Krafft Ehricke, space pioneer

by Marsha Freeman

This tribute to Krafft Ehricke is reprinted by permission of the editors of Fusion magazine, *January/February 1985*.

In this century there have been few men who combined a richness of creative ideas on how to expand the frontiers of space with the moral commitment to see these ideas implemented. Space pioneer Krafft A. Ehricke, who died of leukemia Dec. 11, 1984, was one of that handful.

Throughout his life, Ehricke was working day-to-day on the frontier technical challenges posed by space flight. At the same time, he was studying and designing the space initiatives for the future to carry man out of the "closed world" tied to the Earth, on to the worlds that could exist beyond it.

Ehricke helped lay the basis for the technical achievements that in 1969 took man to the Moon. He also prepared the groundwork for the colonization and industrialization of the Moon as the stepping-stone for full-scale human exploration and settlement of the solar system. The tremendous scope of Ehricke's scientific and engineering ideas will be able to guide man for decades to come.

In recent years, Ehricke passionately confronted the anti-science ideas of the environmentalists, their cultural pessimism. He also saw first hand the increasing danger of the protofascist Green Party in Germany. In 1981, when he and his wife, Ingeborg, made a tour of European universities with the Fusion Energy Foundation, Ehricke battled to get across the ideas of progress and no limits to growth, despite threats of physical violence from rock-throwing, anti-nuclear Greens.

The classical tradition

Krafft Ehricke brought with him to the United States the great tradition of German science, to which he had access through the Humboldt curriculum during his studies in Berlin. Recently, he joined the advisory board of the Schiller Institute to continue the fight to spread classical culture internationally, creating a renaissance to combat the pessimism and hopelessness of the Malthusians. Throughout his life, he fought to meet the challenge of this task, defeating the voices of despair and moving human civilization off its home planet to a "new open world," as he put it.

As a young man in the 1930s, already fascinated with the idea of conquering space, Ehricke had filed two patents on rockets in Berlin. He had gained his technical foundation there with Hermann Oberth, the father of German rocketry. When the World War II rocket program at Peenemünde was accelerated, Ehricke was sent to work there with some of the best minds in German science. Under the direction of Walter Thiel, Wernher von Braun, and others, Ehricke worked on solving chemical rocket propulsion problems for the V-2 project and also examined the potential of nuclear energy for space propulsion. He concluded at that time that nuclear power would be required for future space flight.

Ehricke never wavered from his scientific conclusion that nuclear power was necessary, both for civilian energy and propulsion. During the 1970s, this position made Ehricke's work somewhat unpopular with the media and even with that part of the scientific establishment, which bowed to anti-nuclear ideology and its unscientific solar solutions.

At the end of the war, Ehricke and his wife came to the United States and he joined the more than 100 other Peenemünde scientists who were working for the Department of the Army at Ft. Bliss. After a brief stay at the Redstone Arsenal in Huntsville, Alabama, Ehricke joined the staff of Bell Aircraft in upstate New York.

During the 1950s, Ehricke was in the forefront of the technical developments required in the U.S. intercontinental ballistic missile race with the Russians. At the Convair division of the General Dynamics Company, he contributed to the Atlas program—the first U.S. ICBM.

In 1958, still at Convair, Ehricke tackled and solved the problem of taming highly energetic liquid hydrogen for propulsion. The Centaur rocket, placed on top of the Atlas, gave the United States the capability to place payloads into higher orbits, or even to escape the gravitational pull of the Earth.

The Centaur, still used today to launch probes throughout the solar system, laid the basis for the liquid-hydrogen-fueled engines of the Saturn rocket that carried American astronauts to the Moon. To the present day, the United States is the only nation that has an operational liquid-hydrogen rocket.

The philosophical basis for space flight

When Sputnik was launched in 1957, Krafft Ehricke had already outlined why man should go in to space, how he could do it, and when.

As he put it in a November 1957 article, titled "The

Anthropology of Astronautics," in the American Rocket Society magazine, *Astronautics:* "Altogether, in the United States and other countries, billions of dollars are spent on the development of a technology which gives every indication of being or becoming an astronautical technology. This is extremely gratifying to all those who, during the first part of this century, fought for the recognition of space travel as a serious, practical, and worthwhile effort—not at some future time, but right now, in this century and in this age of ours.

