national security decisions may engage more Presidential interest in what the experts think, it would be hard to use that conclusion to improve the utilization of scientific expertise.

Finally, the variable on "Led by an Agency with a Scientific Culture" was introduced by literature that proposed that agencies such as NASA and the EPA would be likely to address an issue as one of science more than traditional policy agencies and departments. The operationalization of the variable, based on the backgrounds of the Agencies and Departments that acted as the primary advocate for the Presidential decision, led to a judgment that in the cases studied here, that variable was not in play. Neither State nor HEW was such an organization. However, in each case, there was another Agency that was critical in laying the scientific groundwork for the decision (CDC for the decisions by President Ford and EPA for the decision by President Reagan), and that agency would have such a tradition of leadership by scientific experts. The variable does not capture the complexity of Presidential decision-making. Moreover, it is hard to see from these cases how it would improve the use of science advice if we knew that Agencies with a Scientific Culture made a difference, since the issues tend to define who will lead the discussion with the President. Moreover, the lack of such an Agency did not prevent the engagement of the President and his staff in issues of science and the involvement of undeniable scientific experts in the decision-making process.

**Summary Findings**

First, there are cases where science advice is the primary factor in Presidential decisions. Such cases may be rare among Presidential decisions, but they continue to exist even in the post-Nixon presidency. This study has looked at three such decisions under two Presidents.

Second, some of the variables proposed as determining whether a President would listen to science advice are not present in the cases studied here, and should be considered unlikely as determinants of whether a President will use science advice. Those variables are:

a. Single Strong Science Advisor;

b. Committee Created for this Decision;

c. Committee of Standing Advisory Body;

d. Direct Report to the President; and

e. Communication (without a policy recommendation).

Third, in the three cases studied here, scientific experts were effective in acting as full participants in policy agenda development and prioritization. Their scientific expertise was useful to, and not compromised by, debate about practical trade-offs among policy implementation options. These cases suggest that the mechanism of full participation that works for scientists at lower levels of scientific advisory boards in the regulatory process plays a similar role even in Presidential decisions.

Fourth, these three cases suggest that, when they think science matters to their decision, Presidents will seek consensus among experts inside and outside of government before making their decision.

And last, there is reason to be suspicious of the notion that further improvements in the mechanism of advice is the most important factor for improving the use of science advice. Most of the mechanisms proposed in the literature to ensure that scientific expertise was considered, had, at best, mixed results in these cases. Moreover, the lack of such mechanisms did not impede meaningful consideration of the scientific facts relevant to the decision. In the 1960s, there may have been significant need to improve the s of science advice, but now there may be sufficient advice mechanisms to ensure that experts will be consulted whenever the President needs scientific expertise.

## Chapter 5. Conclusions, Discussion, and Suggestions for Future Research

This Chapter presents conclusions, addresses the relevance of this research to theory, offers recommendations relevant to the policymaking use of this research, and makes suggestions for future research.

### Conclusions

This study began with three research questions:

**Under what circumstances does scientific expertise have an important role in Presidential decisions?**

**What are good examples of such decisions?**

**Are there common factors among such decisions?**

The research has provided some initial answers to these questions. After reviewing the previous research relevant to these questions, 16 variables were identified as potentially common factors that could encourage the use of scientific expertise in Presidential decisions. Outreach to previous Presidential science advisors and members of the President's Science Advisory Committee identified several good cases where science was believed to have made a significant role in the Presidential decision. Detailed research was conducted on three cases: two were decisions by President Ford on the swine flu vaccination program and one was a decision by President Reagan on negotiating a binding limitation on chemicals that can weaken the ozone layer.

Of the sixteen variables, five were found to be absent from all three cases, and are judged unlikely to be common factors in such decisions. The most important of these was the absence of a single strong science advisor, which has often been argued as a critical ingredient in the effective use of science advice. Five more variables were tentatively judged unlikely to be of high value for future research, or for improving policymaking, after reviewing their roles in these cases. Of the remaining seven variables, three variables were common to the three cases and are potentially promising for further research and for focus on improving the use of scientific expertise by policymakers:

- Experts from Outside Government;
- Wide Scientific Consensus; and
- Scientists taking the role of "Participating in Policy Agenda Development & Prioritization."

The use of experts from outside government (the first factor) was present in all three cases. That suggests that there is a desire by policymakers to ensure that the individual agencies and departments do not provide only experts tailored to their position. Such an approach is consistent with Alexander George's suggestions for how to incorporate expertise on foreign policy into a better policymaking process, and seems to be a good practice for any important decision. This conclusion supports the contention in the science advice literature that scientific expertise internal to the government will never be sufficient. On the other hand, for decisions rising to a Presidential level, the system may be primed to find a way to incorporate outside expertise whether or not there is a structured mechanism for doing so. If so, the emphasis in the science advice literature on creating standing boards or other mechanisms to bring in outside expertise may not be as critical as the advocates suggest – or at least may no longer be a primary concern, given the range of mechanisms for science advice that have been developed over the years.

