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GE Challenge
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FOOTPRINTS ON THE FRONTIER

We call it the frontier of space, and the names given our prairie schooners add picturesqueness to the metaphor. However, Explorer, Pioneer, and Discoverer, to name only three, do more than identify missions—they describe the men who sent them. These men, who turn hope into hardware, are clearing a path through the previously trackless wilderness so that settlers of the future will have footprints to follow—footprints left by the imagination of men like Kurt Debus.

Doctor Kurt Debus, director of NASA's Kennedy Space Center, makes his headquarters in Florida, but his management domain extends westward to NASA's launch facility at the Western Test Range, Lompoc, California. His job—the assembly, checkout, and launch of manned and unmanned spacecraft—is one he's been doing for as long as there has been a NASA—and before. There's probably no one in the world with more experience in the field.

Nearing 60, Dr. Debus is a chain-smoking, soft-spoken scientist who has retained in his speech a trace of his native Germany. Frankfurt-born, Darmstadt University-educated, he took his first steps towards the frontier at Peenemunde where he was manager of Ground Support Systems. The journey later carried him to White Sands, New Mexico; Huntsville, Alabama; and finally to Cape Kennedy, nee Canaveral.

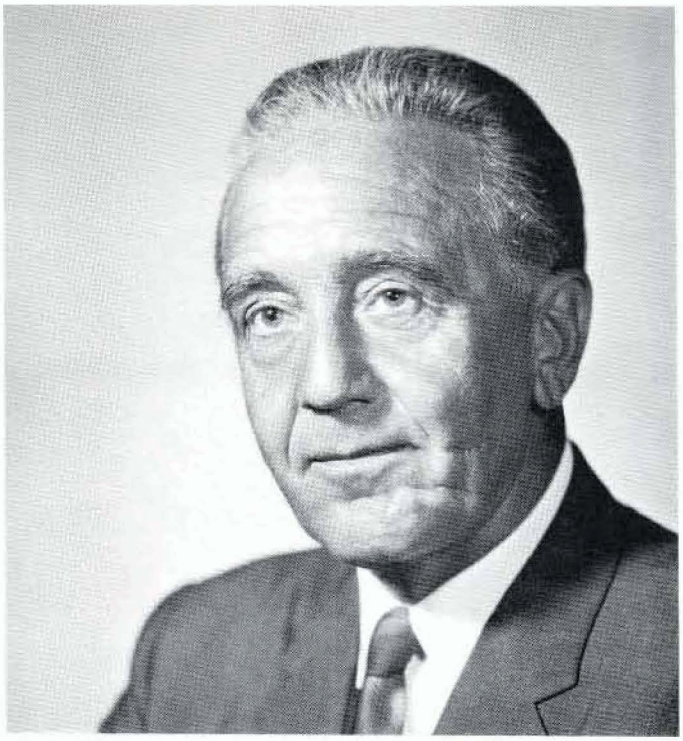
His vocation has always been science, but he's served it in many ways as a scientist, engineer, teacher and manager. The total experience has produced a man whose sense of duty and limitless vision are paralleled only by his affability and charm. And in spite of the pressures imposed by responsibility, Debus has cultivated a sense of humor which, though subtle, is very much in evidence in his conversation.

Presumably, Debus needed a sense of humor to match his sense of duty when he first viewed the Air Force's 17,000 acres of sand and palmetto scrub, some of which he was to turn into a launch facility. He recalls that the real estate nearby consisted of a couple of hotels, a rotting pier, and a restaurant or two that had always just "closed for the season" regardless of the time of year. His hangar roof leaked, and of his equipment he says, "everything seemed to arrive in too many pieces." That was 15 years ago at the Cape.

Debus supervised the construction of launch facilities at the Cape for the Army's ballistic weapons programs, and made them suitable for Redstone, Jupiter, Juno and Pershing shots. And on August 20, 1953, he had the satisfaction of firing the nation's first ballistic missile, Redstone, over an Atlantic course. Looking back, he says, "We showed the world that America was not to be counted out. We fired imaginations, which have, in turn, fused a national space goal."

A few hundred missile launches later, that space goal has made Debus the proprietor of one of the most valuable "hardware stores" in America. An 80,000-acre, one billion dollar facility: that's today's John F. Kennedy Space Center, NASA. In addition, NASA utilizes launch complex facilities on adjacent Kennedy Air Force Station, and there's also MILA—the Merritt Island Launch Area or "Spaceport U.S.A." Here voyages to the moon and beyond will begin.

