ADVICE FOR PRESIDENT RICHARD NIXON

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Let me briefly talk about science advising in the Nixon administration. I will draw some conclusions from my experiences there. I have put these in the form of vignettes, brief accounts of events regarding such issues as politics versus science and engineering, also the representative aspect of the Science Advisor's job, the ways of science and political thought and the differences, the lack of compatibility between science and politics, and the narrow line between intellectual integrity and political expediency. Then, too, I have some comments on Presidential attitudes toward science. Let me say that I will mention the names of several persons involved in such matters. But I don't mean to criticize their honesty, integrity, or capabilities.

Before setting out on this agenda, let me try to tell you briefly where I am coming from. My career has been research based. My work at Bell Labs, as President of Exxon Research and Engineering, and my publications always have had an element of moving technological innovation forward. That implies an integration of science and engineering with the broad range of national policies and needs. That integration requires a process for transferring research achievements from labs into the marketplace where they can benefit the public and the commercial world. The U.S. is at a point where public benefits and commercial progress are the expected outcomes of science and technology programs. Indeed, such expectations have been satisfied in many instances. The role of clear purposes by researchers and consideration of priorities are less well registered as essentials in the process. By bringing purposes and priorities into the picture, the efficiency and effectiveness of research and development can be increased and perhaps assured.

At one time I called this the integrity of purpose. I still believe that clear purposes by researchers yield an integrity of research and its follow on, namely technological innovation. My sensitivity to this matter was instilled in me by my time at Bell Labs through my many mentors there. So all that leads me to be enthusiastic about purposeful activity as opposed to spontaneous action. This idea is much more widely held today by scientists and engineers than it once was. It means that it is prudent to ask in response to a research proposal, not only "why?" but also "compared to what?" When there are not enough resources, or an oversupply of ideas mostly unevaluated and of uncertain outcomes, that is the time to consider purposes and priorities. So you see my bias toward purposeful research and development with high priority outcomes.

There is one other matter of prime importance. That is the interpersonal relations necessary to bring off success beyond just purposes and priorities. Personal relationships are critical to successful outcomes. They are especially important in matters where science, engineering, and politics come together. So I am always looking to see if people involved are adequate, whether they are communicative, and whether they are flexible enough to adapt to the unexpected events which usually occur in research and politics.

There is still another necessity; that is education; including schooling, college level education, post graduate learning, all depending at least in part on research universities such as those here. Accomplished people have a high regard for education based on such institutions.

None of the above will surprise you, so we can now revert to the subjects aforementioned.

I joined the Nixon administration in September, 1970 after first being contacted about the job in the spring of that year. I was appointed after certain dissatisfactions with Lee Du Bridge,

the President's science adviser at that time, were aired publicly. It was the White House staff and not the President that was disaffected.

That episode illustrates an important source of tension for all science advisers, namely that the job has a certain representative aspect. In this case, the White House staff viewed Lee Du Bridge as a representative of the academic science community. His concerns about academia and its fortunes stem from his career capped by his Presidency of California Institute of Technology. At the time of his stay in the White House, the academic community was causing the administration considerable discomfort over issues such as the antiballistic missile program (ABM), the supersonic transport (SST) and other subjects. It was clear that a representative of that community was unacceptable within the White House itself. There had been several leaks of information which the White House staff considered private, not an unusual occurrence in Washington.

Furthermore, the White House staff desired science advice that was more broadly representative of industry and technology as opposed to pure science. I was the first Science Advisor from industry. After talking to a number of people in the White House, including Henry Kissinger, John Ehrlichman, Peter Flanigan, and the President, I took the job on the condition that it was administration policy to further science and technology in the national interest, including basic research in the universities. It seemed that they were very strong on that, but thinking back on it, I should have been a little more skeptical.

The issue of being in the White House and representing a constituency rather than serving the president is still before us. It has reappeared in the issue of stem cell research and the availability of stem cell lines. Also there is the controversy over global warming, its credibility, and what should be done. That leads to questions of energy supply-demand and hydrocarbon burn-

ing. I won't say more about that because I think you probably know what they are all about. But it is worth noting a recent article by Dr. James Schlesinger, former Secretary of Energy, entitled "The Theology of Global Warming". It appeared in early August in the Wall Street Journal, and contrasts political theology with scientific evidence.