Perhaps the most surprising of these conclusions to most scientists would be the search for a wide scientific consensus (the second point). Scientists are trained to be suspicious of consensus as a basis for scientific decisions, preferring experimental evidence. Most scientists are quick to point out the number of times that the best scientific thinking proved incorrect even when everyone agreed on a perspective. Moreover, it is unlikely that there is a complete consensus on many scientific issues, and such consensus is even less likely to emerge on an issue with immediate policy implications. None-the-less, in all three cases studied here there was a Presidential interest in knowing that the science was largely settled before the Presidential decision. This would be unsurprising to policymakers. If they are going to make a decision by trusting someone else's expertise, they will want all the experts to largely agree. One insight from these three cases is that the consensus sought by Presidents is less a complete consensus on the scientific details, and more of a broad consensus that the science is sufficient to support a particular policy option. Scientific advisers might gain from focusing on how to develop such a consensus.

The consistency in scientists taking the role of "Participating in Policy Agenda Development & Prioritization" (the third point) extends conclusions from studies of scientific advice in the regulatory agencies. Those studies suggest that science advice is most effective when it is conducted in the context of working as part of the total policymaking process, rather than as an external review, or suggestions from an outside and open-ended perspective. Despite the science advice literature's emphasis on scientists avoiding the difficult political choices and sticking to provable facts, these case studies suggest that effectiveness is dependent upon understanding the policy constraints and trade-offs. Jasanoff's careful research on advisory boards at lower levels of government strongly suggests that outside scientific experts should join with scientists internal to government, and fully engage with policymaking officials on defining and assessing the effectiveness of options that could be implemented under the actual policy constraints. Apparently that is true even for scientific experts operating under extreme time pressure, and at the highest levels of government.

**Limitations and Contributions of the Research Study**

This research only begins to address questions of the effectiveness of scientific expertise in supporting important policy decisions. The methodology used in this study, while appropriate for an exploratory study of the variables suggested by the science advice literature, cannot be considered to be definitive. The science advice literature tends to write about specific Presidential decisions for comment based on the prescription they recommend. The work presented here is best understood as a step towards talking about the effectiveness of scientific expertise in the context of developing measurements of effectiveness, in contrast to the normative and prescriptive nature of much of the science advice literature.

Drawing conclusions from three cases involving only two scientific issues and two Presidents can legitimately be challenged as a very limited beginning. To make stronger conclusions, more case studies are desirable, and conclusions would best be informed by moving towards statistical insights on the number of times such common factors are found.

The choice of variables is also limited by the scientific advice literature as captured in this paper. The attempt to operationalize the variables from that literature suggests the potential for some other variables that might be interesting to explore, although not mentioned in the literature. For instance might science advice be more common from organizations with strong scientific sub-organizations such as the role CDC played within HEW? The range of variables that might enhance the likelihood that science advice would be used is probably not completely exhausted by the books and articles reviewed in Chapter 2.

The five findings of this study are limited to the results of these cases. Only two of the findings are stated as more than suggestions. Those two conclusions -- that there are real cases where science advice is a significant determinant of the Presidential decision, and that five of the proposed factors that would enhance the use of science advice are not necessary for influencing a Presidential decision -- can be justified on the basis of a single case. The other findings in Chapter 4 – such as the proposal that the advisory mechanisms may have become less important to future improvements in science advice than focus on the kind of expertise provided– can only be stated as hypotheses for further study.

Within those limitations, however, the study does make some contributions to the literature. This study:

- establishes that a positive, rather than normative, approach can be taken to identifying elements that contribute to the effectiveness of scientific advice;

- provides several reasons to discount assertions that scientific expertise never matters in major policy decisions;
- establishes that some of the variables proposed as important to the effectiveness of scientific advice are not necessary for science advice to be accepted;
- suggests that existing literature on the effective mechanisms for advice in the regulatory environment are also relevant in Presidential decisions, including ones taken under time pressure; and
- provides, as a result of an interview with a participant, new information on a widely discussed decision by President Ford.

**Recommendations for Further Research**

This study suggests three promising directions for useful further research on the effectiveness of scientific advice: further case studies, developing descriptive statistics of good cases, and more detailed research into scientific consensus for policy-making. In addition, it would also be useful to develop methods for studying cases where science advice was offered but a decision in conflict with the prevailing scientific consensus was selected.

**More Case Studies**. The study demonstrates high value from abstracting case studies to identify the elements that feed a Presidential decision and those that influence scientific expertise. Two techniques seem particularly useful from this study. Defining a very clear Decision Analysis Timeline was effective in isolating elements that influence a particular decision. It avoids the unnecessary concern that "everything matters" in assessing a decision as a unit of analysis. Second, the abstracting process used in this study takes the case studies beyond being interesting narratives, allows focus on the variables of interest, and reduces the tendency in previous studies to choose the example that makes a particular point. It would be very useful to conduct more case studies like these. It would be particularly useful to look at all five of the issues proposed – one from each Presidential Administration – in the response I received from scientific experts who have served on Presidential Advisory boards or groups. Future work might focus only on the seven variables that seemed to have greater potential for research based on the findings of this study.

