

Edward C. Stone

(1936–2024)

Space scientist who led humanity to interstellar space with Voyager.

Edward Stone was a pre-eminent space scientist with an exceptional record of leading space missions and building ground-based astronomical facilities. The public face of NASA's Voyager missions for the launch of the two probes in 1977, he served as project scientist for 50 years. Stone introduced the world to the wonders of the gas-giant planets (Jupiter, Saturn, Uranus and Neptune) in multiple press conferences, from Voyager 1's encounter with Jupiter in 1979 to Voyager 2's fly-by of Neptune in 1989. He also oversaw the probes entering interstellar space – the first in 2012 and the second in 2018. They continue to transmit data to Earth today.

At the helm of the California Association for Research and Astronomy in the 1990s, Stone was involved in the development of the twin 10-metre Keck telescopes on Maunakea in Hawaii, two of the most productive ground-based astronomical facilities ever built. And as the executive director of the Thirty Meter Telescope, for eight years he oversaw the huge international collaboration that plans to build one of the world's largest optical-infrared telescopes on the same mountain – land that is sacred to Native Hawaiians, leading to years-long protests and controversy. The telescope aims to capture light from the earliest galaxies in the Universe and search for habitable planets. Stone's involvement was a service to the astronomy community, because his observational interests were focused on cosmic rays.

Stone was born in Knoxville and grew up in Burlington, both in Iowa. His father was a construction supervisor who communicated his curiosity about how things worked to his son. Stone studied physics at the University of Chicago, Illinois, for a master's degree and PhD. Soon after he started studying there, in 1957, the Soviet Union launched Sputnik 1 – the first artificial Earth satellite – starting the space race. Stone took notice, and was at a good place to get involved. His thesis adviser, cosmic-ray-research pioneer John Simpson, was deploying instruments attached to high-altitude balloons as well as using ground-based neutron monitors. Instruments on rockets soon followed. Stone's thesis experiment was on a now-declassified US spy satellite, Discoverer 31, flown in 1961.

After earning his doctorate in 1964, Stone joined Rochus 'Robbie' Vogt, whom he studied alongside at Chicago, at the California



Institute of Technology (Caltech) in Pasadena, as a research fellow. Together, they formed the Space Radiation Laboratory, where I work. They focused on observations of cosmic rays, with instruments first carried on balloons and later launched into space. Stone moved up the academic ranks at Caltech, becoming a professor of physics in 1976. In 1972, he was appointed project scientist for NASA's MJS77 mission, later renamed Voyager. Stone was also directly involved in developing an

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instrument for use aboard the Voyagers – the Cosmic Ray Subsystem – helping to design its cosmic-ray telescopes and draw up the calibration procedures.

The Voyager missions capitalized on a rare alignment of the four gas-giant planets – a once-in-176-years opportunity that allowed a single spacecraft to visit all four. It required a launch between 1976 and 1980 to succeed. For budget reasons, only a two-spacecraft mission to Jupiter and Saturn was initially approved. Voyager 2 was later re-programmed to visit Uranus and Neptune as well.

Eleven experiments were planned. Stone's role included developing a planetary fly-by

programme that would be agreeable to all the participating principal investigators. To accomplish this, he learnt about the science of each experiment – earning the respect of all involved. One of the researchers, Tom Krimigis, recalled: “He was always knowledgeable, insightful and fair in his decisions, with the principal focus on the best science; he never deviated from that.”

The Voyager planetary fly-bys resulted in many discoveries, including moons, rings, a moon with volcanoes, moons with more water than there is on Earth and Triton – a moon of Neptune that is one of the coldest places in the Solar System and yet has geysers. Textbooks on the outer planets of the Solar System were rewritten. But the culmination of Stone's research career came when Voyager 1 crossed the heliopause – the boundary between interplanetary and interstellar space, at 18.2 billion kilometres from the Sun. The Cosmic Ray Subsystem was at last able to measure something that cannot be quantified inside the heliopause because of the Sun's out-flowing solar wind: the intensity of low-energy cosmic rays in the Milky Way galaxy.

For his work on the Voyagers, Stone was awarded the National Medal of Science by then US president George Bush in 1991, and in 2019 he received the Shaw Prize in astronomy. A prolific administrator and multitasker, Stone chaired the physics, mathematics and astronomy division at Caltech for five years in the 1980s and was the director of NASA's Jet Propulsion Laboratory from 1991 to 2001. During his tenure there, he oversaw the first landing of a robot on another planet – the Mars rover Sojourner. His work ethic was extraordinary. In total, he held a major role on 14 NASA missions and 2 US Department of Defense missions – most of the time while running the Space Radiation Laboratory at Caltech.

In 2022, owing to declining health, Stone retired as Voyager project scientist and became emeritus professor at Caltech. He was always even-tempered in his dealing with colleagues and sought to reach a consensus on whatever debate was going on. He will be greatly missed in both the space-science and astronomical communities.

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