One of my early contacts with the President illustrates another important point. At that time, aircraft hijacking was becoming a nuisance. Planes were being hijacked to Jose Marti airport in Havana by people wanting to join the early Castro government. Out of the blue, I was called to the Oval Office to discuss the hijacking matter with the President, John Ehrlichman, Peter Flanigan, and Henry Kissinger. The President in effect asked me how science could be used to stop the incidents. I had the distinct impression that he expected a final solution to be laid on the table at once. I'm afraid I told him the rather unwelcome news that the situation was extremely complex and there was neither a sure fix, nor any technological magic that I could conjure up to solve this problem. I pointed out that the problem was mostly sociological and not technical. I did suggest that handguns could be magnetically detected and that baggage could be searched or x-rayed fairly expeditiously. That all seems so routine today, but those ideas seemed outlandish then. The group I met with decided my suggestions were not practical and certainly did not have the gravitas the public expected from the White House. Nevertheless, that meeting eventually yielded today's security measures.

Before the equipment and the airport security procedures we are familiar with now were implemented, federal marshals were put on flights to prevent hijacking. When that recommendation was made I objected. I thought it was more dangerous and much more expensive than just having an unscheduled stop at Jose Marti airport. However, the President decided that the

air marshals were just what the situation demanded. Of course, they did prove effective in deterring hijacking

In my mind, this episode illustrates that presidents tend to look upon science and technology as tools with which to execute policy, rather than as activities to be valued on their own. This issue also remains before us. Unfortunately, some technical people have tried to take advantage of presidential naivete regarding science in order to accomplish their own ends. The so-called Cancer Cure program begun in 1971 by the Nixon administration is an example of this in my opinion. As I recall, one of the President's lay supporters, Mr. Bebe Robozo and also Mary Lasker lobbied him to establish and support this program. I'm reminded of Lord Keynes statement to the effect that it is not difficult to bamboozle a president but it is very difficult to debamboozle one.

Another interesting situation I found myself involved with was the Apollo program. When I arrived on the White House scene, two Apollo missions had already been cancelled. They were Apollo 18 and 19. There were originally plans, as I remember for 20 and 21. Apollo 21 never really got off the drawing boards. The possible cancellation of Apollo 16 and Apollo 17 was in the wind, even though those two missions were slated to provide important scientific information. Most of the man-hours on the moon came during those two missions. In fact, most of the scientific measuring equipment they placed on the moon is still there.

After examining this issue closely with the help of the President's Science Advisory Committee (PSAC) and specifically the help of Professor Tommy Gold of Cornell, I wrote a memo to the president saying in effect that since the nation had bought everything for these trips except the fuel, we ought to go ahead in light of the potential knowledge to be gained. That memo had some effect and Apollo 16 and 17 proceeded.

The interesting aspect of this was the reason for considering cancelling Apollo 16 and 17 in the first place. That reason was essentially political. It focused on the timing of those two launches *vis a vis* the 1972 presidential election. Apollo 17 was slated to launch about a month before the election day, early in November, 1972. The big worry of the political forces was the possible effect of an Apollo 17 accident on the election outcome. By suggesting that Apollo 17 be postponed until December and that Apollo 16 was too early to have much influence on the outcome, we did win that day for the final two moon missions. This illustrates namely that political thinking is very different from scientific thinking. Anyone coming to the science advisory post without considerable experience in the political milieu is due for some rude shocks.

A further point is raised by the infamous Supersonic Transport tussle which went on in 1969, 1970 and 1971. The SST program began as a federally-subsidized Boeing project. The issue of continued federal support for that program, an essentially commercial venture, precipitated a major fight in Congress. Lee Du Bridge had commissioned a PSAC study of this project presumably in order to advise the President. Dick Garwin, who some of you know, was the chairman of that committee. The report was not made public but the conclusion-namely that PSAC was opposed to the SST-was leaked. Congress wanted the report but the administration balked, so legal action was instituted to force the administration to release the report. All of that was really nothing more than a foil. Dick Garwin testified against the administration program on Capitol Hill and that infuriated the White House staff.

The real issue was, I think, two-fold. First, there was some concern that the SST was a white elephant, that it was not economical as an operational aircraft. Second, there was the argument that the feds were getting involved in commercial activities where they had no business, and the program was a subsidy for Boeing. Garwin and other scientists felt very strongly that

the SST was an expensive boondoggle. They also worried – something that I still worry about, not with respect to the SST but with other things – that a large expenditure or commitment of the kind that the SST required, would unbalance the U.S. science and technology program. In other words, so much money would go into one effort that others which were just as important or more important might be neglected. You have to remember that at that time the federal R&D budget was well over sixty percent of the total U.S. expenditures on R&D.

