r. George Mueller:

THE MAN BEHIND MANNED

Dr. George E. Mueller is NASA's sociate Administrator for Manned ace Flight. But to let it go at that like allowing that Mickey Mantle plays baseball for the New York Yankees. Either way, you say something, but not nearly enough.

From his fourth floor office in NASA's headquarters in Washington, D.C., George Mueller directs a 300,000-man outfit with people located at the Manned Spacecraft Center, Houston, Texas; the George C. Marshall Space Flight Center, Huntsville, Alabama; the John F. Kennedy Space Center, Florida; in Washington, D.C., and about 20,000 industrial plants around the country. A staff meeting with everyone in attendance would be SRO in a facility three times the size of Philadelphia's John F. Kennedy Stadium or the Los Angeles Coliseum.

Employment figures, although they indicate an organization's size, give no hint of the complexity of its task. Referring to one program—Apollo—Dr. Mueller grins as he recalls a remark made by Bob Hotz, editor of *Aviation Week*. "Bob once said that the technical challenge presented by the Apollo program alone was equal in complexity to building the supersonic transport, the pyramids, and the atomic bomb—taken together.

"I don't think there's any doubt that the manned space effort is the most complex effort this nation has ever undertaken. We started with no road maps, no proven methods for getting where we wanted to be in space. And I do believe that Apollo and Gemini represent the toughest technical challenge the world has ever seen. On the other hand, I guess the program manager on the pyramid job figured he had some pretty tough technical problems to handle, too!"

Probably. But the stringent long-life reliability requirement seems to have been offset by a rather liberal cost/schedule package. Obviously, things have tightened up a bit.

Some things, however, never change. One is the need for effective communications throughout an entire program organization. Dr. Mueller's is no exception. "Because of our size and the complexity of our task," he says, "we have an almost unique communications situation. Generally, it works pretty well, but there's always room for improvement. If I had to point to a single area in which there's no room for a breakdown, it would be communications. It's absolutely necessary that we have clear, accurate, hard communications—within NASA and between NASA and its contractors.

"You can't operate this organization or these programs on emotions. You've got to know what the problems are, and then get on and solve them. People have got to talk to each other, and this dialogue has to be present during all phases of a program. We and the contractors must work together to develop a program and a schedule for its successful completion. Then we've got to meet that schedule, or at least signal each other if we see a delay coming.

"The necessity for detailed planning—and for adherence to the plan—is clear. But I see with equal clarity the need to keep others on a program informed. There's simply no alternative."

George Mueller's is not a one-sided view. It's one he's acquired through years of experience and changing perspective. Trained as an engineer, he's done research, been a teacher, a businessman, and now a NASA executive.

After winning his electrical engineering degree from the Missouri School of Mines, Dr. Mueller moved on to Purdue University where he earned a master's in E.E. His next stop was Bell Telephone Labs. While with Bell Labs he performed TV, microwave and measuring experiments. It was during this period that he did some pioneering work in measurement of radio energy emitted by the sun, microwave propagation and low-field electrons.

While at Bell, Dr. Mueller attended Princeton University and undertook additional graduate studies. Later, he joined the faculty of Ohio State University where he eventually became a full professor of electrical engineering, did more research and won his PH.D. degree. His research activity carried him into the fields of broadcast and dielectric antennas, cathode emission, low field magnetrons and traveling wave tubes.

He then had one more stop to make along the way to becoming America's top man in the manned space effort.

At the Space Technology Laboratories, Inc. (STL), Dr. Mueller continued his pioneering ways. He merely exchanged his lab jacket for a suit coat. His list of assignments is impressive:

—Director of Electronic Labs
—Director, Able program
—Vice President, Space Systems Management
—Vice President, Research and Development

As research and development vice president, Dr. Mueller gave the marching orders for all of STL's tech-

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nical operations. And since STL was itself so deeply involved in so much of the nation's space activity, Dr. Mueller was at one time or another responsible for design, development and testing of systems and components for Atlas, Titan, Thor, and Minuteman ballistic missiles. Space probes were yet another area in which his influence was felt.

