WHERE ARE WE GOING IN SPACE MANAGEMENT

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The subject, "Where are We Going in Space Management", is general, broad, and futuristic. 'Where we are going' will in large part depend upon 'where we came from.' This is the fifth year of the government space effort and the twenty-fifth year of space work for some of the seniors now in NASA. In another way, 'where we go' turns on the promise of the whole undertaking as mankind knows it and encourages or permits others to work at it.

I would like to think that if there is a true and innate ability in the American and in the nation it is the ability to manage large programs of any diversity. What I think this country needs to recognize, however, is the need today for a true sense of national purpose. Space, and the mastery of it, is the destiny of not only this country but all of mankind. It is a program so large that full achievement can only come through a common bond among men and nations never before realized. While science and engineering may have created the environment for this bond, it is the sensitivity of the professional manager to certain factors of progress -- which have been basic since the beginning of time -- people, wealth, time, and product, who will mould the final product; a product which will have universal appeal for the Jeffersonian masses and acceptability by the masses, or it will have no use.

Space management is heading toward a marshaling of that inevitable common destiny of mankind into a dynamic, flesh and blood, reality. And mankind will conquer space not because it is of value scientifically, not to win some Heraulean contest, but simply because he must in this ventu of living.

The body of this speech turns about seven functional areas of space management that will experience development, enlargement, and change. But before going to that, I would like to mention two even more general attributes of the next ten years which I think will be among the most fundamental changes in space management.

For the first, I would like to point out that one of the realistic myths that will fall by the wayside in the coming decade is the separation of administration from technical work performance. There will be a general realization and use of the knowledge that almost any human enterprise must have unity and space management is no exception. These three constituent elements are capital pools: First, technology, which is a combination of people and knowledge; second, plant, which is large and small toolings; and third, administration, which is the less distinctive name for management. I think that in ten years we are looking into in space management the cohesiveness and interplay of these three factors, forces, and functions will measure the progression of management as well as productiveness of the space effort.

The second aspect of general development over the next ten years will see the substantial elevation of the test function into a role as a co-designer with the engineering and scientific people. This parallelism of test and design into a concurrency of design is a must to assure first-time successes in the expenditure magnitudes that the space agency daily engages in.

Now, with that out of the way, where are we going in space management? To determine this, we must first declare what space management is. Space management is R&D management on a particularly grandiose scale.

And what is R&D management?

Often it appears to be the management of the unrestrained, by the undisciplined, for the delivery of the undefined and undesigned.

Although this statement is more a caricature than a definition, it does have just enough truth to demonstrate the difficulties of space management when compared with the more traditional managerial challenges.

R&D programs of any description are a relatively new phenomenon in the United States. R&D on as huge a scale as the space program is entirely unprecendented. It calls for new management thought and action in at least seven vital areas.

I am going to discuss each of these seven at some length. Space management is going -- and must go -- in the direction of originating and applying new approaches in these seven areas, over the next decade. Otherwise it is going to get axed from the taxpayers budget or get a "cover position" as a part of another undefinable -- National Defense.

Let us talk about these seven areas in which space management must build, understand, activate, and use the products of new thinking and new approaches.

COST FORECASTING

The space program is likely to involve massive annual outlays for as long into the future as men can imagine. The nation's plans must be geared for this. Only as we become better able to predict the costs of our future projects can we provide the nation with a sound and reasoned planning basis. This, in turn, may lead to a more ordered progression toward goals less characterized by the present and past "feast and famine" cycle characteristic of today's annual space budget calisthenics.

We can confidently predict that money management will reach a new and broader plateau in the next ten years. R&D programs in general, and space R&D in particular, are becoming so huge, complex, and far flung in execution, that money is

virtually the only "common demoninator" which can comprehend their outer limits. This means that we must become more skilled in using "measurement by money" as a tool of space program definition, comparisons, and administration. "Measurement by money" must become a tool of general management and not simply a specialty which gives financial management personnel their claim to professionalism.

