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ADMINISTERING A LARGE MILITARY DEVELOPMENT PROJECT

During the past fifteen years I have addressed the students of the Postgraduate School at Annapolis on a number of occasions. My talks have all been confined to technical matters, and they have not required extensive preparation, because I was talking about matters familiar to me, and which dealt with things, with engineering facts, which I could discuss with some facility and with objectivity.

But when one talks about how a job is done, he necessarily talks about people, and not about things. He enters the realm of the subjective. His thoughts and his actions stem from his personality, from his own experience, from his own view of things. The temptation is strong to talk in generalities, to define accomplishment in terms of standards of organization; or to stress the oft-repeated qualities of leadership, such as intelligence, wisdom, honesty, virtue, tact, grace, agressiveness, humility, courage, tenacity, and so on - in other words to describe not a man but who possesses the attributes of a God.

In my younger days I was bothered by these criteria. Somehow, things just didn't work out the way the books on administration and on leadership said they should, and I early became aware that I could never qualify as a leader, if it were really necessary that I possess the twenty or so qualities most books or articles on leadership claimed to be necessary. So far, I have found no one in the Navy or in industry who possesses more than a few of these qualities, and so I have regretfully come to the conclusion that the only person who ever possessed all of them died some 1900 years ago.

I mention this because the quest for the <u>impossible</u> may so condition us as to prevent us from accomplishing the <u>possible</u>.

Politics has been defined as the art of the possible. In my opinion, politicians are those men who more face up to the realities of the world and of mankind, than any other group of citizens. A politician must get things done, or he loses office.

I commend to you the political approach towards accomplishing objectives. One thing that can be said for it is that it works. A very eminent Secretary of the Navy, Mr. Forrestal, once said: "Government without politics is like conception without sex." And it will probably surprise you to know that even George Washington practiced politics in the appointment and promotion of officers when he considered it necessary to do so for the public good. He once wrote:

> "But if officers will not see into the political motives by which I am sometimes governed in my appointments, and which the good of the common cause renders indispensably necessary, it is unfortunate; but it cannot, because it ought not, divert me from the practice of a duty, which I think promotes the interests of the United States, and is consistent with the view of that power under which I act".

The development of naval nuclear propulsion plants is a good example of how one goes about getting a job done. It is a good subject to study for methods, because it involves not only the accomplishment of a recognized difficult technical operation, in which expenditure of hundreds of millions of dollars is necessary, but also because it involves the intimate working together of two large governmental organizations, the Navy on on the one hand, and a civilian organization, The Atomic Energy

Commission, on the other. It has involved the establishment of procedures and ways of doing government business for which there was no precedent, and which I believe will be necessary in future for similar large projects.

The first step toward accomplishing anything is to have a goal. Goals are set by people and not by organizations. At some point, sooner or later, organizations lend their names to a project, but the concept and the initial work is always started by an individual. This is difficult for military people to comprehend, because they are used to operating under a relatively rigid impersonal system. Official letters, for example, are written in the third person; the appearance is that a Bureau or an Office does something. It should be obvious that Bureaus and Offices are inanimate, and therefore cannot generate ideas or do things.

Early in 1946 the Manhattan District decided to build an atomic power pile to demonstrate peaceful application of atomic energy. Industry, as well as the Army, Navy and Air Corps, were invited to participate in the technical work at Oak Ridge. Several officers and civilians were sent by the Navy. I was the senior one of the group. All of the naval officers and the civilian engineers were sent as individuals to be assigned by the Manhattan District as they considered necessary. At Oak Ridge the Navy people were assigned to various disconnected activities and no serious thought was given to their education. I soon realized that unless the Navy people were organized into a unit and their training and education systematized we would complete our year's stay at Oak Ridge and still not be prepared to commence work on an atomic propulsion plant. Since the Bureau of Ships was in no position formally to request such organization,

I established personal relations with the military and scientific people at Oak Ridge, and soon all of the Navy people were assigned to me. I arranged for their general education in nuclear matters, and, in addition, assigned each one a specialty in which he was to become proficient. The result was that by the time we left Oak Ridge we had the nucleus of a technical organization.

