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PIONEER C LAUNCH

The United States will launch Pioneer C, third in the current series of Pioneer interplanetary spacecraft, into orbit around the Sun from Cape Kennedy, Fla., no earlier than Dec. 13.

The probe will seek a clear definition of the tail of the Earth's magnetosphere, and monitor solar events as the Sun reaches the climax of its 11-year cycle in 1969. The spacecraft will be named Pioneer VIII on successful launch.

The window for the first planned launch opens at 9:08 a.m. Dec. 13 and closes at 9:43 a.m. EST. The window opens slightly later the next two days and the open time decreases to about 20 minutes. Pioneer C reports and data from Pioneers VI and VII will be important in predicting "solar weather" in Earth's protective magnetic envelope, the magnetosphere.

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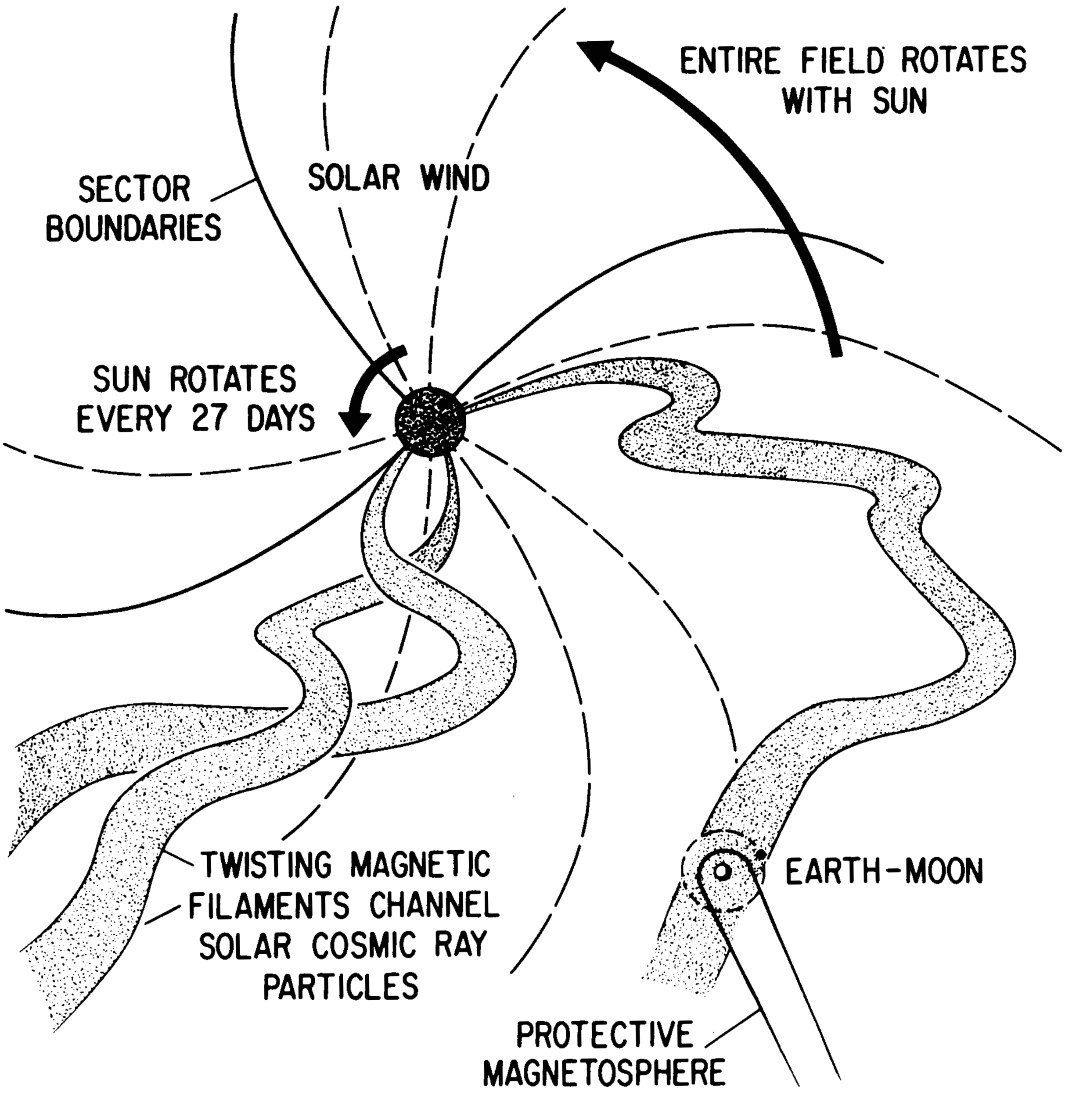
"WEATHER MAP" OF SOLAR SPACE

(VIEW LOOKING DOWN ON SUN'S "NORTH" POLE)

THE AVERAGE ANGLE OF MAGNETIC FIELD LINES TO THE EARTH-SUN LINE IS ABOUT 45° CAUSED BY SOLAR ROTATION. ONCE A MAGNETIC FILAMENT ROTATES PAST THE EARTH, THE HIGH-ENERGY PARTICLES IT CHANNELS WILL MISS THE EARTH.



The two previous probes are now 144 million and 68 million miles, respectively, away from Earth and are still returning data which will be valuable during coming manned Apollo flights.

Spectacular advances in long-distance data retrieval by NASA's Deep Space Network and unexpected long-life performance of these spacecraft make these reports possible from widely separated points in the solar system.