"The campaign for technical and scientific recognition of space flight is won. However, the fight for recognition of astronautics as a vital part of man's future, rather than as just an accepted technical or scientific specialty, has hardly begun. Astronautics is the science of operating in space and traveling to other worlds. The implications are such that it now becomes increasingly important to develop the philosophy, as well as the utilitarian aspects, of this new science.

"The concept of space travel carries with it enormous impact, because it challenges man on practically all fronts of his physical and spiritual existence. The idea of traveling to other celestial bodies reflects to the highest degree the independence and agility of the human mind. It lends ultimate dignity to man's technical and scientific endeavors."

Natural Law and 'realism of vision'

In this article, Ehricke establishes three laws, which he calls the "basic tenets in the pioneering of space flight": first, nobody and nothing under the natural laws of this universe impose any limitations on man except man himself; second, not only the Earth, but the entire solar system, and as much of the universe as he can reach under the laws of nature, are man's rightful field of activity; and third, by expanding through the universe, man fulfills his destiny as an element of life, endowed with the power of reason and the wisdom of the moral law within himself.

"We must be realistic," Ehricke says in summary, "but there is a wrong kind of realism, timid and static, which tells man to live for his existence alone and not to rock the boat. The kind of realism we need is the realism of vision—the realism of a Columbus, of our Constitution, of a Benjamin Franklin, of an Albert Einstein, of a Konstantin Zoilkowsky, and of a Hermann Oberth."

Ehricke's realism led him to actively intervene in policy-making to put forward the creative ideas he knew needed to be implemented. In 1957, he was the chairman of the American Rocket Society's Spaceflight Committee, which recommended the formation of a civilian space flight agency to President Eisenhower. In the same year, he was asked to participate in a congressional report, "The Next Ten Years in Space," which contains forecasts by leading authorities in space.

Based on his knowledge of the state of the art and his vision of what technology could accomplish over a decade, Ehricke stated that in the next 10 years (to 1967), we could expect to see: communications and relay satellites in geosynchronous orbit; global weather-monitoring systems; radio-navigation satellites for ships at sea; one or more small manned space stations; nuclear auxiliary power supply systems for satellites and stations; satellites around the Moon and landings with instrumented probes; manned circumnavigation of the Moon, and "probably the first landings by man"; interplanetary probes covering the entire solar system; and close international cooperation.

"Man will have sufficient information to decide for or against a permanent lunar base and will begin to look to the planets Venus and Mars as his goals for the decade to come," Ehricke said.

Throughout the 1960s, Ehricke worked on the advanced space technologies made possible by the Apollo mission to go to the Moon and to probe the planets. At the same time, he was readying his lunar development plan, which he elaborated in the early 1970s. By that time, the opponents of the "power of reason" were readying their forces for a head-on collision with Western civilization and the goals Ehricke sought.

In recent years, Ehricke passionately confronted the anti-science ideas of the environmentalists, their cultural pessimism. In 1981, when he and his wife, Ingeborg, made a tour of European universities with the Fusion Energy Foundation, Ehricke battled to get across the ideas of progress and no limits to growth, despite threats of physical violence from rock-throwing, anti-nuclear Greens.

In February 1971, Ehricke addressed the National Space Meeting of the Institute of Navigation in Huntsville, summarizing his concept of the development of the Moon as the "seventh continent" of the Earth. Noting the "wave of pessimism" that could "undermine Man's confidence in a soaring future," Ehricke states that "a science policy that places the protection of our environment over Man's overall needs of tomorrow is not realistic, however well-meaning, because preservation of the environment is only a necessary, not a sufficient requirement.

"Space is obviously not a panacea for all of Man's problems," he said. "Neither is Earth, in the long run, because of its sensitive biosphere and its limited resources. We need

Ehricke helped lay the basis for the technical achievements that in 1969 took man to the Moon. He also prepared the groundwork for the colonization and industrialization of the Moon as the stepping-stone for full-scale human exploration and settlement of the solar system. The tremendous scope of Ehricke's scientific and engineering ideas will be able to guide man for decades to come.

both. Man has needs that will outgrow his planet in time."

