Voyager

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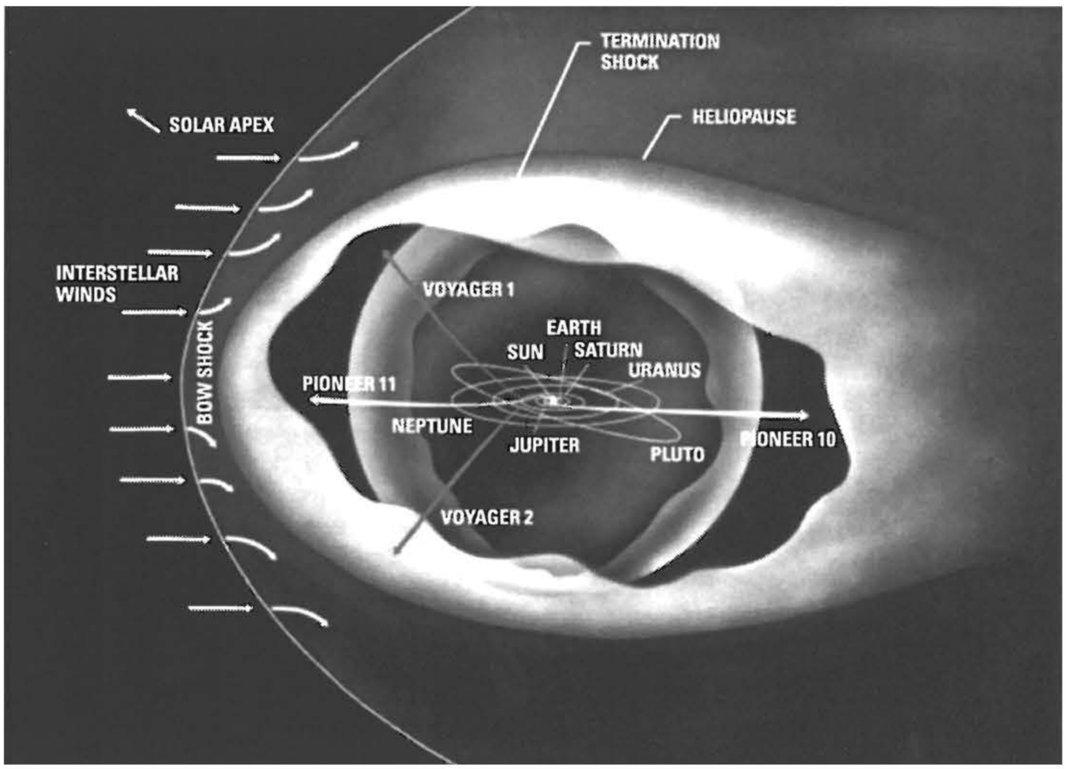

Four spacecraft — Voyager 1 and 2, and Pioneer 10 and 11 — are now far beyond the most distant planets in our solar system. Each spacecraft is traveling in a different direction from our Sun. They are looking for the "termination shock," which signify the edge of the Sun's influence in space.

(Note: Pioneer 10's mission is over, but it is being tracked occasionally. The last communication with Pioneer 11 was in November 1995.)

The Voyager Interstellar Mission — Exploring the Unexplored

More than 20 years after beginning their historic voyages of discovery through the outer solar system, the twin Voyager 1 and 2 spacecraft continue to set records and shape our understanding of our solar system.

From their launch in 1977 and throughout the next 12 years, the Voyagers investigated the four giant outer planets — Jupiter, Saturn, Uranus, and Neptune — returning treasure troves of data about these gaseous planets, their moons, rings, atmospheres, and magnetic fields.

On February 17, 1998, the Voyager 1 spacecraft became the most distant human-made object in the universe, having passed beyond 10.4 billion kilometers (6.5 billion miles) from the Sun. (The previous record was held by NASA's Pioneer 10 spacecraft.) To put this distance into perspective, imagine that in the time it takes you to count from 1 to 3 you could have traveled 52 kilometers (32 miles) if you had been moving at Voyager 1's current rate of 17.3 kilometers per second (about 39,000 miles per hour) (relative to the Sun). And consider this: Voyager 1 has been traveling at close to that speed for more than 20 years!

As the most distant human-made object in the universe — now at a distance that is more than 70 times that from the Sun to Earth — Voyager 1 is heading in the direction of a star identified as AC+79 3888; it will make its closest approach (1.64 lightyear) to that star in the year 40,272 A.D.

Voyager 2 is now more than 8 billion kilometers (more than 5 billion miles) from the Sun. In the year 40,176 A.D., it will finally be closer to another star than it is to our own. At that time it will be 1.65 lightyears from Ross 248 and 1.99 lightyears from our Sun.

The two Voyager spacecraft are currently taking advantage of a unique opportunity to explore a stellar "bubble" from the inside out. In the case of the Sun, such a region is called the heliosphere. The Voyagers' observations have demonstrated the connectivity between the region from the Sun to the outer heliosphere and the implications for Earth's local space environment.

The Sun is surrounded by a large outer atmosphere called the solar corona, which extends beyond the orbit of Earth. The flow of the corona outward from the Sun is called the solar wind, and the area of space dominated by the flow of the solar wind is called the heliosphere. The solar wind has an extremely low density of particles and yet is very hot — approximately 200,000°C (360,000°F), which is 330 times the temperature necessary to melt lead. Its speed typically varies from 300 to 800 kilometers per second when it races past Earth, but past Neptune's orbit it travels at a more uniform speed of about 1.5 million kilometers per hour (almost a million miles per hour)!

The longevity of the Voyagers allows studies of long-term changes in the solar wind. The spacecraft's extreme distances allow studies of the evolution of the solar wind, shock waves, and cosmic rays, in conjunction with studies by other spacecraft in other areas of the heliosphere.

The ultimate goal of the Voyagers is to observe the termination shock, heliosheath, and the heliopause, and to directly measure magnetic fields and charged particles in interstellar space.

When the supersonic speed of the solar wind abruptly becomes subsonic, the spacecraft will detect a shock wave called the termination shock, which will signal the spacecraft's entry into the heliosheath, a transition region between the Sun's sphere of influence and the interstellar medium. The current best estimate is that the soonest this is likely to occur is in 2001, but it might not occur until as much as 10 years later.

The solar wind pressure ebbs and flows, unlike the steady pressure of the interstellar wind. Thus, the heliopause and the termination shock are "moving targets," and Voyager may cross into and out of the heliosheath several times as the solar wind pressure varies.

The Voyagers are exploring the near-space of our own star, and thus will provide clues to the composition, density, velocity, temperature, pressure, and structure of other stellar spheres.

Using a 20-watt radio transmitter, signals from Voyager 1 currently take more than 9-1/2 hours to reach Earth. By the time the signals reach Earth, they are 100 billion times weaker than the power used by a digital watch. Both spacecraft have enough propellant (for orientation) and electrical power to operate until about the year 2020. The cameras on board the spacecraft were turned off several years ago to conserve power and because they were designed to image nearby planets, not distant stars.

The Voyager Interstellar Mission is designed to be as automated as possible, with repetitive science observations, multimission hardware and software, and a very small team of controllers. It is indeed a tribute to the designers and builders that the Voyagers continue their journeys of exploration and discovery, truly "going where nothing from Earth has gone before."

The Jet Propulsion Laboratory (JPL), California Institute of Technology (Caltech), manages the Voyager Interstellar Mission for the National Aeronautics and Space Administration (NASA).

Visit our Web Site at —
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