The preparation and the writing of reports is a tedious and unwelcome job, when one is already devoting most of his time to study. But I knew that it was important that the Chief of the Bureau understand what we were doing. So I compiled a list of reports which were to be prepared during the year and assigned them to individuals to prepare. The result was, that once every two weeks a report covering a specific technical subject was sent out. These reports served two valuable purposes; they forced the students to learn the specialized subject, and at the same time they served to educate the leading people in the Bureau of the actual status of nuclear power.

The next step was to select a suitable naval vessel, and a suitable reactor to be developed. After considerable discussion we agreed that the submarine offered the greatest promise, and that a thermal neutron, water cooled reactor, the best propulsion plant.

Because we were closely organized and fairly well trained in nuclear technology in accordance with what was known at the time, we were in a position to take advantage of any opportunity which might arise. Such an opportunity soon came.

Because work on the power pile at Oak Ridge did not pan out well,

the Atomic Energy Commission, which had replaced the Manhattan District, decided to cancel the project. Because we were on the spot, because we were organized as a group and knew what we wanted, we were able, without the Washington authorities realizing it, to divert the people and the effort at Oak Ridge to the study of a submarine pile.

Shortly after this, we all returned to Washington. The naval group was broken up and assigned to different duties. Nevertheless I continued in my effort to achieve nuclear propulsion for a submarine. There was now a group of scientists and engineers studying the problem at Oak Ridge, but no authorization for the work, and no requirement for a nuclear submarine by the Navy. Obviously it was only a matter of a short time before the work would be terminated, unless the Navy itself decided it wanted an atomic submarine and succeeded in convincing the Atomic Energy Commission that it was important.

So the next step was to obtain a "Hunting License". This is a piece of paper which authorizes one to do a certain thing. It is frequently called a directive, or some such descriptive term. One must have such a piece of paper as a "Huhting License"in Government, if he is to get anything done.

Contrary to what most naval officers believe, particularly those who have not had duty in Washington, policy letters and other important documents signed by the Secretary of the Navy or by the Chief of Naval Operations are not prepared by them, but by the particular individual who wants the job done. It is he who must fight the policy letter through the various layers and levels before it reaches the Chief of Naval

Operations or the Secretary of the Navy.

This requires tenacity and considerable patience, because the Navy Department is like an automobile with six individual brakes; the car cannot start until all six passengers agree to release their brake. Many individuals in a large organization have the power to say "No" - and many projects are stopped because the originator meets discouragement after discouragement and finally says "what the hell", or else is transferred to other duty.

Therefore, one must have a saleable item which appeals to a large group of people - preferably to those in responsible positions. As a rule, the higher people are in an organization, the more receptive they are to new ideas, and the problem is how to get to these high people. This requires a thorough knowledge of the organization, of the mental attitude of those who might approve and of those who might disapprove. There are many who will disapprove. They are like onlookers in a struggle in which they have not personal stake. They are adept at the etiquettes of organizations, but without experience in doing things. They must be by-passed.

In this process of obtaining the "Hunting License", as well as obtaining approval of any other important idea, the method of presentation is important. If you have a proposal with five points, for example, don't try to sell all five at one time. Likewise don't try to sell 5 points simultaneously to a group of 5 people. If one of the 5 objects to one of the proposals, he will vote against your entire package. If three of the 5 each object to one of the proposals, then your whole package is lost. But if you only present one proposal at a time, you can stand to have two people vote against you, and still win out.

It is also well to remember that many important people fail to become interested in various projects, not because they lack interest, but because they lack time. Therefore, you must so plan that your own project receives the attention of these people.