**Descriptive Statistics of Good Cases**. The work here establishes that there are good cases where scientific expertise makes a difference in the Presidential decision-making process. The techniques initially proposed to identify cases could be extended to categorize cases where science made a difference across Administrations. This would allow an opportunity to discuss the relative strength of different cases, and to address questions like the relative prevalence of national security issues in cases where scientific expertise was used and sought. An extended case set would also allow a researcher to explore such interesting questions as differences across Administrations. Identification and categorization of cases before and after the Nixon Administration could allow a quantitative study of whether scientific expertise is used more or less in decisions under the current mechanisms for science advice. It is often taken for granted that science advice made more of a difference before President Nixon ended the Eisenhower-created structure of science advice, but that hypothesis should be tested.

**Detailed Research into Scientific Consensus**. Presidents (and likely other policymakers) count on confidence about a scientific consensus. The emphasis on consensus for policymakers raises interesting research questions. What tools have been used to achieve, or possibly measure, scientific consensus? Does an attack on scientific consensus derail a Presidential decision? What does an effective scientific consensus look like? The three case studies in this research suggest that Presidents rely on someone to tell them whether there is a scientific consensus, but it may be possible to break down what that person is being asked to judge. In these three cases, consensus did not seem to represent either policymaker consensus or consensus of every single scientist, but did seem to require consensus among scientific opinion-leaders both inside and outside of government. What makes someone such a scientific opinion leader? All of these questions suggest useful areas for research, not only for those interested in science advice as a process, but also for advocates of improving scientific advice.

**Cases where the consensus was apparently rejected**. This study chose to focus on cases where the scientific advice was the reason that a President chose to make a decision. For the purpose of this research that was a critical choice; the study needed to address cases where no one would doubt that the science advice had made a difference in order to study contributing variables. But anyone looking a the question of science advice is always equally interested in cases where science advice is ignored or rejected. In fact, much of the science advice literature is focused on such cases, and argues that the bad decisions that resulted could have been avoided by more attention to science advice. Research on improvements in science advice will eventually require developing a way to study such cases in a structured way.

There are several challenges to studying such cases that will need to be overcome. First, very few policymakers believe they have "ignored or rejected" science advice. Books like Herkin's *Cardinal Choices*, which point out multiple places where the author believes that scientific expertise would have led to a different Presidential decision, usually criticize the lack of scientific expertise provided for the decision more than an outright rejection of advice tendered.

Instead, policymakers usually believe that the science advice they received was either too conflicted over what science could say about the decision, or overwhelmed by factors that made the scientific data irrelevant to the decision. Moreover, Presidents and other policymakers may sometimes think that they followed science advice even when many scientists do not agree with the decision. Consider that President Reagan would have made a different decision on the negotiation of a path to banning CFCs if he had asked his Science Adviser what to do but might have still believed that he was following science advice.

There are also dangers for researchers on science advice in the possibility classifying decisions as ones where science advice was rejected. It is not always clear that "decisions with which many scientists disagree" is synonymous with "bad decisions in which science advice was ignored." This research study suggests that the public consensus on the "bad" decisions of the Ford Administration about the swine flu vaccination program may not match the impact of the decisions when we look back on them. When President Carter chose to pursue stealth aircraft development – or at least when such developments were announced several years after the decision – the initial scientific consensus was that such an approach would not work. Only those scientists involved with the technology would have judged otherwise. Many policy decisions with scientific elements may look like bad decisions at the time and prove to be good decisions in a longer term (and vice versa).

Future research might begin to assess such cases by dividing them into to categories: cases where the President was unaware of relevant science; cases where he was unaware of an overwhelming scientific consensus; cases where other factors rendered the science secondary; and cases where there was legitimate uncertainty over how the science would inform the decision. Some of these categories might relate to variables used in this research, such as "Experts other than Advocates" and "Experts outside of Government." Moreover, the conclusion of this study that Presidents are very interested in the degree of scientific consensus suggests that making the degree and impact of consensus among experts may be important to giving greater weight to scientific advice.

All such research will require careful definition of the cases and decisions that fit each category. This research project suggests the level of clarity that is required. Research on such cases may also require statistical review to understand how much or how often they occur.

But such research is required. These are indeed cardinal choices, and the best science advice is necessary on public policy decisions where science has expertise to offer. When there really is a conflict between a strong scientific consensus and a Presidential decision, a failure for the policymaking process should be expected.

**Recommendations for Policymakers**

Policymakers could draw several lessons from this study:

- Scientific expertise can be used as a source of meaningful and effective advice, even though it rarely will be the only important factor in a decision;
- The policymaking system in place today is likely to bring forward good science advice, but it helps to ask for it;
- When seeking advice from scientists it is useful to ask for the degree of consensus and for the range of dissenting opinions;
- Science advice improves when the policymaker clarifies the alternative policy options to the science advisers; and
- It is important to ask science advisers for a way to divide the policy alternatives into a step-by-step process, and when practical, for intermediate steps to be delayed until more information is available.

