Confessions of an Ex-Physicist

Following churchmen, lawyers and economists, scientists came to government as advisors. They have progressed from part-time to full-time service, and lately one has found them managing nontechnical enterprises. Perhaps technical training is suited to these jobs too.

by Harold Brown

My Title indicates that my vantage point is that provided by a scientific education, with most, if not all, of the attitudes that that encourages. Following my graduate work I participated in several scientific and technical enterprises, both as a working scientist and as a manager. As Secretary of the Air Force, I now find myself in quite a different kind of situation.

From this new vantage point I wish to express some of my observations on the more general problems of the interaction between scientifically educated and oriented people and what are essentially nontechnical activities, as are most of the activities in the world. What I write of course is colored by my own personal history and reactions; inevitably I must make some reference to both.

Management by scientists is new

Why should anybody be interested that someone with scientific training is managing a large enterprise whose operations are not primarily technical or scientific—however much they may depend on technical or scientific components? Surely no lawyer, no businessman, no banker would be asked to explain to his professional colleagues the implications of his being Secretary of the Air Force.

The distinction, I suppose, is the novelty of the situation. Even operations that are principally *technical* have only in recent years come to be run by technical people, at least at the governmental level. Keith Glennan, as head of the National Aeronautics and Space Administration and Glenn Seaborg, as chairman of the Atomic Energy Commission, Leland Hayworth at the National Science Foundation, are some examples who come quickly to mind.

But the question I want to examine is this: Does it make sense for scientifically trained people, or people who have a good deal of experience as working scientists, to run large technical or even large nontechnical enterprises, both outside and inside the government? What does this phenomenon, if it is the beginning of a phenomenon, portend, if anything—the arrival of the millennium, or the decay of the Republic?

It is obvious that one factor involved here is the increasing influence of technology, and spe-

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cifically of those kinds of technology that can be fully understood only by people with a substantial amount of scientific training or experience, on broader matters of industrial importance, of military importance, or of importance in national policy. This factor you would expect to be a strong element in the increasing influence of technically trained people who serve in advisory or managerial positions, in either industry or government. Indeed, it is so obvious a cause of participation of technologists in such activities as to be almost trivial. Nevertheless, it has been true for a long time—200 years or more—that technology has been the principal influence that distinguishes ours from all the civilizations that have gone before. We must therefore look for additional factors bearing on the introduction of technically trained people into such positions.

During most of this period, this 200 years, individuals primarily educated in science have not been conspicuously present at high levels of government or in industry as advisors, let alone as managers. I think that perhaps technology first had its influence at the beginning of the period —on the economy, war and politics—principally through what might be described as the mechanical arts. Later on, technology entered the scene, as such, and only within the last couple of decades has science, of a sort requiring detailed professional understanding, been an essential element in good advice or correct decisions.

Beyond the degree to which the problems of modern times have a technical content, the presence of technically trained people in broader managerial posts depends on their ability and willingness to consider other inputs to broader problems. It may be that scientists, having run large scientific enterprises (which require being rather broader and shallower than used to be true) are now prepared to be still broader, and direct other people's enterprises.

In other words, to the increased technical content of modern life is added, these days, the less narrowly technical orientation of the technically trained as a possible additional reason for their participating in broader enterprises.

A third item that occurs to me—and it's only half facetious—is the role of the Soviet example, or anticipated example. Soviet examples are used in the US to justify 1000-BeV accelerators or new aircraft characteristics, and it works the other way too: ours are used to justify theirs, I'm sure. We can also use the Soviet example to justify the use of technical people at high governmental levels, even as prime ministers. A good many of the Soviet bureaucracy are technically trained—metallurgists, chemists, physicists. But of course that's only so because the Soviets don't have any majors in business administration.

Issues determine advisor demand

History displays a whole series of eras in which governmental participation by experts from various other fields can be observed. In general, one can say that the kind of expert who participated in government depended on the burning issues of the time, or what the ills of the body politic happened to be. Reaching back into medieval and early modern times, for example, such churchmen as Becket and Wolsey were the king's chief ministers. The fate of those particular two may serve as lessons to scientists, or others, who aspire to be the power behind the throne.

Later on, when the codification of a permanent written body of law as the instrument of government became important, lawyers like Coke became instruments of the executive, and they have never given up their influence. Skipping rapidly over several centuries to the time of the greatest economic crises in the United States, the early 1930's, one finds economists, such as Moley and Tugwell, arriving on the Washington scene to solve the problems in that day.

It was only in the 1940's that engineers and scientists began to take an even remotely similar role in the government. The particular situation that arose in the 40's was precipitated by a military situation in which the direct application of relatively esoteric scientific principles was able rapidly to create weapon systems that enormously influenced the outcome of the military conflict, both in Europe—radar is the example I have in mind there—and in the Far East, where the atomic bomb terminated the conflict.