Having obtained the "Hunting License" you must set about implementing it. "Hunting Licenses" are not too difficult to obtain. The possession of a license is no guarantee of success. There are generally more hunting licenses issued than there are deer to be hunted. Only the persistent hunter ever gets a deer. First the hunter must get a gun; this is vulgarly known in government as "money" - and without money nothing but good will can be obtained.

It takes considerable thought, work, and time to obtain the funds necessary to carry on a large project. But since nothing can be done without money, this necessarily takes priority over all other matters. In the Defense Establishment there are about 3 offices we must go through before the case is presented to the Bureau of the Budget. And any one of these can deny the funds or decrease the amount.

In the AEC it is much less difficult. The case is presented to the five Commissioners, and, if they approve, it goes directly to the Bureau of the Budget.

It is extremely fortunate that in the early years of our project we were financed almost entirely by the AEC. To have had to go through the Navy procedure in those days, and to convince the many people who possessed veto power - might have resulted in considerable delay in getting started. In the beginning we obtained nearly all of our funds from the AEC.

Gradually the Navy portion has been increasing, until now the AEC supplies about 75% of the research and development funds, and the Navy about 25%. The ability to draw on funds from two distinct agencies is a very valuable one. When the rules of one do not permit certain work to be done, the rules of the other generally do.

The AEC, by law, controls all atomic energy work; no one, including the Navy, can engage in this work unless authorized by the AEC. It became obvious to me from the first, that if we were to play an active and significant role in developing naval atomic propulsion plants, we had to become established as an integral part of the AEC. After about one year of politicking I was finally ordered to duty in the AEC as Chief of the Naval Reactors Branch. At the same time I was assigned additional duty as Head of the Nuclear Power Division of the Bureau of Ships. Thus, one person, one group of people, acted for both the AEC and the Navy. By being part of the AEC we achieved a powerful position to assist in formulating policy and in obtaining money. We have offices in the AEC and in the Navy. Some of our officers are assigned to the AEC, some to the Navy. The same applies to civilian personnel. We use our officers, our engineers, our clerical help, interchangeably - just as we mix our money.

As far as I know this was the first instance in government where a single group of people acted in a line capacity for both a military agency and a civilian agency. In modern war the military cannot stand alone. The Armed Forces are but the cutting edge of a sword; the civilian effort, including industry, government and the national institutions and culture are the heft of the sword which backs up the military.

Therefore it is likely that this type of organization will be followed in the future. Our way of doing business is known and approved by the Bureau of the Budget and by the appropriate Congressional Committees.

In consequence of our being a literal part of the AEC we have been able to have the two most competent AEC reactor laboratories, the Bettis Lab at Pittsburgh operated by the Westinghouse Electric Corporation, and the KAPL Lab near Schonectady operated by General Electric, devoted almost entirely to naval atomic power plants. Without the use of these labs and the many hundreds of experienced reactor scientists and engineers it would not have been possible to make the progress we have made.

Our single group, operating for the two agencies renders it possible to make decisions quickly and with a minimum of red tape. We deal directly with laboratories, with manufacturers and with shipbuilders. Nearly all actions are taken by long distance telephone; we have special leased wires for our project - and the decisions can be confirmed later by letter.

An example of how we act rapidly is the manner in which we incorporate into the Nautilus such changes as have been found to be necessary as the result of operating experience on the submarine prototype at Arco. We have a Change Board consisting of three members, one from my organization, one from Westinghouse and one from Electric Boat. The three people meet once every two weeks, go over recommended changes and make final decisions on the spot, and that same day.

Example. Everything in this world is done by or through people. If the proper people are obtained there is no other problem. It is a fallacy to believe that the head of an organization can delegate this responsibility

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to an employment manager or to a personnel manager. This may be possible in the case of clerical help, but is certainly not the case for officers and engineers.

The problem then becomes one of recruiting people who are more competent, or potentially more competent, than the head of the organization. This is the single most important responsibility of the administrator, and he cannot delegate it. The knowedge required for proper selection of people is knowledge of the deepest kind and which demands most of us. Knowledge of things or of logical propositions is much easier to acquire than knowledge of persons.

