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MANAGEMENT IN AN ENVIRONMENT OF ACCELERATED SCIENCE AND TECHNOLOGY

Dr. Paul W. Cherington

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

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CAPTAIN CASTELAZO: Admiral Rose, Gentlemen: We are living in an age of accelerating scientific and technological advancement. Perhaps at no other time in our history has this advancement been so rapid and had such a pronounced impact on management concepts and practices.

In this environment there is a need to reexamine our management patterns and organizations.

We are very fortunate this morning to have as our speaker Dr. Paul W. Cherington, Professor of Business Administration at Harvard University, who for many years has been a student and a teacher of management. I have just been informed that Dr. Cherington has been honored by being appointed the new James J. Hill Professor of Transportation at Harvard. I don't know whether he has assumed the position yet or not. It has just been published. He is also an outstanding management consultant, having participated in various management and organizational studies in government and in industry.

Dr. Cherington will speak to us this morning on the subject of "Management in an Environment of Accelerated Science and Technology."

Dr. Cherington, it is a pleasure to welcome you to the platform of the Industrial College of the Armed Forces.

DR. CHERINGTON: Thank you, Captain. Admiral Rose, Gentlemen:

The topic that I was assigned is called "Management in an Environment of Accelerated Science and Technology," and obviously we could stay here for all day, if not all week, and explore the various aspects of that. So I felt it was

necessary to try to focus down on something a little narrower, and I am going to talk this morning for this first period about issues involved in project versus functional organizations for the management of complex and advanced weapon systems.

I think all of you probably will recognize that this is a fairly lively topic at the present time. The Air Force went in the direction of project or program management in 1951, the Army did last year, and the Navy is now sort of feeling around to see whether it likes the girl or whether it wants some other girl.

Project management is not perhaps as lively a topic as the Profumo scandals and Christine Keeler's new book, which I understand is called "Bedtime Tories," and the Italian version of it is called "Chicken Cacciatorie," but, nevertheless, there is a good deal of attention being paid in each of the services and at the OSD level to this question of how to organize to run large weapon systems.

Like so many other things, there are a good many proponents of project or program management within OSD. Secretary McNamara has expressed himself as feeling that this in general was the way to run large systems. Mr. Davis, who is the Deputy Assistant Secretary of Defense, I&L, for weapons acquisition, has pushed this concept. In May there was a Program Management Conference up at New London, attended by 250-odd people to discuss the various problems involved, and I would guess that within the next 30, 60, or 90 days there would be some further OSD pronouncements, generally speaking, favoring a project-oriented setup for large systems.

So I thought that it would be worth while to talk on a fairly frank basis

this morning, about what project management is, what it involves, some of the problems that there are in it, some of the fears that have been expressed about it. I suppose that what we should do first is try to define a little bit what we mean by project organization and what we mean by functional organization.

I think probably the seats in here are too soft for any of you to have brought your books, but on page 96, in Kast and Rosenzweig, you will find a chart which shows side by side--it's from General Besson's Seattle speech--a typical functional organization versus a typical project organization. Basically, in the functional organization each of the tasks in the development or production or support of a weapon is performed and managed by a group somewhere down in the organization, that is, a functional group, either by end-item hardware or by particular skill. There is no central authority or responsibility for the conduct of that weapon system on an overall basis until you get pretty well up in the command structure. There may, to be sure, be a coordinator, a man with a girl in his office, who kind of keeps the papers shuffled, but there is no central authority and responsibility for the running of that particular system.

This is in contrast to a project-oriented structure, where a single individual, by name, usually of pretty good rank, is singled out and he is given the authority and responsibility, across the board, depending on the project, for carrying out the development and the support. He is also--and this I think is crucial--given the resources in terms of a staff--and I don't mean a secretary and a clerk, I mean a pretty good size staff--and the money to get his job accomplished.

Now, in general terms that is the distinction, I think, between functionsl organization and project organization. Some of you, I know, and probably most of you, have heard this story, but I think it illustrates what I have in mind better than

almost anything else. About two years ago an OSD team was looking at the organization of one of the large systems, and they couldn't find out who was really running this system. It was a very substantial system covering all three services. It ran from the Pacific to the Atlantic, with a great many contractors involved, and they couldn't pin down who the individual was who was centrally responsible for this $2 or $3 billion system.