Part-time-to-full-time transition

Scientists first came to government as advisors on a part-time basis, in that period and thereafter, to deal principally with defense problems. The late 1950's saw something of a revolution in relations between government decision makers and their advisory structure. A trend toward permanent existence of these structures (and indeed of some of the people in them) seems to have been one of the major lasting consequences of the Soviet sputnik achievement. Large numbers of scientists came in to advise as members of the President's Science Advisory Committee, many of them nearly full-time. The chairman of PSAC also became the President's Special Assistant for

IN HIS OFFICE the Secretary is accompanied by pictures of his wife and two daughters and a sign that reads, "Please be reasonable: do it my way." He finds that managing an enterprise for which one was not specifically trained in school is a challenging way to apply one's talents in the pursuit of excellence.

Science and Technology on a full-time basis, and he formed a small technical staff. For several years after 1959, their attention was principally on military matters, partly because these seemed most urgent, partly because the technical content of military matters was, at that period, more easily discernible than was the technical content for nonmilitary matters. And the consequences of achievement in that area—or lack of achievement—were easily visible to technical people.

From 1957 through 1960, PSAC served as a place where the President could turn for suggestions of alternative actions, suggestions that he could not find in other segments of the government. Both the prestige of science and scientists, and the lack, on the part of a good many of that scientific group, of commitment to an institutional position such as existed in the various departments of the government, resulted in a situation in which practicing scientists appeared to themselves, to the public, and to the military, to influence decisions on weapons systems at least as much as did any other professional group.

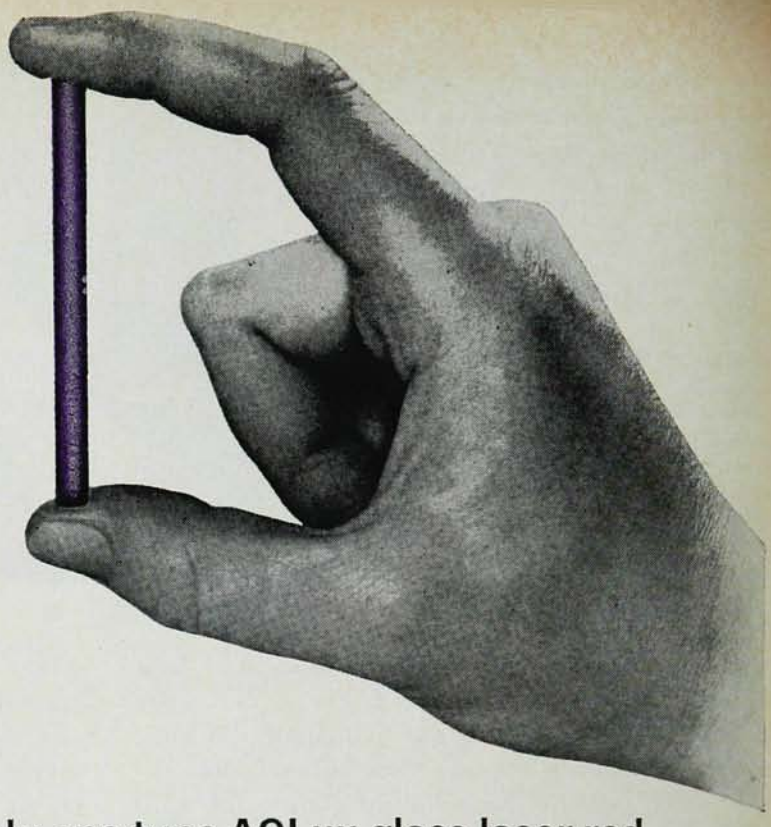
In the long run, however, another activity of the President's full-time science advisors served to erode the influence of the part-time advisor whose principal commitment was the active practice of science as a profession. This was the generation of Presidential appointees in each of the departments of government where science is important. It began with the Defense Department, where the Defense Reorganization Act of 1958 created the Office of Director of Defense Research and Engineering. That innovation was followed quickly in the Defense Department by the assignment of assistant secretaries for research and development in each of those military departments that did not already have them. The Air Force (here's a case where I can point with pride) had had one since 1955. Afterward, assistant-secretary positions, or special assistants for scientific and technical matters, were created in the departments of Commerce, Interior and State. These full-time appointees at subcabinet level have built their own staffs and have created their own connections with the scientific activities of their departments. Inevitably they have tended to displace part-time external advisory groups as sources of technical counsel for the department heads, the executives who in the end must make the decisions.