The SST lost in the Senate by one vote. In a way, of course, it was a shame. Hundreds of millions of dollars had been spent on developing the prototype aircrafts (two of them) at Boeing. They were almost ready to fly: only some twenty million dollars separated them from actual flight testing. Boeing argued that further production of that plane would be based on commercial orders. In other words, the federal government would have subsidized only the R & D that went into developing the plane. But that would have worked only if the aircraft was economical to buy and operate. Clearly airlines were not going to buy an aircraft that was not economical over the long run. If it wasn't economical, the opponents were convinced, and I think they were right, further federal funds would be forthcoming to subsidize the cost of the airplanes so that the program would not look like a total failure.

What does this flap tell us about science advising? It tells us that the way of science, which basically includes argumentation and discussion of alternatives, is not the way of politics. It tells us that science advice in a political setting is part of a larger picture that sometimes overwhelms the scientific view. The implications of these points are profound. On the one hand, I believe that if Dick Garwin had been given a shot at the NASA shuttle program, we might have ended up in a sounder position than we are in today. Perhaps we would have a mixed fleet of reusable and expendable vehicles. Actually we do have something like this, with the help of the Rus-

sians and their Soyuz capsules. On the other hand, we have to realize that without federal support, we would probably not have jet aircraft at all. Neither would we have communication satellites, super-computers and a whole list of other things which we now have. Where does that leave us? It means that the science adviser must walk a very narrow line between intellectual integrity and political expediency, if there is any such line at all.

The conflict between politics and science and engineering was illustrated for me by a confrontation between me and Pat Buchanan (now a well known commentator and writer for the press and the media). At one time he was a candidate for President. The confrontation concerned earlier Science Advisors and a few distinguished members of the PSAC. It had been established by tradition earlier that previous Science Advisors and some thought leaders such as Dr. Edwin Land of Polaroid fame, who were former members of PSAC were invited as ex officio guests at meetings of PSAC. I intended to continue that practice. Pat heard about this and showed up in my office to denounce the idea on political grounds. My explanation that invitees of this caliber could be invaluable in carrying out studies and making judgments about s&t matters. That was to no avail and John Erlichman agreed with Pat. This incident showed me that science, engineering, and politics are often incompatible.

I should make it clear that not all members of the White House staff took such a hard nosed view of maintaining political purity. Recall that two of my colleagues at that time were George Schultz and Pat Monyahan. Both took a more sane view of how to raise science and engineering advice in a political surround.

I could continue with more stories about the Nixon administration and about my experiences there. In general, they all indicate that the science adviser can be in an untenable position. Politicians, and I should add many business executives as well, are little interested in science

except as it can be used to further short-term immediate goals. To put it succinctly, the time constant of science on one hand, and politics and business on the other, are wildly incompatible. Maintaining options rather than long-term commitments is the currency of politics and business. Reflecting this axiom is the fact that the science adviser's office, the Office of Science and Technology Policy (OSTP) has no formal function in the White House at all. The activity is only what the science adviser makes it and what the White House staff allows.

When I left the White House in January of 1973, I wrote a recommendation that the office be given a function. I suggested that it be allowed or asked to approve all of the agency and departmental R & D budgets before they go to OMB. In other words, it would perform a function akin to the authorization committees in Congress. Then the OMB would do the analog to appropriating funds. Such an arrangement would permit OSTP to pull together federal programs across all of the government as well as to see that sound technical programs go forward and unsound technical programs do not. The chances, however, of such a proposal being accepted are nil. OMB is not likely to give up any turf, and the agencies and departments would look on OSTP as merely another barrier to jump over.

This takes us to the point of asking that fundamental question, do we need a science adviser and his supporting OSTP? The latter is now mandated by legislation. Neither one has a generally recognized function. The political environment is basically hostile. Scientists and engineers are not so adroit at managing conflicting interests, yet they are the people in that office of the science adviser. Since the time scales of R & D are not compatible with federal budget or political time scales, science advisers have difficulty getting in step.