One of the members of this group told this story. It's a story about a man who had two sons. One was an optimist and the other was a pessimist. He decided to test these boys out one Christmas, so he bought the pessimist a lot of very handsome toys at Szhwartz & Company. He spread them out under the Christmas tree. He came down Sunday morning and there was the pessimist playing with these toys. He said, "Well son, what do you think? Did you have a good Christmas?" The boy said, "Yeah, great, Dad, but, after all, all these things are going to be broken in two or three days, so, really, what's the use?" Then he went into the next room, where the optimist was. All he had given this boy was a big bag of manure. This boy had spread this stuff out all over the floor. The man said to the optimist, "Well, Son, what on earth are you doing with all this stuff here?" The son said, "Well, Dad, with all this manure there's got to be a pony in here somewhere."

Now, after this fellow on the OSD group told this story, some of his team members were down in a fairly obscure service office, and they thought they had finally found the fellow who was running this project. So they sent a wire back to him, and it said, simply, "We have found the pony." That I think is crucial to remember in project management. You've got to be able to find the pony, and you've got to be able to identify him by name, rank, serial number, and define his

responsibilities and authority.

Now, of course, no organization dealing with an advanced product is either all functional or all project oriented. With the possible exception of, let's say, the Manhattan Project, and things like that, no project office has all of the resources that it takes to do the complete job. So that really, what we are talking about here is various shades of gray.

The Polaris Program is more heavily projectized, let's say, than Subrock or some of the other BuWeaps-oriented projects. But even Polaris didn't have all of the people and the resources and the labs, and so on, that it needed. So it put task orders on various bureaus in the Navy to get things done.

So, although I speak in terms of these as two ends of the spectrum, I hope you will realize that what we are really talking about here is a continuum, and the issues, I think, come down to where you want to come down in this spectrum, whether you want to come down toward the functional end or whether you want to come down toward the project end.

I think it is pertinent to spend just a few minutes to inquire why project management came about within the services, because I think, in talking about that a little--and this is obviously a controversial or a patially controversial area--we get a little bit better understanding of what we are trying to do with a project-oriented structure.

As I say, within the last 20-odd years, I suppose, the outstanding example of a project or a program-oriented structure was the Manhattan Project, a project involving new technology, the utmost secrecy, and the utmost urgency, to say nothing of a hell of a lot of bucks. The Manhattan Project, apart from General Groves, was largely plucked out or built up qompletely apart from any of the

traditional organizations which had to do with the developing and building of weapons. It was a new structure devoted exclusively to getting the bomb ready.

Then, in the mid-fifties, when we got into the missile programs, we did very much the same thing again. We pulled out a few individuals and we set them up in a separate, more or less independent organization where they could take full advantage of the new technology. These projects were highly complex, involving a lot of interfaces, a lot of interorganizational problems, and at the outset, in the Air Force, and all the way through in Polaris, let's say, and to a major extent down at Huntsville, these new organizations focused on one, or, at best, two or three similar systems.

Why was it necessary to do this? Why did we have to build up new groups or new organizations? To be brutally frank, I think the answer is to be found in two facts. (1) Functionalists tend to become parochial in their point of view. This is true of scientists, it's true of engineers, it's true of procurement people, and it's certainly true of college professors and other leeches on the body politic. New, very large systems involving new technology tend to threaten some of the organizational trappings that have typically been set up by pure functionalists.

I also think that the reason for the establishment of new offices to handle missile programs can be traced to the fact that a good many of the functional organizations that we had were filled with incompetents. Now, that's an unkind thing to say, particularly so early in the morning, but I think that if you will think back about some of the organizations that you know, there were some at Dayton, there were some here in Washington, there were some at the various arsenals. The number of really outstanding technical or functional groups is really very, very

small. I don't think we need to be particularly surprised by this. We pay all you people very little. We pay civil servants, generally speaking, very little. We impose all kinds of constraints and controls and other disagreeable features on you. So inevitably a good many of the competent people leave government service, whether it be the uniformed service or the civil service, and go to work somewhere else.

So that what we have been doing, I think, gradually since the end of World War II, and perhaps before, is gradually shrinking the market of the people that we can hold to do the management and in some cases the in-house technical jobs that we have to perform.

So I think it is some combination of the parochial interests of the functionalists and the fact that many of these functional and traditional-functional organizations have become incompetent that led to the establishment of these special offices.

But there was something more to it than that. In part what we saw here was the impact of what is usually described as the accelerated science and technology bearing down on a system that goes on in the military and in the civil service in peacetime which I call the responsibility shell game. In other words, it's much neater and much handier and much safer, if you are a civil servant, to be able to point and say, "That guy did it," rather than to take the odium of having somebody point at you and say, "He did it," and be able to make it stick.

Since life in civil service during peacetime is partly a political or quasi-political game, it becomes advantageous to be able always to point over to that fellow over there and say, "I didn't have the responsibility. I was responsible for only this little chunk here. He had the responsibility for the next chunk."