All of these implications are tentative, based on the analysis of only three cases. But the lessons appear reasonable, tools for improving the use of science advice. Using these lessons might help policymakers avoid some of the obvious pitfalls of relying on the scientific expert who may not understand the range of constraints and options open to the policymaker.

The first two points emphasize there may be scientific expertise on a topic that can contribute to a decision. As in these cases, an issue may arrive on a policymaker's agenda with a scientific question and associated expert advice. But many policymakers do not have a system structured to provide them with all the background expected in a Presidential decision. Such policymakers may be faced with issues where there are data, information and expertise that can help. The policymaker may not know that some background issues may be resolved by expertise rather than being value-based decisions alone. These three cases suggest that the administrative system today is very well structured to tap into scientific expertise inside and outside of government, and to quickly let the policymaker know what is known and how well it is known. The policymaker sometimes has to ask.

The third point addresses the issue of scientific consensus from the policymaker's perspective. While both of the Presidents involved in this study were provided with clear evidence of the degree of consensus on the issue at hand, it would always be useful to ask about consensus, and to do so persistently. It is possible that some science advisors will subscribe to the perspectives described in this study as the Policy Advocate variable and believe that dissent will complicate the policymaker's decision process, but lack of consensus will appear after the decision, if not before. In these three cases, the scientific experts involved described sufficient consensus. There may be other such opportunities.

The fourth point addresses the need for the policymaker to communicate the decision-maker options and constraints to the scientific experts. These three cases suggest that the complexity of scientific debate can be focused towards consensus by asking whether there is agreement on taking a particular policy step. Scientific dissent can sometimes be irrelevant to the policy choices. Clarifying the options that exist for the decision in front of the policymaker can really help, even if those can be simplified to "do this or wait." Policymakers usually have very limited options. Telling the science advisers the options you believe are practical will focus them on whether the science is clearly supporting one option.

The final point of advice to policymakers reflects the opportunity to use scientific experts to maximize the generation and evaluation of options. Asking experts if there are ways to break down the decision in multiple steps, whether there is a way to know when to take further steps, and to define the implications of a step-by-step approach versus an all-at-once approach can lead scientific advisors to provide information they may have dropped along the way to a policy recommendation. In the case of President Ford's decision to initiate the swine flu vaccination program, raising such questions might have helped retain most of the value for the program, while leaving options that would have avoided the perceived disaster that the program came to symbolize. President Reagan's sense of the only options available for moving forward made his decision consistent with the science available. If the Shultz interaction was critical, President Reagan could have reduced his options to "continuing the plan," or "abandoning the plan."

**Recommendations for Science Advisers**

For science advisors, these cases provide a reminder that science advice for policy requires accepting the complexity of policymaking, and consideration of the trade-offs inherent in any policy decision. For those holding science advisory positions there are several suggestions for improving the effectiveness of science advice suggested by this study are to:

- Ask for clarification of the policy options, since some of the scientific options may or may not be relevant;
- Improve methods for developing consensus on how the scientific information available supports the actual policy options;

- Encourage the regular interaction of scientific experts inside and outside of government;
- Encourage the review of important recommendations by non-advocates as well as those most intimately involved with the policy decision, and
- Relax scientists' concerns about the corruption of science advice by involvement in policy trade-offs.

The first four of these suggestions mirror the suggestions to policymakers. If the policymaker doesn't ask, the science adviser should.

The final point, however, reflects that part of the science advice literature that suggests scientists need to focus on speaking truth to power, or need to remain an honest broker without caring what policy options are helped or hurt by their perspectives. It is true that the scientific facts should not be shaded to support or defeat a particular policy. But the three cases here suggest that there is little reason to fear that participating in the process will corrupt the participants. The cases demonstrate that the most effective use of expertise is exercised in deliberations related to real policy options, constraints and trade-offs.

Richard Benedick, State's lead negotiator for the Montreal protocols, wrote that environmental groups were often concerned that scientists would be co-opted by the government and commercial priorities of their host countries if they considered practical policy alternatives. Benedick argued that,

> "My own belief, strongly based on the ozone experience, was that … in fact, the governments were more likely to be co-opted by the science than vice versa." (Benedick, 1998, p. 321)

Scientists could develop equal faith in their ability to maintain the integrity of their expertise.

**Recommendations for the Science Advice Literature**

In speeches over the last three years, John Holdren, President Obama's Science Advisor, has encouraged increased research about the use of science advice for policy, and suggested that a key new discipline is necessary to define effective science for policy. This is the issue that the science advice literature has struggled with over the last 50 years. (Holdren, 2011)

Rather than repeating the prescriptions from much of the existing science advice literature, this study suggests that researchers on science for policy should concentrate on studying what does work in science advice. This study provides some insights for anyone contemplating research on science for policy:

- Minimize focus on improving the mechanisms of science advice, and concentrate on the clarity of the scientific expertise as presented to the policymaker and made relevant to policy issues.
- In particular, do not overemphasize the call for a single strong science advisor. It is not a panacea; it does not always work; and it is only one mechanism for advice.
- Consider how scientific expertise can best be embedded into the policymaking process, rather than seeking to develop a parallel process that is outside of the existing policymaking process. There is no way to influence policy effectively without being part of it.