In those agencies whose principal missions are technical, the vary large professional technical staffs have also, of necessity, come to depend less and less on part-time outside advisors. This is particularly true in agencies such as AEC and NASA. These agencies deal with large development schemes and must project long-range, complex plans for schedules, funding and administration. Whether this reduced dependence on outside advice is a good thing or not is moot; it's clearly inevitable where full-time professional competence is built up within the organization.

As an ex-technical advisor and an ex-physicist, I think that the technical advisors have the great advantage over most others of being both numerical and, hopefully, logical. The lawyers have struck me as being quite logical. The economists are very frequently numerical. Scientists can claim to be both and, at our best, are able to relate both numbers and logic to the real world. Therefore, although the use of advisors has declined, I don't think it is at an end.

Technical training and management

We might expect a third stage to follow the initial use of part-time advice from outside, which was followed in turn by full-time use of scientists—both to supervise research and development and



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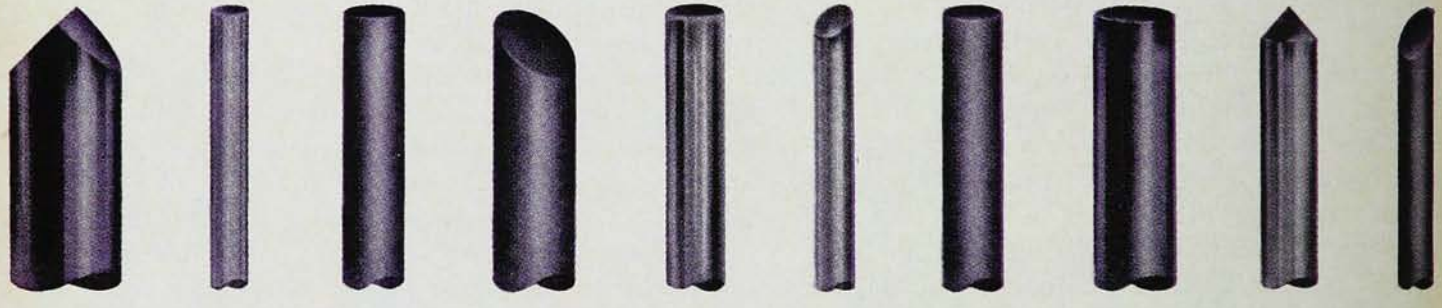

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to provide staff advice on questions that go beyond research and development. The third stage is the introduction of technically trained people as managers of essentially nontechnical enterprises, though practically all modern enterprises have some foundation or component of technical importance. I do not, however, see myself as a prototype of a new wave of technically trained administrators in government or elswhere. Indeed, it's too early for me to tell whether I can expect to be reasonably successful myself in this capacity. It's far too early to say whether anyone else can or should try to follow exactly in my footsteps.

However, there are some general observations I can make about how a nontechnical managerial job differs from a technical managerial job or from a technical job that's not managerial. First, you have to make decisions on incomplete information. This is true, of course, to some degree in any large development program, in decisions on operational military questions or on resource management, which interacts with the operational questions. But the extent to which political, manpower, institutional and other intrinsically less quantifiable factors must be considered is far greater in a nontechnical enterprise. Making decisions in the policy, operational, resource management and research-and-development areas, is part of the job of a military department secretary. He gets only one chance to make a decision and, since history does not reveal its alternatives, there is little opportunity for a controlled experiment. Needless to say, you can not even do the calculation over again because by the time the decision has been put into effect, the whole situation has changed, and you can not reproduce the original circumstances.

Second, the manager of a nontechnical enterprise loses the aura of expertise which tends to make other managers, Congressmen, newspapermen and the general public accept what a technical person says as more likely to be correct than what nontechnical people say. As soon as we technically trained people stop dealing with technical advice on broad questions or on the management of more narrow questions like research and development, we become like theologians who have stopped talking about the attributes of the deity and started talking about the best way to raise children. To put it mildly, we lose the armor of mystery. We have to deal with other people on their own terms instead of telling them that the important factors in the matter at issue are ones that only we can understand.

This is a part, of course, of a general popularization of science. I know that all physicists, even ex-physicists, are annoyed to see the lay public using terms like "order of magnitude" and "quantum jump" and using them wrong. Whenever a nontechnical administrator says "order of magnitude" you know he means 20%, not a factor of 10. (Well, some of the more sophisticated ones mean a factor of 2.) But before you laugh too loud, remember that in 20 years it will mean what *they* say—not what *we* say.

A third difference that I notice is that by retaining a generally analytical and numerical approach to broad problems, one may actually tend to antagonize a wide variety of politically oriented, emotionally oriented or simply nontechnically oriented people who consider nonquantifiable matters important—as they should—but perhaps weigh them too heavily. I should note that this resentment—sometimes mild, sometimes very far from mild—is expressed not only toward technical people; it is expressed toward all people who tend to think about things analytically.