So it was impossible in many of these cases to find the pony. Since a good many of these new systems were in the multi-billion-dollar range and were highly urgent, the top-line commanders wanted to be sure that they could in fact find the pony.

I think it is fair to inquire as to what a project manager looks like. What does he do? In the first place, most project managers, I would say, and you can argue this, are first and foremost managers rather than technical people. There is no question about it that it is helpful, I think, if they have a technical or an engineering background, but what you are seeking in a project manager is not a technician as such but rather somebody who can perform the functions of general management. There are various lists of these; I dare say some previous speakers have discussed them; but basically these are planning, selling, decision making, acting, and controlling. In some combination the successful project manager, I think, has to take all of these and wrap them together in an effective package in order to be able to drive forward his program. Certainly he is very heavily involved in planning and this starts, I would say, right at the outset of a requirement or a concept. It involves drawing up the technical plan, the technical development plan, the budget necessary to go with this, a full series of support plans on logistics and the like. A good deal of the success of the program may rest on how well he is able to draw up realistic timely and effective plans.

I don't have to tell any of you that, particularly in a new system, one of the basic factors which go into the success of that system is whether it can be sold up the line. This is getting to be particularly true since the advent of the McNamara administration, the establishment of DDR&E on a more, shall we say? effective or at least active basis, program packages, and the like.

In a very real way, the project manager now, in the early stages of his program, has to be a salesman. If he is not he is likely to be Houdini-ized. He also has to be a decision maker--technical decisions, program, that is, budget decisions, changes, source-selection decisions, at least at the outset--and then he has to be able to take effective action on the basis of those decisions.

Finally, he has to be a controller par excellence. I know that some subsequent speakers are going to talk to you about various control techniques and devices, but I think that this area is one in which the control aspect is growing very rapidly, and I would simply like to point out that I think that a good many effective program or project managers essentially build themselves two control channels. They have a whole series of reports and control devices and techniques which come up to them through their technical divisions, let's say, on the progress and cost of various technical developments. Then they may also have a check control device, perhaps through their program director, who keeps the technical director and the people down the line completely honest--not in the real General Accounting Office sense of the word, of post-audit, but rather maintaining the integrity of the reporting system on a day-to-day basis. I don't think this was ever fully described but my impression is that Admiral Rayburn, in the Polaris office, had a most effective double-control system of this sort, where the program people were in constant touch with the technical people, and part of their job was to see that the numbers really were added up right.

It's very easy and, I think, very attractive for a lot of us--and there is nothing bad about this--to want to be able to point to our bosses and say, "Everything in my shop is great. I've got no problems. Go away and don't bother me." Pretty soon we begin to see a problem. We say, "Well, maybe if we

wait a little while we'll sweep this under the rug and it will resolve itself and we won't bother the old man about it." A month later this looks like quite a problem, and the contractor is going to slip, or he needs another $20 million, or the thing blew up on the pad. That's when they catch you. But even so, we like to say, "Now, don't worry, Boss, I can handle it. I'm right on top of it. Everything is great." Then, finally, the whole thing hits the ~~band~~ fan. The program has slipped six months, they need $100 million and a basic redesign of the guidance and the compulsion system, and this, that, and the other thing.

That's what the commander has the right to expect won't happen to him, because when that happens he is surprised, to put it mildly, unfavorably surprised. That perhaps is the basic reason why, I think, in some successful programs, the commander or the project manager has seen to it that he not only gets the regular reports analyzed and broken down but he also has a side channel that has the basic job of assuring that those reports really reflect what is probably going to happen to him. He may still have to pay out $100 million and accept a slippage, but at least you slip the knife into him slowly, and that's always more pleasant.

There is a great deal of controversy in the Army and in the Navy, and to some extent in the Air Force, as to how big the project staff should be. Recently I was at one military installation in which the project manager was being imposed on--if that's the proper phrase. The commander didn't like him. He wanted to keep his functional group together and do things just the way he had always done them, which was pretty damn lousy, I might add. But he was convinced finally that he should accept project management, if not on an intellectual basis then at least as a matter of policy and command. So he scratched his head and said,

"Ah, I have it. I'll set up project managers for these four systems. I'll put them high up on the chart, because that's good, and I'll give them each a secretary, because that's good, too. Then I will have project managers, and they can do any damn thing they want so long as they don't get in my way."

He mistook the form for the substance. One man and a girl, no matter what you call it, is not a project management office. On the other hand, in conjunction with setting up some of the Army systems in the early days, the project managers wanted a cast of thousands. They wanted their own guards, their own mail rooms, their own motor pools. They wanted everything, so that they could be nice little command groups of perhaps 500, 600, or 800 people. It's not really necessary to carry things that far.