- Acknowledge the value of expertise both inside and outside the government. Encourage great scientists to spend some time in government service, and good scientists to consider government careers.

The suggestion to minimize focus on improving the mechanisms of science advice deserves one clarification. Nothing in this study should be taken to suggest that it is unimportant to have strong mechanisms for science advice. Such mechanisms are necessary. What this study suggests, instead, is that, in the twenty-first century, improvement of such mechanisms may well have reached diminishing returns as a focus of improving science advice or as a focus for science policy research. While it would be dangerous to overgeneralize from three cases, the cases suggest that an emphasis on improving the mechanism of advice is not the most important area of research or the area needing most attention in the improvement of science advice.

In the policymaking world we live in today, there are literally hundreds of advisory boards intended to provide outside advice to decision makers. One analysis has suggested that, by 1991, over a thousand outside advisory boards exist for the federal government and that about half of them provide explicitly science advice for government decisions (Smith, 1992). Such boards, coupled with full-time science advisors at multiple levels of government, and the large number of scientists who work full-time in the government on scientific issues, provide a strong infrastructure for ensuring that relevant science is considered in scientific decisions, and a network for recruiting expertise when new problems arise. With such a strong infrastructure, improvements in the mechanism of science advice may have reached diminishing returns.

The case studies here suggest that the modern world of science advice is not the same one that called for strong science advisors in the early Cold War. In the post-Nixon world of science for policy, scientists are part of most government agencies that deal with scientific matters. As these three cases show, the role of scientists in government is often to raise scientific issues, to suggest policy consistent with the scientific facts, and to ensure that inside and outside experts are brought into the discussion of the alternatives.

This study began with consideration of a quote from Snow, and it should perhaps end with consideration of another one.

> "If we had scientists of any sort diffused through government, the number of [such] people helping to influence secret choices is bound to increase."
> [Snow, 1961, p. 81]

Perhaps the post-Nixon environment represents significant steps toward the environment that Snow sought to encourage. In the post-Nixon world, there is little likelihood that scientific expertise will be unavailable or unsought on a policy issue. Efforts at improving science for policy might now be able to focus less on getting scientists involved, and more on using their expertise in effective collaboration with the policymakers.

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## Appendix 1

### Text of Request to S&T Experts for Case Selection

The text below is an example of the letter sent to 11 former Presidential Science Advisers and six other persons who have provided science advice at the Presidential level through participation in Presidential Boards. The letter was the same, with the exception of the address and salutation. The letter, often sent as an attachment to an e-mail as well as through the postal service, was intended to clarify my request for case identification, but was also intended to open a conversation more than to seek a survey-type response. For the eight who responded, the letter did generate a good discussion.

--------------------- Text of Sample Letter Begins here ---------------------------------------

January 19, 2008
7805 Glenister Drive
Springfield, VA
pettis@gwu.edu

Dr. John Marburger
Director, Office of Science and Technology Policy
Executive Office of the President
725 17th Street Room 5228
Washington, DC 20502

Dear Dr. Marburger,

I am writing to ask your assistance with the research phase of my Ph.D. dissertation in Public Policy at The George Washington University. I hope you can give a quick response to two questions, based on your own experience, and hopefully with little impact on your time.

My research project is intended to determine common factors among cases where scientific expertise had a significant impact on a Presidential decision. At this point, I am trying to identify cases in which it is clear that the Presidential decision likely would have had a different answer if the President had not been presented with information from the research or experience of natural scientists, engineers or physicians. I am limiting the scope of my research to examples after the Nixon administration, when the role and structure of science advice in the White House changed significantly.

Some parts of the political science literature argue that scientific and technical information has little impact on Presidential decisions, and that such expertise is only invoked as a rationale after the decision is made on other grounds. But it seems that there are occasional examples where the scientific information is so persuasive that a President makes a decision at odds with the direction one would expect from his historical positions and political pressure. I am particularly interested in such cases.

I think there are at least three such examples from recent history:

1. President Carter's decision to pursue the neutron bomb program early in his presidency in spite of his skepticism over nuclear weapons; and
2. President Ford's decision to shut down the ABM system in Grand Forks, despite the support for an ABM system within his party;
3. President Reagan's decision to negotiate a ban on chlorofluorocarbons, despite his administration's resistance to increased environmental regulation and new international treaties;

I'd like your answers to two questions:

1. What Presidential decisions, from the Ford through the Clinton administrations, were most significantly affected by the available scientific expertise or the advice of scientific, engineering, technology or medical experts?
   a. Are there examples where the scientific evidence was so compelling that it led to a decision at odds with what one would have expected from that administration, based on public positions or political pressures?
   b. Are the three cases listed above, good cases?
   c. Are there better choices?

