



## HELIOS-1

### 50<sup>th</sup> Launch Anniversary

### Celebrating 50 Years of Solar Exploration The Legacy of Helios 1

by Joachim J. Kehr and Chat GPT  
Helios Operations Manager (GSOC)  
Editor, Journal of Space Operations & Communicator

Fifty years ago, on December 10, 1974, a remarkable journey into the heart of our solar system began. A collaboration between NASA and the German Aerospace Agency (DLR), the Helios 1 probe was launched to provide humanity with unprecedented insights into our Sun's mysterious and dynamic behavior. As we celebrate the half-century milestone of Helios 1's launch, it is fitting to reflect on the scientific 'firsts' achieved by this pioneering solar probe, which significantly advanced our understanding of solar physics and space weather.

### A Bold Mission to the Sun

Before Helios 1, our knowledge of the Sun was limited to observations made from Earth and near-Earth satellites. The Sun, our nearest star, influences every aspect of our solar system. Understanding its behavior is crucial not only for space exploration but also for our planet's well-being. Helios 1 was designed to study the solar wind, solar magnetic fields, cosmic rays, and other interplanetary phenomena from a vantage point much closer to the Sun than any previous spacecraft.

Helios 1 was part of a two-probe mission (along with Helios 2, launched in 1976) to venture closer to the Sun than any spacecraft had before. The probes were placed in elliptical orbits around the Sun, with Helios 1 reaching a perihelion (the closest point to the Sun in its orbit) of approximately 0.31 astronomical units (AU)—around 46 million kilometers or 28 million miles—just inside the orbit of Mercury. This proximity allowed Helios 1 to study the solar environment in situ, opening new windows into solar science.

### Key Scientific Achievements

1. **Unprecedented Proximity to the Sun:** Helios 1's orbit brought it significantly closer to the Sun than any previous mission, allowing it to sample the solar wind at distances where it had not yet fully expanded. This was crucial for understanding the transition region where the solar wind accelerates, providing valuable data on how solar wind particles are heated and gain speed.
2. **Solar Wind Dynamics:** Helios 1 provided the first detailed measurements of the solar wind's speed, density, and temperature closer to the Sun. It found that the solar wind was more complex and turbulent than previously thought, with rapid changes in speed and temperature. These findings helped refine models of how the solar wind is generated and accelerated, showing that even close to the Sun, the wind's properties could vary dramatically over short timescales.
3. **Magnetic Field Observations:** The spacecraft's magnetometers provided some of the earliest close-up data on the Sun's magnetic field. Helios 1 measured the strength and direction of the magnetic fields carried by the solar wind. It confirmed that the Sun's magnetic field is transported into space via the solar wind, forming a vast heliospheric current sheet that divides

regions of opposite magnetic polarity. These findings were crucial for understanding the structure and behavior of the heliosphere—the bubble-like region of space dominated by the solar wind and magnetic field.

4. **Cosmic Ray Modulation:** Helios 1's observations contributed to the study of cosmic rays—high-energy particles originating outside our solar system. By measuring cosmic ray intensities at various distances from the Sun, Helios 1 helped scientists understand how the Sun's magnetic field influences cosmic ray propagation. This work was essential for developing models of cosmic ray modulation, which describe how cosmic rays are deflected and slowed by solar magnetic fields.
5. **Solar Energetic Particles (SEPs):** Helios 1 also played a crucial role in studying SEPs, high-energy particles produced during solar flares and other solar activities. The probe's proximity to the Sun allowed it to observe SEP events closer to their source, providing new insights into how these particles are accelerated and propagated through space. This research is critical for understanding space weather, which can affect spacecraft and astronauts in space, as well as power grids and communication systems on Earth.
6. **Pioneer in Solar Terrestrial Relations:** The Helios mission laid the groundwork for future missions and research in the field of solar-terrestrial relations. By helping to establish a more complete picture of the Sun's influence on its surroundings, Helios 1 was a forerunner to later solar missions, such as the Ulysses, SOHO, Parker Solar Probe, and the Solar Orbiter. The data from Helios continues to be used to this day, serving as a reference point for understanding solar phenomena and their impact on the Earth and the wider solar system.

## Legacy and Impact

Helios 1's contributions to solar science were groundbreaking, providing an unprecedented look at the Sun's atmosphere and its interaction with interplanetary space. The data it collected has had a lasting impact on our understanding of the Sun and its role in shaping the environment of the solar system. Its findings have influenced countless studies in solar physics and space weather, underlining the importance of exploring our star at close quarters.

Moreover, the successful collaboration between the United States and Germany on the Helios mission set a precedent for future international partnerships in space exploration. This cooperative spirit continues to drive innovation and discovery, as seen in ongoing and planned missions to study the Sun and other celestial bodies.

## Conclusion

As we commemorate the 50th anniversary of Helios 1's launch, we celebrate not only the technological and scientific achievements of this remarkable mission but also the spirit of curiosity and collaboration that made it possible. The legacy of Helios 1 lives on in the ongoing quest to unravel the mysteries of the Sun, our closest star, and in the countless scientific advances that have flowed from its pioneering journey. Here's to another fifty years of discovery and exploration, inspired by the trailblazing path of Helios 1.