Officer Selection. We select between 4 and 6 officers each year and send them to MIT for a special course of 1 year in nuclear engineering. We have found from considerable experience that service records are only about 40 to 50% effective in judging an officer — because the records, as a rule, do not show motivation. An officer may have outstanding fitness reports, but not necessarily be fitted for scientific or technical work, or have that outlook which is essential to accomplish difficult tasks. Fitness reports are generally based on how well an officer does the particular job assigned to him. But they do not usually indicate that he is earnest in preparing himself for other more difficult or complex duties — in short that he has the necessary high degree of motivation for improving himself professionally. And the simple reason fitness reports do not show this is because few officers are so motivated.

Our practice is to select the most promising applicants, and have them come to Washington to be interviewed by a number of our people. For example, we recently selected 5 officers of 17 who came to Washington.

The 17 had what appeared to be the best records of about 40 who applied.

What I look for in an officer is a high degree of intelligence, enthusiasm, willingness to accept responsibility, and the ability to carry through — to get things done on his own, and despite obstacles. Our work is so new, and so vast in its scope; it is increasing so rapidly, that we must have people who are capable of dedicating themselves to a cause without regard to the effort or the hours necessary.

We attempt to instill the idea of total responsibility in each individual — that he is personally responsible, not only for his own specific part of the job, but for everything we do. A true sense of responsibility once instilled in the individuals of an organization will, in a short time, make that organization stand out from its competitors to an extent impossible to achieve by more technical or professional superiority.

This system has been in operation for 7 years; during this time I have never accepted an officer without an interview. The batting average based on performance is about 60%. This is much greater than is usually found in industry for similar important jobs. 25% would be considered very good. The younger the officer, the greater the chance he will make good. The older officers are, as a rule, already too much set in their habits of thought, and have become indoctrinated in routine ways of doing things. They are more likely to be unable to accept new outlooks and new ways.

No the man ever so brilliant, if his prejudices have cast his thinking in a certain mold, so that he will not accept observations which are not in line with his restricted thinking, a chance nugget of an idea will remain as clay in his sight, and he will never discover its true value.

One of the characteristics of engineers which I have frequently observed, and which must be guarded against is the search for exact answers, and the feeling of frustration if the exact answer is not forthcoming. This probably stems from the many years of high school and college training where the answer is always to be found in the back of the book, and the feeling of elation which comes when, after trying several solutions, and looking furtively at the answer, the latest trial finally works.

Unfortunately, in real life there are no exact or final answers. In a job which must go ahead at a rapid pace we cannot withhold judgment "until all the facts are in". Rarely is all the evidence at hand. Decisions must be made, and action taken, before complete knowledge can be acquired.

I have for some time thought that a few of our present day ills stem from this childish faith in the existence of perfect answers. It requires a degree of maturity to realize that all solutions are partial ones.

When the researches of the Pythogoreans brought them face to face with irrational numbers, they were overwhelmed by the discovery. It contradicted the fundamental tenet of their philosophy that everything is rational.

This can be summed up by saying that regularity is abnormal, and that the irregular is always more common than the regular.

In selecting civilian engineers I have come to the conclusion, after many years of experience, that I can do better by employing young men just out of college, and training them myself, than by hiring so-called experienced engineers who already know all the answers. Because of the interest in nuclear power I am able to employ the outstanding graduates of technical colleges. A number of us spend on the average a total of about 100 hours

of interviewing for each young graduate finally selected. We consider this the single most important duty we have.

We select about 5 young graduates each year and send them to the Oak Ridge School of Reactor Technology for one year. Upon their return to us they are given just as much responsibility as they are able to handle. There is no limit to what they are allowed to do — as long as they do it well. It is entirely up to them. The job is so vast technically, and there are so many unsolved problems, that it is like a bottomless pit.