2. Which other people would you recommend I contact regarding this question?

I want to look at cases that seem important to experts who have been involved in providing advice to senior policymakers. I am asking all persons who have served as Presidential Science Advisers, and other people who have been involved with advice to senior government officials. To that end, I would be interested in any perspectives you have on these questions, and am very open to alternative cases, including examples that may be less well known than the three I identify above.

While I am counting on the opinions of experts like yourself in identifying good cases, I will not include in my published study anything you do not explicitly approve for publication, if, indeed, you choose to participate. I hope that you will be willing to let me list your name as one of the people who suggested cases, without linking your name to any specific case you identify, but that, as well, would be completely up to you. I would be welcome your thoughts under any ground rules.

Please feel free to contact me with answers or additional questions, using the email address above (pettis@gwu.edu) or the phone numbers at the bottom of this letter. I would be happy to provide additional information on the research project and discuss potential cases if you wished, although I hope this approach limits the impact on your time.

If you prefer to respond by correspondence, you may mail comments to me at 7805 Glenister Drive, Springfield, VA 22152-2007.

I am grateful for your time and attention to my questions. I would appreciate any response by the end of February.

Roy Pettis
Ph.D. Candidate
Trachtenberg School of Public
Policy & Public Administration
The George Washington University

Phone Numbers: [Phone numbers were provided in the original letter.]

**Appendix 2**

**Interview with Dr. F. David Mathews on April 7, 2011**

Transcription of Interview

| | |
|---|---|
| Dr. Mathews: | Yes, sir. How are you doing? |
| Mr. Pettis: | I'm doing fine. Thank you for taking the time to do this. |
| Dr. Mathews: | So I'm glad we finally worked out a time that was mutually convenient. Elaborate a little bit on what you said about the three questions or the two questions that you posed? |
| Mr. Pettis: | Okay. What I've generally found is that -- I should say what I'm trying to do is to understand the conditions under which Presidents have paid attention to Science advise and I'm looking at five cases that -- where there seems to be a lot of agreement that scientific experts made a difference than what the President did. And so I find that I'm equally interested in regard to the swine flu case as to why he was -- what he felt at the point where his experts were now telling him it was time to end the program. So I'm -- |
| Dr. Mathews: | Suspend, suspend. |
| Mr. Pettis: | Yeah, suspend, you are correct, sir. I was being a little short to say that. I assure you in my writing I'm always very careful to say suspend because not only was it very soon returned but that certainly seems like that was clearly your recommendation. |
| Dr. Mathews: | The reasons I make the point is that the question was -- we just really weren't sure. We'd gotten this spike in Guillain-Barre but we really weren't sure what it meant because there were – there had never been a program of that magnitude -- |
| Mr. Pettis: | Right. |
| Dr. Mathews: | -- so we had very little data on the incidence of Guillain-Barre and as you know it is associated with a lot of things one of them being immunizations, and of all the immunizations I think there was one or only a couple of cases where it was associated with flu.<br><br>So we didn't have a baseline to judge whether that was significant or not so the decision to suspend, really, the prudent decision, I mean it wasn't one of these really gut-wrenching decisions. It was the prudent thing to do and of course it was – vaccine was made |

available shortly thereafter because after examining the data it seemed that the risk was greater in not making the vaccine available than it was in making it available.

The flu season – we were still in flu season but we could have got a late surge of some sort. So it was -- and the deciding factor relative to your question, is that the scientific community specifically Ted Cooper was the principal voice in this matter. We respected and relied on Ted and it was Ted who had set up these unusually elaborate, for the time, surveillance protocols that allowed us to pick up the Guillain-Barre in the first place. So it was really his recommendation, and there wasn't any great reason to question it.

Mr. Pettis: I guess one of the things that surprises me when I read about it is that as recently as the day before, Dr. Sencer at CDC had had a group of his advisers together and they still felt at that point that it was smart to continue the program because of the risk that there could still be a pandemic, and it seemed that very quickly on the next day Dr. Sencer, as I understand it, recommended to Dr. Cavanaugh that it was time to do the suspension. So I'm not trying to make it more complicated than it was but I – was there a sense that something had changed?

Dr. Mathews: No, and David Sencer would have reported it to Ted Cooper. He might have – Cooper might then have briefed Cavanaugh later, but the protocols were clear, he was responsible to Cooper. And Cooper, he worked with Cavanaugh, so they kind of -- they talked frequently and the pattern was for CDC or FDA to tell Cooper, and then he would have then briefed the White House. So I think that causing, suspending, giving enough time to check the data more carefully was really not that inconsistent with what he was saying that -- and it's exactly what was concluded later on that there is the – the risks were greater in not making it available than were in making it available.

Mr. Pettis: Right.

Dr. Mathews: So that was fairly consistent.

Mr. Pettis: Can I ask why you felt that it was necessary to go, to speak to the President about it before suspending the program?

Dr. Mathews: Well, the President had been very much in front on it, and you had to tell him that because he's taking a lead role but it was -- I don't recall his having any question about it. It was a fairly straightforward recommendation. You always err on the side of prudence.