Pioneer I, America's first successful space probe, illustrates the impact of Dr. Mueller's influence. He is credited with having made a major contribution to Pioneer's development. Subsequently, he had over-all program responsibility for both Explorer VI and Pioneer V.

A recognized expert on space communications and space technology—he was one of the originators of the concept and design of the Telebit digital telemetry system—Dr. Mueller carried a long list of achievements with him when he moved into his NASA office. Holder of seven electrical engineering patents, author of more than 20 technical papers, and co-author (with E. R. Spangler) of the book "Communication Satellites," George Mueller has, for all purposes, seen and participated in science and space from every angle.

It's therefore almost irresistible to wonder: why would you want to give up a soft job at an outstanding university and then go into this wild business? But you don't ask it that way. You inquire: "Was there a turning point in your career? Some incident that led you toward your present job?"

George Mueller laughs. He knows what you mean. "I can't recall any special turning point," he replies.

"It's all been fascinating. I must say there is a tremendous contrast between today's job and teaching and doing research at Ohio State. I doubt that I'm any different than a lot of people with relatively similar backgrounds and training. At some point in a person's career he must decide between management and becoming a technical expert. But it seems to me that the problems you encounter as you go along with your profession very often help you with that decision. For instance, the pressure at universities sometimes forces people into assuming certain management tasks. So they're launched on a new facet of their career whether they like it or not. As for me, I like management. Once I got into it, I was determined to learn it as well as my technical specialty and to do the best job I could. And like every other manager, I'm still learning."

The modesty is genuine. Spend an hour with George Mueller and you know it. Some of it he surely brought to the job, and just as surely the job helps a man keep himself in perspective. One of the things he stresses is that manned space is not a one- or ten- or even hundred-man show. Every person and every contractor has got a big job. He says:

"It's often difficult, I know; but all of us have got to put the program before ourselves and our companies. Having been in industry, I know how tough this can be on occasion for a contractor. But contractors have got to give us their ideas, and they've got to tell us their troubles when they have them.

"In Apollo alone, it's so important that people at all levels understand the goals of the program. And communications must be such that the Apollo executives and the presidents and chairmen of the various contractor organizations can always get together to work out the big problems when they arise.

"I think there's a good and conscientious spirit within the contractor community. We've made good progress in overcoming cost problems—and these we had in quantity

until last summer. We've got an active and continuing cost program and we're getting the cooperation we need from industry.

"Regarding communications, we have been operating on the basis that we'll do today what we have planned for today. It's a sort of step-by-step procedure following the plans and goals laid out and agreed on by everyone involved. This is the same procedure that worked so well on Gemini. It was going well on Apollo, too, before the accident. Now, we've made some adjustments and we've strengthened our team considerably."

George Mueller lives in a world where people must act on the problems, not react to them. It's therefore natural that he should offer this comment when asked the primary characteristic of a good manager:

"The true test of a good manager is evident in his ability to select and then persuade people who are better than he is to work for him. This, I think, is the essential ingredient prevalent in the best managers. I think that all of us must constantly strive to find ways to improve our ability to do this.

"This is a basic problem that all of us—in NASA and in industry—face. We must never cease to replenish the reservoir of skills so vital to proper support of the program.

"This is something we could all do better. We've got to seek out and develop new ways to maintain high morale and enthusiasm at all levels.

"Furthermore, I think that to be truly successful with Apollo and future manned programs, contractors are going to be so confident in what they do that they really stand behind the products they build—this is the real challenge of Apollo.

"It's always easier to begin a program than it is to successfully complete one—within budget and on schedule. And I must say that by and large the contractors have done a good job here—and General Electric has done an excellent job."

For George Mueller, the Apollo program is just a beginning. He sees the so-called post-Apollo period as one that will bring the real rewards of space activity down to earth. Some of the goals for this period:

—The extension of man's experience in space through a step-by-step process in flights of one month, two months, and eventually a year or more in orbit.