I would say that the criteria for a minimum project office can be answered only by asking the question: Does the project manager have the staff, the technical staff, in numbers and in qualifications to manage his system, whether it be in the development cycle, the production, or the support? Generally speaking, these minimum numbers seem to be 25 or 30 for relatively small, not too complex systems, and up to 300, 400, or 500 people for very large, very complex systems.

Polaris, if you count all the bodies, including the people in the contract companies who reported directly to the project office, the people in APL, Vitro, and so on, had, I suppose, somewhere around 1500 people doing project management work. Some of the Air Force SPO's, on large projects, have 100 to 200 people in the military office plus several hundred people in the SETV contractor's office. The largest of the Army project offices has, I think, a little over 300 people, and the smallest has a dozen or fifteen.

Every one of these offices, I think, is going to look a little different, reflecting what the system is, where it is in its life cycle, what the problems are, and so forth. I think the important distinction is that we do not mean by project management a project coordinator who shuffles papers, and we don't necessarily mean that he has to own and maintain and run every one of the labs, functional groups, and so on, that work on his system. He has to be able to manage his program in the functions we just mentioned--planning, salesmanship, decision making, action taking, and control. To a large extent his organization should be tailored to those jobs.

Now, another issue that frequently comes up is where the project manager should report. How high up in the organization should he be plugged in? This has been handled differently across the services. Admiral Rayburn reported essentially to the CNO and Secretary. The early ballistic missile programs in the Air Force came in either direct or on a red line pretty well up in the organization. The Army has set its programs up either reporting to General Besson in ANC or to the major subordinate commanders.

There has been all kinds of talk and use of so-called red-line channels of authority, where the project manager who might be down in the organization had an avenue into top side that he could use, albeit most of them felt, at his own peril, because running around your commander in the military is apt to be pretty hazardous business.

We took a group of Army project managers out to a briefing at Inglewood last summer, and General Estes was sitting there at the front of the room listening to one of the Air Force presentations. One of the Army fellows, who was about to become a project manager--God help him--put up his hand and said, "General Estes,

does your project manager here have a red line around you to General Schriever and Secretary Zuckert?: General Estes said, "Yes, he does." The project manager said, "How often does he use it?" General Estes said, "Just once."

It really is impossible, if you are going to have a project structure for very many of your systems, to have all of them reporting in to the Chief of Staff or the Secretary, or, for that matter, into the commander, whether he be the head of the Bureau of Weapons or Naval Materiel or AFSC or ANC. I think the short answer to this question of where the project manager should report in has got to be resolved over the next few years by differentiating between the various projects. If the Air Force has 50-odd projects projectized or semi-projectized, and the Army 34, and the Navy X number, some discrimination has got to be made as to where the project managers report in. There is nothing very startling, I think, about feeling that a project manager on Titan III or Minuteman should report in at a higher level than 433L, let's say, which is a small kind of applied research and early development weather reporting system. On the basis of size and on the basis of priority, these projects have got to be differentiated, since they all can't report right in to the top.

The whole red-line system, which was developed, I suppose, first of all in its full glory at the Air Force, I think, works on a very informal basis, but the project manager is clearly at risk here. He damn well better be right or, as General Estes said, he'll use it just once.

I think it is appropriate to inquire what project management means for industry. My observation is that in the last couple years industry has become somewhat nervous. Of course they have always claimed that they don't make enough money, but they have become somewhat nervous over the closer scrutiny and control

that are being exercized in their handling of some of these development and production tasks. Most of them seem to accept with fairly good grace the project manager system. They recognize, I think, that this may involve closer control and scrutiny, but, by the same token, if the system is working, it tends to make their ear base with the Government very much easier than it was when they had to hit all of the functional organizations that might possibly be involved. I don't say that they don't have to hit the higher echelons still. They do, but they generally seem to like to be able to find the pony that they should talk to about a particular project.

So they are a little ambivalent about the project manager system, at least the ones I have talked to are. They are worried that it may be too effective and hence give them a little less flexibility to maneuver around in. But, by the same token, they seem to like the central point of contact.

A good many firms--I would guess virtually all of the large defense firms--have changed their organizations in the last 3 to 4 years to interface better with the project management system.

Here I think you have to look very closely to be sure that they have not simply added the trappings of project management and put a sign on somebody's forehead that he was the Missile Y project manager and have not really gone into project management, because everybody is nodding his head up and down about project management because this is the name of the game this year, and nobody wants to be left on the side. A number of organizations that I have seen have, as I say, the trappings of project management but within their own organizations they have stayed essentially functionally as functional groups.