Mr. Pettis: And in this case it wasn't completely clear what was prudent, so as you were suggesting the unknowns about --

Dr. Mathews: You don't know.

Mr. Pettis: Right.

Dr. Mathews: Absolutely. And that's what you have to impress on the people who follow you. We had a meeting at the White House with President Obama and his Cabinet, and that was our advice, is that that this is a case not where science knows, but where nobody knows, you can't know, you cannot predict what a flu virus will do. The flu virus probably doesn't even know. So that has to be uppermost in your mind as you go through one of these incidents.

Mr. Pettis: Yes sir. I guess when the three of you spoke to the President the way you're describing it here it sounds like that the Guillain-Barre was the primary reason, not if you will, the lack of appearance of swine flu in the time up until the 16th. Is that correct?

Dr. Mathews: Right. I mean, this was the middle of December-- you're at the peak of the flu season. You can't know what's going to happen that early into the season. And don't I remember that the 1918-19 one peaked in the spring --

Mr. Pettis: Yes, the worst wave was in the spring.

Dr. Mathews: Right, yeah so --

Mr. Pettis: It had a very early wave and then it peaked again, peaked in the spring and that was really the deadly wave.

Dr. Mathews: Right. So that's why you couldn't take any comfort in the fact that that it had not appeared. But on the other hand it certainly argued that … what could be a relatively brief suspension was an order.

Mr. Pettis: Right. It might have been different if there had been a pandemic underway, at that point the side effects would have looked different.

Dr. Mathews: It might have been very, very different. But we were not in a situation where we certainly could be comfortable it wouldn't occur.

But we had to act on very much the possibility it might resurface in the spring as I said already. And that had already happened once.

Mr. Pettis: Right. Then the third issue that was in some of the notes that Dr. Sencer had at that time was his great concern about the liability for the government for Guillain-Barre even if it didn't prove to be really caused by the vaccination. Did that come up in your discussions at all?

Dr. Mathews: Remember that the liability issue came up much earlier, in late '76 when the insurance companies balked. We had to get the Congress to do something in the legislation that would provide additional protection. And there again, Ford was directly involved. He was the one that called Tip O'Neill and said, "This is real and you've got to do something."

Mr. Pettis: Yes, sir. In my write-up I tend to -- it is very clear that President Ford was involved. I count him as having made four presidential decisions over the course at the time. But, I am particularly interested in the start and suspension decision because those seemed very clear to be the reason that other experts had suggested to me this was a good case when a President listened to its scientists.

Dr. Mathews: Right, right. And as you recall I don't know that it will never happen again, that the, not complete, but the overwhelming uniformity of scientific opinion on the question of beginning, I mean if you've got Salk and Sabin on the same page, that's significant.

Mr. Pettis: I'll comment sir, that one of the things I was interested in looking at was in the rather extensive science advice literature there is a lot of discussion about what factors might make a difference. I will say that at this point in my research that since that there is a consensus among the scientists seems to be a strong factor of President's paying attention. So I think --

Dr. Mathews: Absolutely.

Mr. Pettis: I think this case because of things like that special meeting that you arranged for the President, I think it's an amazingly clear case of consensus being clear to the President.

Dr. Mathews: Yeah, and I don't know that it will ever occur again, but it did then and strikingly so.

Mr. Pettis: When you spoke to the President about the suspension, did he have any questions or concerns?

Dr. Mathews: I don't really recall any. It was just a fairly open and shut presentation. We didn't know what the situation was. We had evidence of a spike. We weren't in the middle of an outbreak. Why not suspend to give enough time to check the situation now.

Mr. Pettis: Did he ask -- I guess kind of in the context of the decision to initiate the program -- did he ask whether there was unanimity or whether there was other people who would disagree with the decision?

Dr. Mathews: No, by that time Cooper it was clearly the lead in this and we had met all along back in July, we'd gone over the situation, so everybody was comfortable that Ted had a grasp of what was going in the scientific community.

Mr. Pettis: And as --

Dr. Mathews: And if there had been some difference, other than the original stockpiling argument, he would have asserted it and he didn't. He was a very responsible official and a cautious one as shown by this surveillance system that he put in place.

Mr. Pettis: I've been struck, as I was reading up on this and reading some of the original documentation, that including Guillain-Barre as one of the things to look for in the plan strikes me as almost being prescient because it was such an obscure potential connection.

Dr. Mathews: Right, yeah. Very obscure, and we still don't know what the reason was that caused the spike, or whether the spike was as exceptional as it seemed at the time.

Mr. Pettis: Right. I read what you wrote up and I have to admit that it's very consistent with -- even though I had not seen that in other documents, I'd seen with what I wound up saying in a footnote about where we stood today that there is -- it's hard to say that the literature can confirm that there really was a spike at the time with the data we have today, but it looked different in December of 1976, I'm sure.

Dr. Mathews: I wonder if in this last go-around with the flu shots was there any Guillain-Barre spike, would it? Do you know?