The training of our people goes on forever. Much of my time and that of my leading people is spent in personally pointing out errors. One thing that has impressed me about our Naval Service is the infrequency with which officers I worked for took time personally to explain my mistakes to me. I have always considered this a primary part of my duty — because it is the best way of transmitting what we know to those who follow us and who will have to assume our responsibilities.

This day-to-day personal attention is the essence of training. It is generally unpleasant, at the time, to the one who is being taught, because few people are able to accept criticism impersonally. And yet it is essential that the one who is being taught recognize that criticism is impersonal — that the criticism is of the act, or of a thing, and not of the person. This is a never-ending job, but it more than pays off. Unless one continually does this, unless he constantly trains others to do his work, he becomes completely limited and circumscribed.

The same mistake may have to be pointed out to the same individual 10 or 11 times, but if the lesson is learned the 11th time — that area of

work can be relinquished forever — and one is free to go on to other things. In an organization where the work is expanding rapidly this procedure is essential. If an individual shows he cannot learn — if he cannot grasp new ideas, it is best to leave him go without too much delay. It is a truism that young men do not show greater promise as they grow older; therefore one will be disappointed if, after a short time of trial, he expects radical improvement.

A man, by working 24 hours a day, could multiply himself 3 times. To multiply himself more than 3 times the only recourse is to train others to take over some of his work.

Some of the ideas I try to get across to the people who work with me are the following:

1. More than ambition, more than ability, it is <u>rules</u> that limit contribution; rules are the lowest common denominator of human behavior. They are a substitute for rational thought.
2. Sit down before fact with an open mind. Be prepared to give up every preconceived notion. Follow humbly wherever and to whatever abyss Nature leads, or you learn nothing. Don't push out figures when the facts are going in the opposite direction.
3. Free discussion requires an atmosphere unembarrassed by any suggestion of authority or even respect. If a subordinate always agrees with his superior he is a useless part of the organization. In this connection there is the story of Admiral Sims when he was on duty in London during World War I. He called a conscientious hard-working officer in to him to explain why he was dissatisfied

with the officer's work. The officer blushed and stammered when Sims pointed out that in all the time they had been together the officer had never once disagreed with Sims.

4. All men are by nature conservative but conservatism in the military profession is a source of danger to the country. One must be ready to change his line sharply and suddenly, with no concern for the prejudices and memories of what was yesterday. To rest upon a formula is a slumber that, prolonged, means death.

5. Success teaches us nothing; only failure teaches.

6. Do not regard loyalty as a personal matter. A greater loyalty is one to the Navy or to the Country. When you know you are absolutely right, and when you are unable to do anything about it, complete military subordination to rules becomes a form of cowardice.

7. To doubt one's own first principles is the mark of a civilized man. Don't defend past actions; what is right today may be wrong tomorrow. Don't be consistent; consistency is the refuge of fools.

8. Thoughts arising from "practical" experience may be a bridle or a spur.

9. Optimism and stupidity are nearly synonymous.

10. Avoid over-coordination. We have all observed months-long delay caused by an effort to bring all activities into complete agreement with a proposed policy or procedure. While the coordinating machinery is slowly grinding away, the original purpose is often lost, the essence of the proposal is being worn down, as the persons most concerned impatiently await the decision. This

process has been aptly called "coordinating to death".

A system under which it takes three men to check what one is doing is not control; it is systematic strangulation.

Technical Competence — In 1945, after the defeat of Germany we sent technical missions to Europe to learn what we could of the enemy war effort. Col. Leslie Simon who was at the U. S. Army Aberdeen Proving Grounds during the war was one of those sent to study the German technological effort. He reported that the German Air Force had been far superior to the German Army and Navy in science and in technology because the German Air Force had available at their headquarters' organizations people who were equally competent as those in industry with whom they had to deal. As a result, it is safe to say that, considering the effort required and the limitation of men and materials, the German Air Force performed the outstanding development job in aircraft. The German Army and Navy on the other hand relied almost entirely on industry itself to do the job — and the result was a much poorer performance.