RESPONSE TO FISCAL CONSTRAINTS

We are in a period of fiscal constraints. Can't we improve our methods of response to these constraints? We want to preserve and nourish the essential parts of our program and to jettison the non-essential -- but only the non-essential. Management must develop more skillful techniques than we now have for distinguishing the essential from the non-essential. "Across-the-board" percentage reductions -- the time-honored technique -- are too gross. Savings on trips, supplies, and telephone charges are too petty to meet the need. We must develop the managerial sophistication to be able to identify the urgent and dispense with the unnecessary.

And make no mistake. It is becoming more and more vital to the space program for us to identify the urgent and dispense with the unnecessary. As the program has accelerated, both the official and general public have tended to view with jaundiced eyes the program's claims of need.

The only way we will be able to counter this jaundice is to offer communicable program characteristics which possess multiple elements of "lay appreciation". We will need more and more to demonstrate our integrity and to convince doubters that we operate in good faith and deliver hard performance -- by our people as well as our hardware.

APPORTIONING BETWEEN PROJECT AND LONG-RANGE EFFORTS

Another problem posed by fiscal constraints is how best to apportion our limited resources between high priority projects and longer-range scientific research. Such high priority projects as the manned lunar landing, and others, represent firm commitments made to the nation which we must and will deliver. At the same time, the national underwriting of such projects was in pursuit of an even broader space mastery than the projects themselves will bring. In this sense, the projects were recognized by the nation to constitute learning devices on the road to space comprehension of untold promise and dimension. If we are not to default in this larger endeavor, we must continue to devote some portion of our program resources to the learning process itself, and to the application of this learning for purposes even beyond our present ones.

The moon vehicle is finely trained to run a specific course, but to say (as one magazine writer did recently) that it will have no extra

power or maneuverability to overcome unexpected obstacles, is to buy into a static concept of management -- and to dismiss the demands for dynamics as unrealistic. This exclusive and static reliance on "forces in being" refuses to accept or even comprehend the gauntlet that has been thrown down to management, which challenges the manager to exercise responsibility commensurate with the needs of the case.

Space management involves the discharge of an implicit but binding obligation to extract the fullest possible measure of nationally beneficial results; and also to incorporate in the program the broad coverage required as the national insurance base to replan and rebuild from which to go forward, in the national interest, to minimize space misadventures and hold to the course through the vitality, depth, and application of our expanding reservoir of managed technological knowledge.

As our fiscal constraints become tighter, the space program managers will have an ever-increasing need for a precise, valid, continuously up-dated basis on which communicable apportionment decisions can be made judiciously. We do not now have really refined management tools for this vital purpose, and we shall have to develop some as soon as possible.

REQUIREMENTS DEFINITION

We must find ways to define "scope of work" more specifically, with more sophistication, and earlier in the conceptual process than we now do. Strangely enough, this is very possibly more a managerial problem than a scientific or technical one. Much more scientific and technical knowledge and practice exists in this world than can ever find its way to paper. The management problem is to find ways of striking just the right balance -- extracting the knowledge without distracting the scientist. However, we need to recognize the virtue of a cautionary note in this area. There is a lure in the notion of a "sure fix", even on things which are not yet at that point of fruition, that often causes the impatient manager to move too quickly. It is the manager's job to take the pregnant idea, "break it off", run with it, and bring it to ultimate reality. But it takes a very high order of managerial sensitivity to "break it off" at the right time, so that neither the creative idea nor the creative scientist gets killed in the process and development of process.

A word of caution -- control can never create -- it is at best a post-applicative force that reaches a height of productivity in the ordering of creativity-interfaces with the commonness of enterprise execution.

CONTROL OF THE DESIGN/ENGINEERING CHANGE PROCESS

The achievement of firmer control of the design process and the engineering change process will serve purposes even beyond control. That is because top notch documentation is both an indispensible ingredient of control and a key to the orderly accumulation of human knowledge.