The Debus team, consisting of government and industrial personnel, has faced and been equal to every technical challenge imposed by the era, and this includes those



Kurt Debus: scientist, engineer, teacher, manager.

of both manned and unmanned launches. Last year alone, KSC at the Cape and at the Western Test Range handled 30 major flights, including such diverse programs as Gemini, Nimbus, OGO, Biosatellite, ATS, and Surveyor.

Of all the programs he's been associated with, does Dr. Debus consider one a tougher technical challenge than the others? He comments:

"Perhaps Redstone, but then Explorer I, which was different in its challenge, was also very satisfying to me. You must understand that each program presents a new and sometimes different challenge. The challenge is always there, but it changes its character.

"In the early days, with Redstone, the flight hardware was not developed as it is today. For that reason, launching always contained many unknowns. You might fly 50 development birds before you came to understand all that would happen with a flight. What we really did was to develop a system by shooting it, evaluating the flight, and modifying the system accordingly.

"Later, as new programs were developed and the space environment became better known, we were able to bring more of what we today call 'Qual Test' into play. Then, as systems became more complex, computers and automatic checkout equipment were introduced. But we're only now beginning to harvest the bounty made possible by these techniques.

"The advantages are obvious, because today, with our increased understanding of the environment, we can perform tests in the lab where formerly we performed them on the pad and in flight. In-flight experimenting has yielded engineering knowledge which permits design against unknown environmental stresses and the phenomena of flight dynamics. It permits us to move the testing from the flight to the ground, and into the laboratory

and test stands. This brings us to the big challenge of today—to make it much more likely that a first flight will be successful."

Cost, schedule, and performance are critical factors for KSC personnel, just as they are for everyone else in the space program. According to Debus, his team can achieve top grades in all three by inspiring confidence among systems engineers.

"Our job at Kennedy Space Center is simply to carry out the share of the mission which we've assumed. We must insure that schedules are maintained—and this is a critical factor. We must work always toward the highest possible quality performance in our activities—100 per cent is our goal—and we must do these things within costs.

"We have both a management and a technical contribution. We must bring into play to their fullest extent the checkout procedures designed for the systems we launch. Regarding this, we're undergoing a full-fledged learning process, and our goal is and must be to perfect this equipment to the point where the systems engineers can put their absolute trust in it. The result of this confidence will be great savings in both time and money. However, we've already moved from very restrictive to more sophisticated programs of computer and checkout equipment applications."

Preparing and launching the flight hardware requires special facilities and equipment. What about the organization of KSC people to do the job?

"At Kennedy we've had to establish and maintain the team concept, and turn it into an active effort on the part of many aerospace industry contributors as well as the government. To accomplish this for the flight hardware programs—that's a combination of the launch vehicle and the spacecraft—we have analyzed and separated the various activities into functions.

"Our functions are Launch Operations, Launch Support Operations, Design Engineering and Installations Support. We also have program offices responsive to the needs of the various programs. They must insure that things are done—but they must do this without performing the effort themselves. For example, we have an Apollo Program Office, which manages the work of many groups, government and industry. And Voyager, if it comes, will have its own program office.

"Since the preparation of various vehicle stages, modules plus the spacecraft, is a contractor's end-product, our management approach is one of tying the contractor's fee to the performance of the item he develops. For this reason, we feel it's only right that the contractor should have the right to prepare the item or stage for flight. It's not only fairer, but it makes the stage contractor responsible for the performance of his product. It's, therefore, an incentive for him.

"Because we're bringing together so many contractors whose histories and affiliations differ, we're now raising a whole generation of technicians, engineers and managers and bringing them into the mainstream of the space program. This phase of our growth must be organized so that a single purpose launch team emerges."

As far as Dr. Debus is concerned, the team is working well. He views the current *incentive* contract system as a dramatic improvement over the former cost-plus-fixed-fee arrangement, but he recognizes a need for vigilance in order to preserve the delicate balance.

"Industry and government are jointly pursuing common solutions to many problems. And now we're sharing both the savings and the over-runs, when they occur. This is very healthy and has produced good results. We must insure, however, that the system guarantees the contractor the right to manage his own efforts on a given program. The government must see that the job is done, but it must not have people around who are actually supervising the contractor's people. The contractor must have the opportunity to show that he can do the job and meet the cost and schedule commitments," he continues.