—The continued scientific exploration of the moon, after the initial landing, at the rate of two to four flights a year.

—Research and development of new payloads that will exploit the capability of the Saturn-Apollo systems in earth orbit and lunar orbit.

—Improvements of the Apollo spacecraft so it can be used with the up rated Saturn I launch vehicle as a six-man ferry between earth and earth orbit, with capability for landing on land.

This venture, called the Apollo Applications Program, has two principal objectives. Dr. Mueller comments: "Our first objective is concerned with the advancement of manned space flight capability. The second is related to things that can be done with this capability.

"Obviously, in the first category are efforts to develop the capability for economical space flight and to determine the usefulness of man in space. In the second category, we see the opportunity to conduct astronomy observations, extended lunar exploration and experiments to study benefits on earth.

"Of course we don't yet know all the commercial applications that may result from the man-in-space program. A lot of people want to know if space vehicles will one day replace the airplane. I don't think it's likely, at least not for intraplanetary travel. It would seem to be a relatively inefficient use for a spacecraft and booster, and the cost of transportation always determines its applicability. On the other hand, I'd like to point out that during the past nine years of the space program we've gotten our cost-per-pound of payload down by about 1,000 times.

"Over the next ten years this may be reduced additional hundreds of times. Another factor: our fuel costs are minute compared to those of the airlines, where fuel represents a main cost of transportation. This part of the future is difficult to predict."

In the immediate future of manned space flight, Dr. Mueller emphasizes the efficiency and economy of the Apollo Applications Program. He points to current and continuing efforts toward improvements that reduce vehicle unit costs, thereby speeding the day of economical applications.

"One of the cost-saving aspects of Apollo Applications is the re-use of the Command Module. We hope to refurbish Command Modules flown in the Apollo program for Apollo Applications, and thus avoid several million dollars in costs for new hardware.

"Another step is the addition of land-landing capability which facilitates re-use of the Command Module. This would have even greater impact on costs if it should lead to the ability to dispense with the requirement for naval recovery forces.

"The land-landing capability will provide still another major benefit, an increase in crew capacity from three to six. This is so because land-landing requires retrorockets that soften the impact to three or four feet per second. In water landings, the impact is between 10 and 20 feet per second. The lowering of the impact shock reduces the requirements placed on the couches and their suspension; therefore we can have a crew of six.

"A fourth item is the double use of the second stage of the up rated Saturn I—the S-IVB. After it has done its job in the launch phase of the mission, the stage will be converted to the Orbital Workshop.

"Fifth is the repeated use of the Orbital Workshop as an embryonic space station.

"Number six is the plan to conduct flights of increasing duration. The program worked out with the advice of the space medicine community envisions a series of steps that roughly double the length of each previous flight. We hope this process will lead to missions lasting a year or more in orbit.

"Finally, one of the most important economy features of Apollo Applications is its basic concept—that of using the flight hardware and physical plant developed for Apollo, and employing the skills of the Apollo people and industrial organizations as they become available."

But before any of these programs with their increased benefits for science, and indeed the entire nation, there's still the matter of the first manned Apollo launch and subsequent Apollo flights. Or as Dr. Mueller has put it, doing today what we have planned for today. "It's quite clear," he says, "that the future of this nation depends on its ability to produce more and better things for all people. Man-in-space, and the subsequent application of what we learn, is just one of those things—but an important one. To date, the creative participation of individuals from government and industry—working as a team—has resulted in bringing about changes and benefits to the national way of life that even the greatest visionaries wouldn't have dreamed of.

"Most of what we have already accomplished has been the result of intelligent and dedicated individuals joining together to form a team. We can't afford to lose that spirit. We must have enthusiasm, we must insure that people retain their respect for the program and its goals. As managers and as individuals that is perhaps our greatest challenge—and in this we must not fail." O