Now admitting that we need more careful documentation, do we also need better control? Yes! We need to freeze designs once they have reached the point where further sophistication and refinement would satisfy only preferences and enthusiasms rather than requirements. Also, we need to manage our configurations closely, which means knowing what we've got as of any given time; and systematically evaluating and approving all proposed changes, before they are made -- in terms of their likely effect on the total configuration and not just on the subsystem or component immediately affected.

UNITY OF SCIENTISTS AND ENGINEERS WITH MANAGERS

There is a great and growing need for scientists and engineers to devote their time and efforts to managing the space program. This need has become more and more pressing as the release of vast segments of the program to industry has accelerated, because the monitoring of industrial performance has become a gigantic exercise of essentially technical management. Now, in order for any person to be willing to devote himself to managing something, he must have, at the absolute minimum, three present or potential qualities:

1. Interest in managing.
2. Managerial "bent", or talent.
3. Belief that the contribution he can make by managing is at least as great or greater than he can make by doing anything else. In essence, this is a conviction about the value of management.

This latter quality, conviction about the value of management, is not as pronounced in scientists and engineers, generally speaking, as it is in many other groups. As "rugged individualists", who must depart from the group consensus in order to innovate, scientists and engineers tend to regard managers as people intent upon curbing freedom of personal action for mean and small reasons.

This coin has another side, too. Managers exist because, over the course of history, group action has been found to be more productive, more often, than individual action. The job of the manager is to marshall and manipulate groups in the interest of obtaining this larger productivity. Consequently, the manager often tends to view "rugged individualists" as selfish people for refusing to subordinate themselves to the group objectives.

One of the managerial imperatives of the next decade is to achieve greater unity between scientists and engineers with managers, a unity which does not stunt the creativity of individuals, yet bridges the gap of understanding and increases the respect of the scientific community for managerial activities.

MANAGING THE INDUSTRIAL CONVERSION

The pace of industrial conversion accelerates more and more. Thousands of contractors and subcontractor, spread across the nation, perform and produce bits and pieces of the space program.

Most of the bits and pieces are significant only in terms of the whole program, rather than having independent value. Even in terms of the whole program, the value of these bits and pieces is predicated not upon technical performance and production alone, but upon timely production with justifiable and proportionate piece-costs. How shall this expanding kaleidoscope be guided so that every piece emerges in its due time and cost, and makes the program whole? Can "Alert", "Pert", and "Squirt" do this, or must these be supplanted by a new dimension of bold and sensitive managerial insights?

Some of the questions that must have measured answers in the process of managing the industrial conversion are:

> How much contractor "penetration and visibility" are needed to give space managers the right amount of managerial grasp? What kinds of "penetration and visibility" do we need? Do we need to monitor technical performance, financial performance, timed-progress, all three, or none of these? To what level of detail? How do we restrain our contractors from diverting too much of our high priority project money into efforts designed to foster their own long term corporate growth? How much is too much?
>
> Finally, and of most importance, how do we encourage the contractors to do what is uniquely their function -- direct, innovate and modify the elements of the space program

from the competitive market place of American ingenuity and daring. The incremental storehouse of our productive greatness in industry.

Well, gentlemen, conceiving, exploring, developing and applying new tools for attack in the seven areas we have been discussing is the managerial "order of the decade". That is where we are going in space management, if we are to go anywhere worthy of note. Space exploration is a daring dream, with government, industrial leadership, ingenuity and initiative, combined in a mutuality of national performance. That I hope is worthy of note for each and all of us.

Now if you review in your minds, for a moment, the seven areas we have been talking about:

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you will realize that each of them is a huge one. Both individually and collectively, these areas are so big that when we say "space program management" we have to mean management by the American government.

But can the American government truly face up to these challenges without abandoning its traditional defensiveness -- which construes "management by government" as somehow not quite sporting? The space program must be "managed for the total", a job which only the government can do. In the space program, management by government has found its true and completely defensible milieu -- it must recognize the fact and live up to it.