The lesson from this is that a military agency which aspires to do a large development job, and rapidly, must have at its headquarters scientists and engineers just as competent as those who are doing the work in the field. Otherwise, the headquarters is at the mercy of the field and becomes essentially an agency for merely supplying the necessary funds and rubber stamping the technical decisions.

(Example of Westinghouse, E. Phila. — jet engines)

Technical decisions in the nuclear power game are made jointly by the members of my organization and by those in the field. There has never yet

been an instance where we have had to order anything to be done. We argue things out, and finally a common decision is reached.

The relations we maintain with the laboratories and the many industrial organizations with whom we work is one of complete informality. In dealing with industry one must always bear in mind that getting along well is a give and take proposition. One cannot constantly chide a contractor in small matters, and then expect him to meet sudden large demands with enthusiasm. The contractor must be given the feeling he "belongs", that he is an equal member of a team, and he will be treated fairly. As far as I personally am concerned, I consider that I am just as responsible for the welfare and training of the men and women of the organizations which do work for us as I am for those in my own organization.

Responsibility -- One of the major difficulties in getting things done in a large organization is the fact that it is practically impossible to pin-point responsibility. A Bureau or an Office can't be made responsible because, as I said before, they are inanimate and therefore are incapable of perception or of feeling. Limited tours of duty of two or three years in positions of responsibility accentuate this situation.

I have attempted to solve this problem of responsibility by assigning to each project an officer whom I hold personally responsible to me for the entire project. It is up to him to use whatever means he has to in order to get it done. For example, there is a project officer for the Nautilus, one for the Sea Wolf, one for the Central Station Nuclear Power Plant, and so on. These officers are kept on duty for 5, 6, or 7 years -- as long as necessary. In this way I achieve permanence and responsibility. It is futile to imagine

that an individual can take charge of a highly technical project, stay two or three years and then leave, and really contribute anything. If this were true then the system used by American industry is wrong. With the geometrical advance in science and in engineering it behooves us, the military, to recognize that an officer can no longer be master of many skills, and that a considerable period of learning and of training is essential if one is to be more than a pure administrator. And I submit there is no such thing as a pure administrator. A man must have technical competence in what he is administering; this is the only way he can assume true leadership and make real contributions.

Administration — The administration of a complex development program cannot follow any rule book. The fact that it is development at once defines it as a search or a groping for knowledge which is beyond our horizons. If known rules or known technology would serve to solve the problem — it would no longer, by definition, be developmental.

Therefore, the true test of an administrator for developmental or new work is his ability to concert and release the energies of those who work with him. Followed faithfully, the strict organizational approach, with its faith in channels, job descriptions and organizational charts, chokes vitality, stifles imagination and deadens creativity. It plays safe with administration and, while it no doubt insures against abysmal failure, it also insures against brilliant success.

The technique we use might be called "indefinite jurisdiction", but it often provides a testing of initiative, competence, and imagination which produces far better results than playing safe by the book.

I could go on at length on a subject of this kind. By this time all of you should have recognized that I am talking from the viewpoint of one who is enthusiastic about his own work.

A fitting close to this talk is the following extract from a letter I recently received from an executive of one of our large industrial organizations:

"What I find most exciting is that your job establishes a new concept in industrial operations, a concept of an operation which is neither straight technology nor scientific research, but a combination of both. It seems to me this concept is going to set the pattern of the things to come, since the day of the scientist in his ivory tower on the one hand, and an industrial operation exploiting "practical" inventions on the other hand, is over.

Both technology and science are rapidly becoming so complex that no one can predict what will be "practical", and one scientific discovery requires many others before it can be made to serve humanity.

Consequently a successful industrial executive of tomorrow will be one who can make scientists and engineers work side by side, in harmony, as one team -- one who will have the practical judgment and the organizing ability to interpret and handle creative temperaments.

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