One thing that somebody from industry expressed to me is the question of

whether it wasn't much harder under project management to divide and conquer their client or agency than it was under functional organization. I never really had thought about this and I didn't quite know what he meant. What he meant was that in the olden days it was very easy to go to one lab and get a little cross-rough going against another on some technical point, and the contractor could kind of knife in between. But now that there is project management, this is a little tougher to do if the project manager is effective. I don't really know what the answer to that is.

So, generally speaking, I would say that industry is interested in this system, a good many people are going along with it, but they are watching it critically.

In the last couple minutes here I'd like to raise four questions that are sometimes asked about project management. One is: Is it a more expensive way of doing business? That is, does it take more manpower, total manpower? The general conventional wisdom seems to be that it is more expensive, but I have never seen any very good numbers to prove it, and at least one organization that I can think of, when they attempted to prove it with numbers, by manipulating their numbers a little bit, proved that they had saved manpower by going to a complete project structure. So I would say that the answer is pretty hard to get at in terms of whether it is more expensive. I would be willing to stipulate that it is to some extent more expensive, but not much. But, if project management is confined to the major and important systems, I would guess that it is easily worth it.

Another question or fear that is sometimes raised is: Will project management wreck the functional organization and structure of the particular service? In other words, by attracting into project offices some top talent, good people--

and they've got to be or the thing won't work--what is going to happen to the remaining functional structures? That's one kind of problem.

Another kind of problem is: If the project manager is given a good deal of say-so as to whether he will or will not use the in-house technical, functional group, isn't it possible that a lot of them will be zero funded over time and won't have any mission in life?

Both of these are real dangers. I think it is up to commanders and top-level people in all the services to see to it that the functional organizations, which are clearly needed by the project managers, are not only not wrecked but if anything are strengthened. I don't have much sympathy for a laboratory or an arsenal or a shop or an office somewhere that complains that it is about to lose its mission, largely because, I think, in the past we had perhaps maintained some of these places much longer than their real value would justify, and it might be good to put the heat to some of these people to get some of their problems corrected, to get some new technology ground in, to get some new people involved, and the like.

A third problem which is mentioned often is the question of whether project management will wreck your career, both civil service and military. It is certainly true that project managers, named by definition aggressive, having to be a little pushy at times, are vigorous in their approach, often, to senior officers. This can get rough. At least three project managers that I know of for a fact I would guess have been good project managers and have not been promoted, perhaps because they were a little too good and a little too pushy.

By the same token, I know of a good many project managers who have been promoted to general or flag officer status and who I think substantially improved their career chances by virtue of being project managers.

So I don't think the answer here is all black or all white. It is possible, obviously, that when you are as visible as some of these people are you are apt to get into a real scrap with somebody who can clobber you later on. I think this is unfortunate but, after, all, it is not unique, it is not a unique by-product of project management. So I would say that, if anything, if it affects it at all, project management probably on balance enhances your career progression possibilities.

Finally, it is sometimes said that project management is very good for R&D type projects but no good for anything else. I think clearly it is good for R&D, but on the other hand I know of several Army projects that were essentially in production where project management, by pulling together this program and getting some of the production problems solved, has greatly expedited the program and lowered its cost.

When you get out into the support and the supply of spares to fielded weapons, I think the case is less clear for project management. In other words, when the weapon has been delivered to the troops in substantial quantities, I am not convinced in my mind yet that project management, at least as it is applied to R&D and production-type work, is really necessary or desirable.

I wish I could foresee in the future exactly how this project-versus-functional-organization argument or issue is going to be resolved and developed in the next 3 to 5 years. My guess is that, at least while the McNamara administration lasts, there will be increasing pressure on the services for large, complex, and expensive systems to have a centrality of authority and responsibility and visibility for those systems.

I would urge that, if the services want to keep control of the basic

issues regarding these systems, which are essentially the requirement, the definition, the source selection, the program, the reprogram, and changes, they had better have an organization, and I think it is a project organization that is responsive to the sometimes-in-error-but-never-in-doubt approach by some of our friends in OSD, because, if the services don't provide that kind of organization, I think you are going to loose major pieces of your responsibility in the weapons acquisition area. I think that is as inevitable as it is that we are sitting here. I don't really think you need to do that. But, if OSD and higher up the line can't get the facts and feel that the program is all over the floor, I think they are going to yank some of these responsibilities in and do them themselves.

You'll still be sitting there, but you won't be able to find the pony in any of this.

Thanks a lot.

CAPTAIN CASTELAZO: Gentlemen, Dr. Cherington is ready for your questions.