The situation is becoming worse rather than better. The old style science adviser, a distinguished person whom the president looked upon as his house intellectual to be listened to on the

complex and new issues of nuclear arms, nuclear defense, advanced technologies, infectious disease, and so on is not likely to recur soon. Science advisers in the 1960s and perhaps the early 1970s came from a community that had supported government policy unflinchingly. That was the legacy of World War II. Today the community has basically detached itself and is a critic, not a friend of the administration. That went for the Carter, Johnson, and Nixon administrations as well as for the Reagan and Clinton administrations.

There are additional trends that make the science advisory task increasingly oblique to national policy. The federal government is no longer the principle support for U.S. R&D. Industry is becoming increasingly dominant in that sphere. The latest figures that I've seen indicate that industry supports around sixty percent of the total R&D expeditures in the United States. The federal government supports about forty percent and a small part comes out of other funding. Basic research is losing its identity as international competitiveness becomes a prime national goal. Defense sees research as a part and parcel of national policy, and SDI (Strategic Defense Initiative) is the prime example there. Industry-university couplings are increasingly sought, not only by the National Science Foundation (NSF), but also by state and local governments in the service of economic development. In other words, the traditional activities and viewpoints of science and research are becoming increasingly submerged in the wider goals reflected in government and business.

Another indicator of this trend is the popularity of emergent enterprises and entrepreneurship, particularly small business innovation. Witness the congressionally mandated "set-aside" for such activity. It's probably one of the only real "set-asides" that has been passed in the last twenty five years. How much further are these trends going to go? Where will R & D be ten or twelve years from now? It's clear, I think, that technological ventures, for example small busi-

ness start-ups and small business generally, will become a larger and more recognized part of R & D and science policy. That stage is emergent today and will grow further. People both in government and industry will begin to look upon small business enterprise start-ups as a part of their R & D activities. On the federal side, DARPA has adopted such a viewpoint.

It is worth injecting here that the preponderance of research and development is aimed at the commercial, competitive world. The federal government takes a remote view of this world with some exceptions. Federal interests tend to focus on military and defense matters, on health and the life sciences, on environmental preservation, on the nation's infrastructure to assure adequate transportation, and the necessities of life and living including education and energy across the board, all under the banner of infrastructures. All of these matters and much more were evident during my stay in the White House. It is interesting and significant that much of what occupies science and technology policy today began over 30 years ago, in the twilight of World War II. The energy matter arose when OST (that was the name before OSTP was initiated in 1976), was considering new technology programs. This effort was started by Bill Magruder, an assistant to John Erlichman, in late 1971. No new programs or technologies actually came out of the effort, but one of the candidate projects was a large parcel of energy r&d including solar, nuclear, wind, and so on. OSTP was heavily involved with all this, but the point is that early efforts in several current fields were spawned in 1972 or before. Yet the important matters of cost and price of alternative energies was not mentioned.

Let's get back to the science adviser. We need to ask what the White House believes that it needs in the way of science advice, because that's what it probably will get. It clearly needs a professional capability to analyze the technical dimension of issues and make recommendations. That capability must be politically astute, not so that it can tell the president what he would like

to hear but so that the view can be convincing and timely. The White House needs to be able to tap the movers and shakers outside the White House for research and analysis of complex topics.

Furthermore, the ability to canvass those on the outside and to do the analytical work in-house, requires longevity. Let me just cite an example of how effective long term tenure can be. We have the case of one Mr. Hugh Loweth, associate director of OMB for many years. He had science and related budgets as one of his principle responsibilities. Through his actions and insights on what was good or bad for science, engineering, and new technology development, he has, in effect, guided policy beyond what any science adviser could have possibly done. That's mainly due to his longevity there. He knows how the system works and how to make it go.

In closing, let me reiterate that the trend today is away from fundamental research as a good to be pursued for its inherent merit. Rather the objectives of economic development and defense against terrorism are in the minds of most r&d sponsors. This has already led to new federal programs and others sponsored by the States individually. One of these where I was involved was here in Colorado under the control of the Colorado Advanced Technology Institute (CATI). Some of you will remember this effort. State programs are now widespread around the country, and provide a diverse framework for r&d funding aimed partially at local interests. The effect of this trend on R & D activities and advice for the highest levels of government is bound to be profound. Careful thinking on this situation may very well bring us to a different concept of science advising for the future. Thank you for listening. I'd be glad to discuss these ideas with you further.