The fourth change that takes place when one moves to a nontechnical organization is the change in the individual. I, myself, note a loss of intellectual facility for technical matters. It's painful to have as much trouble reading and understanding PHYSICS TODAY as I used to have reading parts of *The Physical Review* that dealt outside my own field. I console myself with the thought that I *could* go back and learn, but that illusion fools me less and less as time goes on.

The challenge and reward

All of these differences between technical activities and management of nontechnical activities may tend to repel rather than attract a technically trained and technically oriented person. I would be less than candid if I said that I myself liked to encounter or undergo these changes. Nevertheless, so far at least, I find that there are several rewards that compensate for these differences and disadvantages. In the first place, I find it a very great challenge to do things in an area in which most of my professional training has not taken place. If happiness is the chance to use one's talents in the pursuit of excellence, I think that a particular and, indeed, very special kind of happiness comes in trying to excel at things that one has not been—at least not in school—professionally trained for. I find it so with respect to problems going beyond technical matters.

A second reward, and perhaps most important, is that the scope and importance of problems broader than technical ones add a certain zest to

the pursuit of excellence. There is no question (except I suppose among those who share the Tolystoyan view of history) that the most important issues are decided at the government level in Washington, not only for science but for our industrial, social, economic and political futures as well. Both the Director of Defense Research and Engineering and the Secretary of the Air Force have the chance to be near the center of the great public issues of our times—to see and occasionally participate in some of the great decisions and a multitude of the small decisions.

Third, by moving from management of research and development, and from technical advice on matters of military policy to the management of a broader spectrum of affairs—training, procurement, organization, and deployment of military forces—I find another compensating satisfaction. This you may find a somewhat surprising one. It comes from the authority to make a decision and see something happen rather quickly. I used to enjoy seeing this happen back in the old days when I was directly in scientific study or even in the early days of small development programs —the opportunity to do something and have its results seen quickly. That opportunity was pretty well lost when I moved into the upper management echelons of research and development, where things generally take years and sometimes a decade or more between their initiation and the completion of an end product. Especially now at a time when we are engaged in substantial military action, the interval at the level of the secretary of a military department between a decision, its implementation, and a conclusion as to whether it was a correct decision or not is greatly telescoped. This can be pretty uncomfortable when the conclusion is that it was an incorrect decision, but it has a certain appeal, nevertheless.

A fourth advantage has been the opportunity to work with military people, from four-star generals to airmen third-class. That is a very valuable opportunity. Their virtues are different from those of the technically trained professional, but they are nonetheless real. It is a great satisfaction to see the professionalism and dedication of our military people.

Finally, I'd like to point to the satisfaction that comes from participating in a managerial revolution that involves the application of technical, analytical and rational techniques to the planning and managing of an enormous enterprise. The Air Force share of the resources that go into national defense is over $20 billion a year. The Air Force family—and I can assure you that it's a family even more tightly bound than the university or laboratory families—includes about 900 000 military and 300 000 civilian people.

I believe that the methods of planning and analysis, combined with technical facts and judgments, that have so flourished within the defense establishment in the past five years, are now spreading into other parts of the government. They should be useful in resource planning, transportation, urban development, and control of the environment in general. I expect these techniques to have increased application in local government as well as in industry and the universities where so many of these techniques originated. The fusion of technology, analysis and planning, and their application as a management technique, may well be the most outstanding change in the way government operates during the 1960's and early 1970's. I would not have wanted to miss the chance to be a part of it.

I confess to a nostalgia for my days in the laboratory, but I recognize that of the alternative patterns a man's life may take, the pattern that is taken is determined by his conscious choices—personal, professional, moral, and political—and by circumstances that often are merely a disguise for his unconscious choices. Now, I think I have some choices left, and I may retrace my way—part way at least—in those that remain to me. But I don't regret the path I have been on and to which my own professional choices have led me.

And so what starts out as an exposition, may end as a potential exhortation to those who are attracted by these values, and I know that's not every one. I do believe that scientifically trained, educated and scientifically experienced people, as well as economists, lawyers, and bright young men of all kinds—and wise older men too—should participate in the governmental decision-making process. The part-time advisor is only an apprentice at that profession. The full excitement, the full satisfaction, the full accomplishment can be achieved only through a full-time job, either staff or line, dealing with technical matters and their accomplishment, giving technical advice on broader decisions or even using one's own technical expertise and habits of thought in making decisions on broader questions. I know that there are many others who would enjoy it and I invite them to take the road, at least part way, that I have found to be so filled with exciting challenge and rewarding experiences. □