Mr. Pettis: I don't -- I've looked at data that's tried to reanalyze the 1976 one but that's interesting, sir. I will look because that would be an interesting thing to include.

Dr. Mathews: Yeah, I haven't seen anything but it is important to know. I mean if -- because you have to have inoculations of this scale and it seemed to me that the scale this past go-around was about the same level as in '76, 40 to 50 million inoculated. I remember this.

Mr. Pettis: Correct. And so it would be interesting to see if there is anything that's very similar, and I have not seen that data. In fact, come to think of it, to be honest, it probably would be publishing being published roughly now rather than a --

Dr. Mathews: Yeah, but you can call the CDC folks. Dave Sencer's still around.

Mr. Pettis: Yeah, I will follow up on that. I guess in regard to the meeting with the President on that day some people have suggested to me that they wondered if perhaps the President, acceding at that time, was less than an active decision that it might have been just sort of weariness of the whole thing. The people who said that had no basis for saying it, but I did want to ask if you had any sense that he was engaged and understood this was a decision that needed to be made, or was at this point nearing the end of the presidency and disengaged?

Dr. Mathews: No, Ford -- it was not in Ford's personality to disengage. He wasn't that kind of a person. And his old background, which is military career, you stay at your post until relieved by the next contingent, that was his mentality.

It was not a wrenching decision, that was true. I mean it's fairly obvious decision to make. That we ought to stop, we don't know what's going on here. The consequences of stopping were not horrendous, and so prudence ruled the day as it should have.

Mr. Pettis: Okay. Well, thank you, sir. I think those are the questions that I felt like - I'm very grateful for your willingness to talk about it because I was surprised that there seems so little documentation on -- what I still think of as an equally important decision, as you say not necessarily wrenching, but when where a President said, "My experts are telling me this, so we should do it."

Dr. Mathews: Yeah, well, if you look at Ford's career. Think about the recombinant DNA decision, that's called genetic engineering today. It's exactly the same path. I mean, there was a great deal of unease and apprehension. There were uprisings in places like Cambridge, Massachusetts. I remember all of these P3 labs.

This whole question has come up more recently, are you tampering with nature or God, about these E. coli in the lab that might one day get out and eat Cincinnati or Chicago because there's nothing that will stop them. And there, the scientific case, as you know, that Science has to go forward; we have as many safeguards as we can come up with and we're very careful. And he followed the scientific advice. So this was a consistent pattern.

Mr. Pettis: One of the things that I had done early in this research project was to contact as many of the President's Science Advisers who were willing to give me comments on places where they thought that there was a clear case of the scientific experts making a difference and President Ford came up in many of their conversations, and of course the Swine flu case was actually the single-most cited example.

Dr. Mathews: Yeah, yeah.

Mr. Pettis: Well, I had meant to ask at the beginning of this but I have been running a recorder while we've talked. I can erase it if you don't want it to be recorded. But is it okay with you for me to keep a recording of this and to quote from it in my dissertation?

Dr. Mathews: Well the only favor I would ask you is that you send me a copy.

Mr. Pettis: Of course.

Dr. Mathews: Because somebody later on will ask me about this and I will be racking my brain to remember what I said to you.

Mr. Pettis: Well, I will certainly do that, sir. It is disturbingly long as a dissertation, but I will also e-mail you the -- e-mail the segment to your executive assistant where I quote from you so that you'll have that part easily available.

Dr. Mathews: And if we could have the recording of this conversation that would be very helpful.

Mr. Pettis: Oh, okay, I will do that.

Dr. Mathews: That's so nice of you. Well, good to talk to you!

Mr. Pettis: Thank you, sir! Thank you for your time!

Dr. Mathews: Welcome!

Total Duration: 22 Minutes

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For context in understanding the interview, the text of the letter sent to Dr. Mathews requesting the interview is provided below.

Dear Dr. Mathews:

I am a Ph.D. candidate at George Washington University, writing a dissertation that explores the conditions under which Presidents have been responsive to science advice. One of the cases I'm studying is the 1976 swine flu case; however it turned out, it was clearly a case where the President listened to the experts. I have a question I can't answer from documentation, and I hoped you would be willing to provide your first-hand memories.

I am interested in the December 16, 1976 decision by President Ford to suspend the National Influenza Immunization Program. You were one of the participants in the meeting with the President to seek his concurrence on suspension. My interest is in what persuaded the President that it was time to suspend the program.

- Was he concerned about the potential for side-effects like Guillain-Barre syndrome (GBS)?
- Was he reacting to the lack of evidence for outbreaks of swine flu by December?
- Wash he concerned about government liability for side effects?
- What questions did he have for the participants in the meeting?

My impression from the existing documentation and previous literature is that Dr. Sencer at CDC felt that the link between GBS and vaccination was likely spurious, but that the impact of not having GBS listed as a concern on the informed consent forms would open the government to growing liability costs if the program continued. I am very interested in understanding how President Ford perceived those issues. I would welcome any insights you have about his reactions that day.

If you have time to respond, I would welcome any form of communication: a phone call, and email, or a written response. My contact information is at the head of this letter.