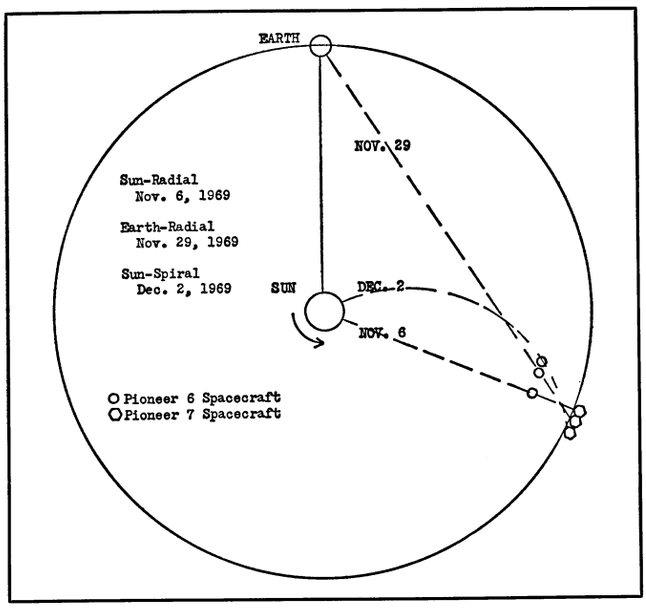
Longevity gives bonus in space

Scientists reap benefits from unexpectedly long-lived sun-circling space probes



Three lucky line-ups of Pioneers 6 and 7 took place in less than a month.

One of the oldest families of space probes is the United States' Pioneer series, which began on Aug. 17, 1958, barely 10 months after Russia's Sputnik 1 had opened the door to the space age. The United States had only four successful launches to six failures under its belt at the time, and the early Pioneers did nothing to brighten the picture.

In 28 months, nine Pioneers were launched under various names; eight of them, attempted lunar probes, failed to reach their objective. The one exception, Pioneer 5, was not a moon vehicle but a deep space probe, and it was a triumph.

Aimed to investigate space conditions between the orbits of earth and Venus, Pioneer 5 was a star performer. It mapped particle energies and distribution, charted magnetic field phenomena, gauged solar flare effects and set a space communications record by responding to earth commands from more than 22 million miles away.

Two unsuccessful moon probes later, the Pioneer nameplate was shelved. When it was reinstated, five years and a day later, on Dec. 16, 1965, it marked a strictly deep-space effort. And, as if following Pioneer 5's lead, it has far exceeded its mentors' plans.

There are now four Pioneers providing data from their sun-circling orbits, two inside and two outside the earth's own path. When Pioneer 6, first of the new batch, and Pioneer 7, eight months later, were launched, they were intended to operate for about six months and as far as 50 million miles from earth. They have now been working for 48 and 40 months respectively, and Pioneer 7 has communicated with earth from as far away as 186 million miles, on the far side of the sun from earth.

These super-performances are providing a bonus. Last month, at the National Aeronautics and Space Administration's Ames Research Center in California, scientists were beginning to analyze data from three fortuitous line-ups of the two spacecraft with the sun and the earth. The researchers knew from early study of the orbits involved that the line-ups would occur, but expected that the probes would have stopped working by then; Pioneer 5 had lasted only three and a half months.

Dr. John Wolfe, Pioneer project scientist at Ames, happily admits that they were wrong.

On Nov. 6, Pioneers 6 and 7 reached positions that for the first time put two identical spacecraft on a common straight line with the sun. This enabled the probes to measure the same solar phenomena—speed, d i r e c t i o n and temperature of the solar wind, as well as the concentration of cosmic rays at different energy levels—at a given point, and then to see how conditions had changed by the time they reached another point 17.5 million miles farther from the sun.

Three weeks later the two satellites were again on a line with a major body, this time the earth itself. This yielded experience in monitoring two spacecraft simultaneously with the 210-foot-diameter deep-space antenna at Goldstone, Calif., providing valuable practice to the NASA Deep Space Tracking Network for the Mariner and Viking Mars missions in 1971 and 1973 respectively. The 1971 flight will require Goldstone to track a pair of Mars-orbiters, and the latter mission will include an orbiter plus a robot soft-landing craft.

Having already produced data on low-energy solar particles by their Nov. 6 alignment, the two Pioneers on Dec. 2 continued their tricky geometry by arriving simultaneously on one of the spiral lines of the sun's magnetic field. Though the magnetometer on Pioneer 7 was not operating, thus preventing comparative magnetic field measurements, data were gathered on the sun's high-energy particles, which are oriented along the lines of force, as they arrived at the two craft two to three minutes apart.

Detailed results of the two solar line-ups are unlikely to be available before spring, Dr. Wolfe says. Early looks are only accurate enough to confirm the line-ups, but not to reveal the fine differences that computer analysis will bring out.

The Pioneers are far from finished, however. In September and October of 1970, the same three line-ups will occur with Pioneers 6 and 8. Both at present have operating magnetometers and should fill in the missing magnetic field comparisons.

The following month a different configuration will arise, as Pioneer 9 reaches a point exactly opposite the earth on the far side of the sun. This will permit another experiment that was impossible with Pioneer 7: a radio occultation test in which Stanford University researchers will measure the strength of a signal from the spacecraft as it approaches a tangent line with the sun, is blocked out by it and then emerges on the other side. The same experiment is part of Pioneer 7's equipment, but with a less powerful amplifier that makes it unworkable at such distances.

Another triple line-up will take place in May 1971 with Pioneers 7 and 9, then from April through June 1972 with 8 and 9. "I guess," says an Ames engineer, "you could say it's getting pretty exciting." *JE*