Taking a Good Measure of the Sun – the Helios Pioneers
By Joachim Kehr, Helios Chief of Operations

In 2024 the 50th anniversary of the launch of the Helios-1 sun probe (December 10, 1974) is coming up. This brief article is intended to remind you of the beginnings of satellite-based research in close proximity of the Sun.

The sun excites the whole,
makes all the stars to dance their role.
If you are not excited too,
you're not part and can't appreciate it all.
(Angelus Silesius 1624-1677, free translation by the author)

Figure 1

Figure 2

Figure 1: From left: H.-J. "Jacky" Panitz (GSOC Project Manager), Joachim Kehr (Chief of Operations), and subsystem support engineers from MBB in the Helios control room of the German Space Operations Center (GSOC) of DLR Oberpfaffenhofen, Germany.

Figure 2: Helios control room for controlling the two Helios probes simultaneously: left in the background is the telecommand console, in the middle is the team chief position, right the engineering support for telecommunications and navigation, in the foreground consoles for thermal control, data handling, power control and experiment coordination. An electrical wallboard block diagram could be illuminated to show the relevant systems in action.

"Closer to the Sun" was the motto for the Helios-2 solar probe, which was launched on January 15, 1976, 5:34 am UTC with a Titan IIIE / Centaur / St-37E in the direction of the Sun. The Titan Centaur was one of NASA's most powerful rockets at the time. The deep-space Helios project emerged from political negotiations as cooperation between Germany and America. It was the first big scientific collaboration to study the sun at a very close distance. No object had ever observed the sun from a distance of 0.31 AU (about 50 million km), let alone dared to withstand the expected heat and solar radiation.

Two probes were designed and built in Germany, the rockets were provided by NASA. Helios-1 was successfully launched a year earlier on December 10, 1974, and had already achieved perihelion (point closest to the Sun at 0.31 AU). The goal was to place the two probes in opposite positions with respect to the sun and get even closer with Helios-2, with an approximation of 0.291 AU.

For security reasons, Helios-1 was monitored by the German Helios control team at NASA's Center for Interplanetary Missions at JPL, in Pasadena, California. After a year of Helios-1 operation, the German team had gained so much self-confidence to take over the Helios-2 mission, including the

critical start-up and commissioning phases, directly from the new operations center of DLR in Oberpfaffenhofen. For the first time in its history, NASA agreed to have these critical phases carried out completely by the partner on its own premises.
Another first was that JPL transferred raw telemetry data to a control center outside the USA and also allowed direct commanding of the probes.

Exhausted, leaving the control center early in the morning of January 16th after having covered the Helios-2 launch and experienced some tense moments during initial acquisition, antenna deployment, and configuration of the probe, we expected an excited "pad on the shoulder" from the press, however, there was little coverage of the successful launch of Helios-2, as Ernst Albrecht's unexpected victory as the new CDU Prime Minister in Lower Saxony on January 15, 1976, dominated the headlines

Fig.1 shows me, Joachim Kehr (chief of Helios operations) and the GSOC project manager Hans-Joachim "Jacky" Panitz, and some of the engineering team members on the launch night of Helios-2 after a successful lift-off, confirmation separation and first signal acquisition. The relieved tension as "chief controller" can be seen.
For me, as a young electrical engineer, in addition to the groundbreaking, innovative active and passive temperature control devices of the spinning spacecraft - inside the probe, there was room temperature at all times - the ability to use a 20 watt transmitter to communicate over a distance of about 300 million km (probe and earth in opposition) was just awesome. To achieve this, however, a corresponding receiving antenna was necessary: We were allowed to use the radio telescope in Effelsberg (Germany), which was completed just in time in 1971, for Helios data reception. With its 100m diameter antenna mirror it even made the NASA professionals of the "Deep Space Network" (DSN) pale, who at that time only had 60m antennas.

The scientific mission goals were to take unprecedented measurements of interplanetary dust and zodiacal light (E. Gruen, H. Fechtig, J. Kissel, Ch. Leinert, E. Pitz, H. Link), plasma and solar wind (R. Schwenn, H. Rosenbauer, D. A. Gurnett, R.R. Anderson, P. Edenhofer), electric and magnetic field experiments (F. Neubauer, G. Musmann, G. Dehmel, F. Mariani, N. Ness, B. Bavassano, L. Burlaga, S. Cantarano, C. Scearcw, R. Terenzi, U. Villante, P.J. Kellog, Susan Kayser, Robert Stone, H. Volland, G.S. Levy, M. K. Bird, C. T. Stelzried, B.L. Seidel) and cosmic radiation (H. Kunow, G. Wibberenz, J.H. Trainor, Michelle A. I. van Hollebeke, Nand Lal, Frank B. McDonald) and the passive Helios celestial experiment (W. Kundt, J. Peyn).

Since after completion of the primary missions the performance of the probes was unexpectedly good, a complete solar cycle over 11 years could be measured as an additional mission objective, and correlation- and propagation measurements with the two Voyager probes could be carried out.

After the prime mission phase of Helios-1, the project office reported 425 publications, among them 43 technical scientific papers by universities, 41 papers for achieving Master's degrees, 14 dissertations, and 2 habilitations. Innumerable international publications followed during the extended missions of the two probes, still orbiting the sun at this date but silent since the end of their missions (EOM): Helios-1 was deactivated on February 18, 1985, Helios-2 four years earlier on December 23, 1979. [1]

The 0.291 AU proximity "record" of Helios-2 on April 17, 1976 (42.73 million km), was only broken 42 years later, on October 29, 2018, by the NASA Solar Probe Mission (24.8 million km).

Reference
[1] https://en.wikipedia.org/wiki/Helios_(spacecraft)