QUESTION: Dr. Cherington, I am led to believe from your talk that a project should have a completion date, or a target completion date, after which the project office should be dissolved or the functions absorbed in a functional organization. Is that a valid conclusion?

DR. CHERINGTON: Yes, I think it is. The real question is: When do you cut it off? For example, should you deprojectize A-1 and A-2 now, and leave only A-3 with SP, or should you carry on into the future?

In the Army, 2 or 3 and maybe 4 projects have in fact been stood down as project weapons or items, and those functions have reverted back to the

functional organizations. I can't tell you about the Air Force, but, certainly, at some point when the weapon is fielded I would argue that you should stand the project down. Of course if it is cancelled, you should, too. Otherwise you are creating a whole series of WPA's which are probably undesirable.

QUESTION: My question deals with managing multiple project managers at the next level that is above the project manager. Can you discuss for the moment the theory of either a functional organization there or an office organization, contrasting the two? Assuming that they can't all report directly to the commander, they must report somewhere.

DR. CHERINGTON: Well, this has been tried in a number of ways both in the Air Force and in the Army. Take for example the missile command at Huntsville, which has six Army missile programs which are projectized--to use a word. They all report to General McMorrow, who is the Commander at Huntsville. He, of course, also commands the R&D Division, the Procurement and Production Division, and so on.

The projects down there range, generally speaking, in size from 200 to 300 people. In total I suppose there are 1100 or 1200 people--maybe a few more--in those six project offices.

Zeus, which is on the post, reports to the Commanding General, ANC, here in Washington. It essentially is a Class 2 installation on the base. Now let's take a lab, the guidance lab, we'll say, which reports to the Director of R&D, perhaps through several layers. They are responsive to basically work orders or task orders laid on them by the six project managers, plus Nike Zeus. It is hoped that these task orders can be programed sufficiently far in advance so that the

lab director can do his planning and manpower allocation, and the like. Sometimes emergencies arise and, in the case of a priority conflict, if the project managers and the lab director and the director of R&D can't work it out, this goes to General McMorrow, and he makes some kind of command decision that Project A will take precedent over Project B.

I don't think this is any different than most other organizations, but perhaps the lab director is more under the gun for these six projects plus Nike Zeus than he would have been if they were simply represented by little cells or desks or men and girls down in the R&D or the P&P directorate.

I don't know whether that answers your question.

QUESTION: Dr. Cherington, to what extent does the commander of an organization divest himself of basic management responsibilities when he sets up a project management system or office?

DR. CHERINGTON: He doesn't divest himself. He delegates it to the project manager, but, if the project manager falls flat on his face, the commander still has to sit there and take the rap. I don't know of any way that a commander can shove this to one side and say, "Well, I told Joe to do it, so I am blameless." He keeps on a residual basis full responsibility, but he passes to Joe his hat, if you like, for that particular project.

Now, let's say, in the case of Nike Zeus, where Colonel Drury, who is the Project Manager for Zeus, reports to General Besson rather than to General McMorrow, General McMorrow is not responsible for the conduct of the Zeus program, but he is responsible for seeing that his functional people give timely and good support to that office.

QUESTION: Do you see merit in the proposition that, since incompetence

in functional organizations seems to be the principal problem, perhaps a better solution would be to be more brutal in weeding out the incompetents from the functional organizations, rather than to set up projects outfits into which, unfortunately, many of these incompetents would transfer in many instances?

DR. CHERINGTON: I would urge that you do both, but, having been a civil servant once I think we would all have to agree that you struggle with 2, 3, or a half-dozen of these cases of incompetence, and you are tired. You're tired of filling out the forms and of going through the procedures necessary to get this bum off the payroll. In a good many cases I think these incompetents do not go to projects, for two reasons: (1) The project manager won't have it, and, (2) Being visible and on a relatively short span of time, that is, 3, 4, 5, or 6 years, perhaps, the fellow is afraid that if he leaves the functional organization for the project he may never be able to get back. So that by and large the projects that I know of have pretty good people. I don't say they are all world leaders, but I think they average out substantially higher than the run of the mine.

I would agree that generally strengthening the civil service in this particular area, and the military service, for that matter, would be highly desirable. But, given the facts of life, you've probably got to do both--strengthen it and at the same time move toward this project orientation.

QUESTION: Dr. Cherington, speaking of a system project organization, you spoke of planning as one of its initial jobs. In Air Force R&D there are advance planning offices whose outputs are often concepts and plans for new systems or major modifications of existing systems. These advance planning

offices might be described as functional, and they often overlap or are in competition with existing SPO's. Would you comment on this overlap from a management viewpoint?