"What we have is a precarious relationship that can be disrupted if it's not handled right. But so far it's been very satisfactory. I think we've really challenged our industry team to come forth with new ideas. We've gotten away from the cost-plus-fixed-fee concept, because it offered very little incentive for companies to keep costs down or to use their best people. The best people were too often being assigned to new proposals once an old one was won.

"Today we establish a basic contract price which is based on the best possible estimate of cost. If the contractor can cut that cost, he shares the saving. And the employment of the best managers and the best contributors available is now stipulated in the contract. This has made for a much better team, better products, and better services."

Unveiling of bust of the late President Kennedy at KSC headquarters.

Commenting on the Apollo Support Department, Dr. Debus says: "In the area in which I have judgment, your Apollo Support Department has done very well. Both the ACE (Acceptance Checkout Equipment—Spacecraft) and ESE (Electrical Support Equipment) stations are performing quite well. The ACE concept we will try to apply on future Saturn program spacecraft. We're exploring this possibility right now. I think it's basically a very workable and promising concept that has possibility for application on future programs."

From today's team to tomorrow's policy, Dr. Debus offers an opinion on post-Apollo programs: "The main thing is to exploit to the fullest the programs we now have, including Apollo. I specifically mean gaining a capability of putting a payload into near orbit, into synchronous orbit, or sending it the lunar distance. 'Payload' I define as something that makes a landing possible.

"I look also to the Applications program—putting up telescopes that can look back at the earth and out into the universe. We must make this kind of program practical for an entire shopping list of disciplines. We must have programs which help us to better understand our own natural resources. The new earth sensors will help here. We've got to develop the means of understanding the distribution of earth's resources. This, together with development programs for the management of resources—such as food and minerals—will help the governments of the world to feed people and improve living conditions. It will make possible early detection of crop diseases, and inventory and manipulation of crops and minerals.

"While we're exploring the quiet capability, there will be a continuous unmanned probing of Venus and Mars; later we'll go farther out to Saturn, Jupiter and others.

Dr. Debus and NASA Administrator James Webb (right).

Then, still later, we'll see what man can do. I'm convinced, however, that man will be necessary for a total understanding of what's out there.

"We must be careful, however, with our efforts to discover life. We must design the experiments so their results are not misleading. It's impossible to design experiments against a totally unknown environment. A number of investigations may be needed because on a given planet there may be life in only a small spot, and experiments won't necessarily show it. The South Pole experiments have shown this possibility. Finding life can be very difficult with unmanned probes, so we must consider this in future planning."

How can the aerospace industry best contribute to the plans and promises of this period? What responsibility will it be asked to bear?

"I'd ask the aerospace industry to help us to develop a more penetrating understanding of what the future holds. I'd ask help in looking into available resources and intellectually assessing what they can be used for. We need industry's help in finding new directions, scientifically, politically, economically. We need industry's help in the broadest sense for the advancement of mankind.

"By the advancement of mankind, I include the elimination of war, and our space efforts offer this promise. The fact is, when people understand more about each other, they are less liable to hate and to make wrong judgments, which usually are bred by ignorance. Global communications are leading to a shrinking of the earth; people are becoming neighbors—actually looking into one another's backyard. This is already making the propagandists' job more difficult, because they really exploit ignorance.

"As more resources are developed, there'll be a better chance for the underdeveloped countries to become self-sufficient. And, as I said, global communications will help to educate more people. People talking to each other greatly raises the possibility of solving global problems.

"New developments also yield new technologies and create new areas of competition. This is especially important for nations like ours and Russia's—nations that have such devastating destructive power. This competitive spirit in technology and science is very healthy and it's moving further along a technological plateau, rather than toward war and hostility. Even the race to the moon—and the question of who gets there first—is not as important as maintaining this competitive technological spirit.

"Just as in sports, the competitive spirit carries with it a very old, and therefore deep-seated, instinct which has helped our species to survive. This should not become suppressed—nor can it be, even if we wanted it to. It can benefit men and nations if it moves from the plateau of warfare to the much higher plateau of technological competition in exploiting our increased knowledge in science, engineering and management of complex systems.

"Space is an area of conscious competition, and its exploration and uses are helping to keep us out of war. Industry must fully share the responsibility if we are to have this kind of progress." ★