In this brief speech, a summary of a book he and his collaborator Elizabeth Miller had ready for publication on what he called the extraterrestrial imperative, Ehricke outlined what the energy requirements will be for space industrialization and why nuclear power—both fission and fusion—will be the only way to reach these goals. Ehricke describes the new possibilities for using nuclear technologies for extraterrestrial mining and outlines the transport and other capabilities this space manufacturing step will require.

In a 1973 article for *Acta Astronautica*, Ehricke adds detail to the lunar resources available to combat the limits of Earth resources, based on the data from the Apollo missions. Again, he attacks the "closed world," "limits to growth" ideology:

"The world of modern industrial man is no more closed within the biosphere than it is flat. Preservation cannot be limited to the environment at the expense of human growth. Human growth must aim at nothing less than the achievement of a humane living standard for all. The preservation of both environment and civilization hinges on technology and its translation into industry. Many technologies are needed to overcome the present apparent limits to growth. But the one underlying, ubiquitous technology that makes many other industrial technologies possible (either directly or by spin-off) is space technology."

There "is no limit to growth, only to multiplication," he insisted.

His book called *The Extraterrestrial Imperative* was never published, for all the major publishers to whom it was submitted said that the book was too pro-growth, too optimistic, and too pro-nuclear. These ideas, Ehricke was told, were not "popular" in the political environment of the 1970s. And a decade later, upon returning from a European tour sponsored by the Fusion Energy Foundation in November 1981, Ehricke described to a New York audience the frightening political situation in West Germany with the rise of the anti-nuclear Greens:

"It is a little bit disconcerting that the same shock-troop kind of tactics stand at the end of one's life as I have seen as a very young person in Berlin in 1929, 1930, and 1931."

Assailing the "back to nature" mentality of the Greens, Ehricke stated, "If 4 or 5 or 6 billion people will fall back on a life-style of a very embryonic mankind, it will destroy mankind by billions, and it will devastate the biosphere. . . . In the 'Year of the Child' of the United Nations two years ago [1979], 12 million children did not reach their first birthday. That's 50% more than all the battle deaths in World War I. And that is an outrage to a species that calls itself civilized," he said.

In the last few years, Ehricke continued to refine and improve his scientific and technological basis for industrializing the Moon, producing a five-phase evolutionary plan, which includes unmanned orbiters and landers, lunar-orbiting space stations, lunar processing facilities, city building, and finally, a full lunar biosphere, Selenopolis. (Articles by Ehricke on lunar industrialization appear in *Fusion*, Dec. 1981 and May-June 1984.)

One of the totally new fields that Ehricke invented and developed is the science of harenodynamics, which involves the use of the lunar soil as a fluid. (The word comes from *harena*, sand, in Latin.) The soil could then be used in place of liquid fluids on Earth, in applications such as the cooling of nuclear power plants.

Harenodynamic braking has been proposed by Ehricke for a lunar slide lander, a transport vehicle that would land on a sand runway, using small blades to deflect and eject the sand, thus braking the vehicle. Ehricke's method does not require propellant for retrothrusting, as does conventional braking for landing on the Moon, such as that of the Apollo Lunar Module. Also, the slide lander would not release gas in the lunar environment, which allows the possibility of keeping it gas-free for astronomical observing.

Ehricke developed hundreds of ideas over his career that mankind will need to conquer space—techniques for disposing of highly toxic and long-lived nuclear fuel waste in space; using mirrors in Earth orbit to increase agricultural productivity and modify the weather; and small single-mission space stations that would be in different orbits for specific missions, to name just a few.

At his death, Ehricke was completing a book called *The Seventh Continent: Industrialization and Settlement of the Moon*, which the FEF is now involved in publishing. For the tens of thousands of people who can carry his work further, and for the millions of Americans and others worldwide who do not believe there are limits to growth, either physical or philosophical, Ehricke's work will be essential in carrying out what he defined as the extraterrestrial imperative—man's mission to create a more open world to enrich future civilization.