DR. CHERINGTON: I am sure that in every one of the services you are going to have to keep on having this advance planning group both at the command level, such as AFSC or ANC, or the Bureaus, and in the Pentagon. I would urge that, as soon as there is an identifiable system, a project office be set up for this, for two reasons: I think it can be of great help in providing centrality and focus for all of these steps that have to be gone through in selling and defining the program, and partly because I think this provides very valuable information for the project manager to have been in on the early stages of this system, rather than coming in to it, let's say, after program definition.

I would guess that there would be conflict. I think it is a mistake to think that conflict is necessarily bad. This conflict tends to bring some of these problems up to the surface so that somebody can damn well get a focus on them and decide them.

I think in the case of advance planning groups, which are essentially functionally oriented, when a project is set up, there is going to have to be some resolution as to who is going to do what to whom in this new program. By the same token I might add as kind of a footnote that I am not too happy about what I see of the work of some of these advance planning groups. I that there is plenty for them to do, but, when you have a summer exercise, such as you do out at Inglewood, Project Forecast, defining a whole series of things for the Air Force as to what their future is going to be, I think this is a clear sign of failure on the part of the advance planners and the advance planning groups, if you will allow me to make that remark. It is a very naughty remark with so many

blue suits, but that's it.

QUESTION: What restraints do you think can be placed on the project manager, for example, when there is a tendency to bring the system into being, let's say, on a sole-source procurement basis?

DR. CHERINGTON: Clearly the project manager has got to operate within the general policies and ground rules of his organization. He can't go running off completely on his own. Let's take the procurement people. I would say that every project office of any considerable size should have a procurement section of a limited number of people, who know the ASPER, who know the current policy on sole source, incentive contracts, and so on and so forth, and they essentially serve as the advisers, or more than that, they're the project policy makers for the project manager. When he wants to go out and buy something sole source, when he should go out, let's say, on the other extreme and buy it off the shelf on a advertised bid, if such a thing is possible on one of these, the job of his procurement man is to blow the whistle on him and say, "Look, Project Manager, all of the policy we have here from OSD right down implies and directs that you go out and get competition on this, and similarly on breakout types of contracts and so on and so forth."

Now, if he then persists with his not-such-good reasons for going sole source, his neck is on the block, and whoever is in charge of procurement in the command to which he reports, I think, can blow the whistle on him. There's no question about it.

We can't have, as somebody has said, in the Army, where there are now 34 projects, 34 ANC's plus General Besson. They've got to conform policy-wise to the basic parts of the command.

QUESTION: Dr. Cherington, you haven't mentioned Admiral Rickover's

organization. You mentioned Admiral Rayburn. I should like to know how you would characterize his system. Does he combine the old functional lines along with the new concept of project management?

DR. CHERINGTON: I think Admiral Rickover's system probably can best be described as a sport. To tell you the truth, I don't know enough of the details to answer your question. I know that he wears two hats, and so on. Perhaps you could tell us. I can't answer that question.

QUESTION: Dr. Cherington, you mentioned earlier that the Air Force and the Army support the project manager system and the Navy does not. At least, you indicated some uncertainty on the part of the Navy. in this area. Will you amplify your remark, please?

DR. CHERINGTON: Well, in the Navy's realinement, if I read the press release right, the Navy is sort of sniffing around at this system. There are the three T's, partially project organized. I don't know yet whether the Navy is really going to embrace project management as it is represented in SP in the Army and in the Air Force or not. I don't have any clear brand image of which way they are going to move.

I do know that a couple years ago, in talking with some of the people in one of the Bureaus, I asked the question: Who is directly responsible for this particular system: The Admiral who was in charge of the Bureau spoke up and said, "I am." Then I asked, "Who is responsible for this particular project." Again this Admiral spoke up and said, "I am." Well, we didn't go through all of the 32 major systems and all of the 94 total systems that there were in that Bureau to get the same answer. But it would have been the same answer.

In other words, he was the pony for all of those systems. He traced them

down through the organization. If it was not over on the program side of the shop, or if it was not down in the line side of the shop, we in most of those cases came to somebody in a lab, and in some cases in industry, who was the top-ranking, full-time guy with resources, running that program.

Now, I think the Navy is studying and worrying and moving on this, but I can't tell you exactly how it is all going to turn out, because I just don't know.

QUESTION: As you know, Dr. Cherington, in weapon systems development very seldom do major advances in technology develop from weapon system advancement. Would you comment on whether it is the tendency of this project management organization to emphasize advancement of weapon systems at the expense of real advancement in technology?