Pioneer C will fly an "out" mission in the plane of the Earth's orbit, crossing the Earth-Sun line about two million miles outside Earth orbit. In this location it will measure the magnetosphere to determine its exact shape. The "wagging tip" of the tail of the magnetosphere was seen in September 1966, by Pioneer VII, 3.5 million miles outside Earth's orbit.

Five of seven experiments are major improvements over those on Pioneer VII. Two new types of experiments are an interplanetary dust detector and an instrument to study electric fields in space.

The current Pioneers can "see" directions and energies (speeds) of the sub-atomic particles and magnetic fields, which they are designed to measure, better than previous interplanetary spacecraft.

The 145-pound, drum-shaped spacecraft are "spinners." They continuously scan a full circle in the plane of the Earth's orbit. They have a data rate 10 times higher than previous interplanetary spacecraft for major parts of their missions and their instruments are designed for detailed measurements.

Measurements by the Pioneers and other spacecraft, combined with earlier theoretical work, make up the beginnings of an interplanetary "weather map," which will enable scientists to predict the paths of solar high energy particles and warn of radiation hazards to spacecraft.

Pioneer reports were used this year to protect film from radiation fogging aboard the Lunar Orbiters as they photographed the Moon.

Pioneer VI, now 110 degrees around the Sun ahead of the Earth, can "see" two-thirds of the way around the Sun. It now gives warning of solar storm regions 15 to 17 days ahead of their arrival at the Earth-Moon system.

The million-mile-an-hour solar wind, which constantly blows out from the Sun, is threaded with curving magnetic filaments rooted in the Sun, carrying massive streams of high energy particles. These filaments twist around each other with kinks sometimes as sharp as 90 degrees. At the Earth, they have an average diameter of about two million miles; new ones constantly sweep past the Earth, in a co-rotation with the Sun's 27-day cycle.

Very high-energy solar storm particles can break free of the twisting field pattern and reach the Earth by a somewhat more direct path. Day-to-day observations of this magnetic structure of the space within the orbit of Mars by the Pioneers, the Sun-orbiting Mariners, the Moon-orbiting anchored IMP, and Earth-orbiting spacecraft will allow prediction of the paths of solar radiation.

Current Pioneer spacecraft are producing detailed scientific knowledge. Pioneer VI was launched Dec. 16, 1965, Pioneer VII, Aug. 17, 1966. Up to last Nov. 1, the two had received 11,000 commands and had returned 5 billion bits of data, on 5,500 miles of data tape.

These measurements have demonstrated that:

The solar wind does not flow in straight lines (deviating up to 10 per cent from a direct path);

There are an average of 5.5 electrons per cubic centimeter in the solar wind, and 30 to 40 per c.c. during solar storms;

The boundaries of the interplanetary magnetic field sector structure act like vanes of a centrifugal pump as the Sun rotates, tending to sweep the inner solar system clear of galactic cosmic ray particles;

Temperature of interplanetary electrons is 10,000 to 90,000 degrees F and varies with direction of the measurement;

The Sun produces singly-ionized helium nuclei.

Observations by Pioneer spacecraft have helped man understand the Sun, the Earth's primary source of energy. (Among the important questions still puzzling scientists are: How does the Sun's corona get so hot? and, What is the path of solar wind particles through the corona?)

Data returned by Pioneer should help man understand magnetized plasmas (very hot gas made up of positively and negatively charged particles). The promise of plasma research for producing extremely cheap commercial power, by controlling the fusion reaction or other methods, may prove of first-rank importance, scientists believe.

The Pioneers can produce this basic particle data because interplanetary space is like the inside of a cosmic particle accelerator, dwarfing the cyclotrons and other large accelerators on Earth.

Pioneer C will be launched ahead of the Earth to give it the added velocity in solar orbit to move out beyond the orbit of the Earth. The Earth in its shorter orbit will "catch" Pioneer C in 37 days, passing between the Sun and the spacecraft.

To take full advantage of the Delta launch vehicle's payload capacity, a 40-pound Test and Training Satellite (TTS-1) is being launched piggy back from the Delta second stage. TTS-1, designed and built by TRW Systems, Redondo Beach, Calif., will be used to exercise and test the Apollo tracking and communications network.

The Pioneer program is directed by NASA's Office of Space Science and Applications. Project management is by NASA's Ames Research Center, Mountain View, Calif. The Delta launch vehicle is managed by Goddard Space Flight Center, Greenbelt, Md., and is launched by Kennedy Space Center, Fla.

Communications and tracking will be by NASA's Deep Space Network (DSN), operated by the Jet Propulsion Laboratory, Pasadena, Calif.

The Pioneer spacecraft are built by TRW Systems Group, Redondo Beach, Calif. The Delta rocket is built by McDonnell Douglas Corp. at Santa Monica, Calif. The electric field experiment was developed by TRW Systems and the interplanetary dust experiment by the Goddard Center.

The magnetometer experiment, also developed by Goddard, can switch automatically to a high field range during solar storms. The University of Minnesota cosmic ray detector will identify for the first time chemical elements of which incoming particles are the nuclei. It can measure incoming hydrogen nuclei up to 602,640,000 mph., or 90 per cent of the speed of light. The cosmic ray detector developed at the Southwest Center for Advanced Study now can observe galactic particles arriving from above and below the plane of the Earth's orbit.

Range of the Stanford University radio propagation experiment has been increased from 110 million to 200 million miles. The Ames Center solar wind experiment now is 10 times more accurate than its predecessors.

The design life of the Pioneer C mission is six months. But if the spacecraft performs as well as Pioneer VI and VII, it could return data to DSN antennas for several years as it makes a complete circuit of the Sun.

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