

Krafft Arnold Ehricke

*"Man, the cutting edge of terrestrial life, has no rational alternative but to expand the environmental and resource base beyond Earth. Global development, therefore, must be based on an open world concept and include both the development of extraterrestrial resources and the wiser management of our terrestrial resources. This is the **extraterrestrial imperative**, its central goal is the preservation of the civilization."*

--Krafft A. Ehricke , New York Times

Premier Space Scientist, Born Berlin, Germany - March 24, 1917

As a child he watched Fritz Lang's legendary motion picture Woman in the Moon a dozen times. His genius mind and passionately humanitarian spirit became enflamed with the determination to develop spaceflight technologies that would one day open the wider world of space to mankind...and not just for exploration.

Krafts Arnold Ehricke Because of his decision to become an aerospace scientist at a time when this discipline was in its infancy, he was literally forced to invent his own education.

At age 12 he founded a rocket society in his native Germany. He studied celestial mechanics and nuclear physics at Berlin Technical University, where he received a degree in Aeronautical Engineering.

As a German he was forced to fight the Russians in World War II under the dictator he most despised. Injured, he was transferred to the Peenemuende V-2 rocket center where he was a propulsion engineer from 1942-1945. Ehricke became a key member of the famed Peenemunde Rocket Development team, specializing in the propulsion system for the German V-2 rocket. It was here, working on future space projects, that he conceived his theories on manned space operations and nuclear propulsion.

Emigrating to the U.S. in 1947, he worked for the U.S. Army Ordinance Department where he continued his work on ballistic missiles and space vehicles, becoming one of the world's most outstanding space scientists. When research and development in the discipline was turned over to industry in the early 1950's, he joined the newly formed General Dynamics Astronautics Division. As a concept and design specialist, he participated in the development of the successful Atlas Intercontinental Ballistic Missile, which also proved to be a reliable primary space launch vehicle for the USAF and NASA.

Dr. Ehricke was to become world famous for his contributions and his profound understanding of both the technology and philosophical meaning of space development. In the 1950s at General Dynamics he helped develop Atlas. His brilliance and inventiveness has played a major role in the success of U.S. space programs. He was appointed Director of the Centaur program in 1959, and Director of Advanced Studies in 1962. He became a General Dynamics Vice President after inventing Centaur, the first liquid hydrogen propelled upper stage launch vehicle. Centaur empowered the United States to reach across the solar system with planetary probes yielding everything we know today about our closest neighbors. In 1974, Ehricke was appointed Chief Scientist at the North American Rockwell Space Systems Division, where he developed his concepts of the use of space for the benefit of mankind, interplanetary travel, generation of electricity, manufacturing facilities in space, and the mining of the Moon and planets. As advisor to NASA, the U.S. Air Force, and industry, his influence has been felt in all space programs. He headed Space Global, a worldwide astrophysics consulting firm.

Invested 1966 in the International Aerospace Hall of Fame.

During the 1970s Dr. Ehricke lead advanced studies at Rockwell International while working independently to introduce the first comprehensive concept and rationale for space industrialization and commercialization. This led to a priceless legacy of studies, designs, writings and even paintings describing the colonization of Moon and the development of Earth-Moon space. Dr. Ehricke devoted his lifetime to advancing the concept of peaceful space exploitation for the benefit of humanity and worked tirelessly until his last moments. He is survived by his wife Ingeborg and three daughters, who founded the nonprofit Krafft A. Ehricke Institute for Space Development in 1985.

Goddard, Robert

b. Oct. 5, 1882, d. Aug. 10, 1945

The American physicist Robert Hutchings Goddard, b. Oct. 5, 1882, d. Aug. 10, 1945, laid the foundations of modern rocket and astronautics technology. He earned his master's and doctoral degrees in physics at Clark University, in Worcester, Mass., where he later taught. On his own time and money, Goddard conducted research on improving solid-propellant rockets. Further experiments were conducted under a grant from the Smithsonian Institution, and in 1919 the Smithsonian published a 69-page summary of his results, entitled A Method of Reaching Extreme Altitudes.

The most noted milestone in Goddard's work came on Mar. 16, 1926, when he fired the world's first successful liquid-propellant rocket. A simple pressure-fed rocket that burned gasoline and liquid oxygen, it traveled only 56 m (184 ft) but proved that the principle was valid. Goddard's future work was dedicated to developing more powerful rockets and more complex systems. He later received grants from Harry F. Guggenheim and the Guggenheim Foundation that proved invaluable when he moved his work to Roswell, N.Mex. During World War II the U.S. government was unconvinced of the rocket's worth as a weapon and put Goddard to work on rocket-assisted-takeoff units for aircraft.

In 1951, Goddard's widow and the Guggenheim Foundation filed a joint patent infringement claim against the U.S. government. In 1960 a \$1 million settlement granted the government the rights to more than 200 patents covering "basic inventions in the field of rockets, guided missiles and space exploration." Goddard's records were later published as The Papers of Robert H. Goddard (1970). The National Aeronautics and Space Administration named its Goddard Space Flight Center in his honor.

Konstantin E. Tsiolkovskiy

b. 1857 - d. 1935

Konstantin E. Tsiolkovskiy became enthralled with the possibilities of interplanetary travel as a boy, and at age fourteen started independent study using books from his father's library on natural science and mathematics. He also developed a passion for invention and constructed balloons, propelled carriages, and other instruments. To further his education, his parents sent young Tsiolkovskiy to Moscow to pursue technical studies. In 1878, he became a teacher of mathematics in a school north of Moscow. Tsiolkovskiy first started writing on space in 1898, when he submitted for publication to the Russian journal, Nauchnoye Obozreniye (Science Review), a work based upon years of calculations that laid out many of the principles of modern space flight. The article, "Investigating Space with Rocket Devices," presented years of calculations that laid out many of the principles of modern space flight and opened the door to future writings

on the subject. In it, Tsiolkovski described in depth the use of rockets for launching orbital space ships. There followed a series of increasingly sophisticated studies on the technical aspects of space flight. In the 1920s and 1930s Tsiolkovski proved especially productive, publishing ten major works, elucidating the nature of bodies in orbit, developing scientific principles behind reaction vehicles, designing orbital space stations, and promoting interplanetary travel. He also furthered studies on many principles commonly used in rockets today: specific impulse to gauge engine performance, multistage boosters, fuel mixtures such as liquid hydrogen and liquid oxygen, the problems and possibilities inherent in microgravity, the promise of solar power, and spacesuits for extravehicular activity. Significantly, he never had the resources nor perhaps the inclination to experiment with rockets himself. After the Bolshevik revolution of 1917 and the creation of the Soviet Union, Tsiolkovski was formally recognized for his accomplishments in the theory of space flight. Among other honors, in 1921 he received a lifetime pension from the state that allowed him to retire from teaching at the age of sixty-four. Thereafter he devoted full time to developing his space flight theories studies. He died at his home in Kaluga on 19 September 1935. His theoretical work greatly influenced later rocketeers both in his native land and throughout Europe. While less well known during his lifetime in the United States, Tsiolkovski's work enjoyed broad study in the 1950s and 1960s as Americans sought to understand how the Soviet Union had accomplished such unexpected success in its early efforts in space flight. See "Konstantin E. Tsiolkovski," biographical file, NASA Historical Reference Collection, NASA History Office, NASA Headquarters, Washington, DC.

[Source: NASA]