DR. CHERINGTON: Most of the systems that I am familiar with in the three services have not required--I don't know quite how to state this--real technological breakthroughs in order to bring them in. There have been in a good many of them unanswered questions when the program got started, like the reentry question in the missile program, the sloshing question, and so on and so forth, but not fundamental jumps forward in the state of the art. That I think is clearly as it should be.

If you don't have a pretty good answer to the various technical problems on a $2, $3, $4, or $5 billion system, that's a clear sign that you shouldn't start down the system road, I think. By the same token, in the real world, it is often easier, or has been in the past, to get money for a specific system than it has been for applied engineering or applied research, or whatever you want to call it, on a component or a particular area.

I don't think there is any question that in the past, while I don't say that we have paid too much attention or given too much money to systems, we certainly have not given enough to what I think you are talking about, which is, let's say, applied engineering or research.

Now, I would guess that in the last two years some progress has been made in redressing this balance to some extent, and nobody is ever going to have enough money to do applied engineering, because you could spend the national budget squared and there would still be somebody who felt that he was out in the cold.

If I remember these numbers, and I don't think I can recite them, the RDP&E budget going for non-system work, that is work that is not going to be hung on a particular system, has just about tripled or quadrupled over the last 2 or 3 years. I may be wrong about this, but that is my recollection. Increasingly, I think, a lot of programs will be held back and won't be allowed to go into the systems area until applied engineering is done and the feasibility of this, whatever it may be, is pretty well tested.

I would agree with you that we ought to put in more work on this sort of thing. The Rand Corporation has spent a lot of time and effort in arguing the point that we should do mostly applied engineering and research. They back off on this a little bit. I would tend to agree with them. I would also point out that there are very few applied engineering-research projects that you could throw at the Russians.

So somebody has to make up his mind to have some weapons to shoot with. Those, generally, are systems development and production.

I am sure we can do a lot better. By the same token, I think we've got a

pretty good arsenal of weapons, too.

QUESTION: I submit that one reason it is particularly hard to find the pony is because of the social lethargy that seems to be the tendency in this affluent society. I would like to consider a less affluent society for a moment, West Germany, who had great success in World War II in developing weapon systems and has been very successful in the postwar period on producing hardware. Can you comment on their systems as compared with the American systems and emphasize the major differences?

DR. CHERINGTON: Only in a general way. I think the Germans have always been pretty good in this hardware development area. I think that they and the Japanese, under the stimulus of being beaten in the war, have put on a tremendous drive in this particular area.

In terms of growth in the last 15 years or longer, it is a matter of record that their growth and improvement have been substantially better than ours. They are now up to the point where, in many areas, as I am sure you all know, they can beat us more or less at our own game.

I do not know how they get organized to do this. Undoubtedly the question of the affluent society, I think, has a bearing on weapons acquisition. I would describe it something like this: If you look at what might be described as the defense industry, down to the depression of 1958 the big players in the defense field, from 1956 to 1958, were for the most part the aircraft companies and so on. The rise of electronics and the depression of 1958 in the automobile industry, I think, triggered off major changes.

Companies like General Motors, Ford, General Electric, and so on, suddenly took another look at their commercial civilian markets, and also at the

military market, and they decided to get into the act in a major way. This upset some of the traditional companies who, incidentally, were changing pretty fast themselves from one type of product to another.

So that you had some major new entrants into the business and very few exits from the defense industry. This tended to make the competition pretty brutal for the major new systems.

In part, because of the way we had rigged the acquisition system in a good many cases all of the emphasis was placed on capturing the new system, at which point you were then locked into the Government for 6, 8, or 10 years, a very nice condition to be in. Under the general lack of control, perhaps you might describe it, you had a fair amount of flexibility to move around in, and you used that flexibility to try to capture new systems.

So I would describe this more as a reflection of the type of acquisition system that we had than the fact that we had an affluent society. These defense manufacturers--and I take it this is what you are getting at--when they performed badly, this was not because they were lazy; it was because, generally speaking, their main focus and attention were on the future rather than on the on-going system, in some cases.

This was not, I think, because they were fat, dumb, and happy but because they wanted to be fairly plump in the 1960's.

Now, just how that compares to the structure in West Germany, I really don't know.

CAPTAIN CASTELAZO: Gentlemen, our time has run out. Dr. Cherington will be available for further discussion in the cafeteria between now and the

time our seminars take up.

At this time I want to say to you that we have 12 distinguished guest panelists with us, four from each service, who will be with the different discussion groups. May we have our panelists stand up so that we can get a look at them. These are expert project managers, gentlemen.

Dr. Cherington: On behalf of the Commandant and the students, thank you very, very much for a very stimulating talk this morning.

DR. CHERINGTON: Thank you.