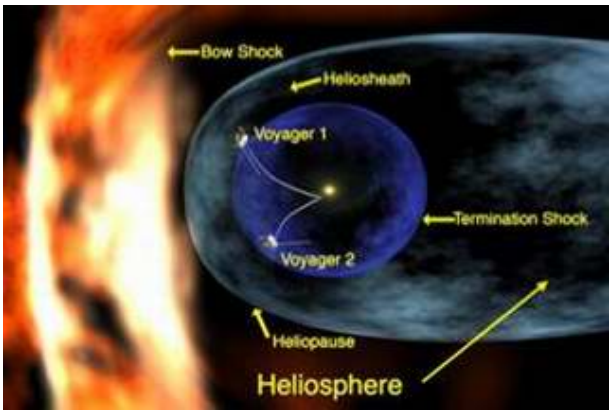
Voyager Spacecraft Enters Solar System's Final Frontier



NASA's Voyager 1 spacecraft has entered the solar system's final frontier. It is entering a vast, turbulent expanse, where the sun's influence ends and the solar wind crashes into the thin gas between stars.

"Voyager 1 has entered the final lap on its race to the edge of interstellar space," said Dr. Edward Stone, Voyager project scientist at the California Institute of Technology in Pasadena. Caltech manages NASA's Jet Propulsion Laboratory in Pasadena, which built and operates Voyager 1 and its twin, Voyager 2.

This still shows the locations of Voyagers 1 and 2. Voyager 1 is traveling a lot and has crossed into the heliosheath, the region where interstellar gas and solar wind start to mix. Credit: NASA/Walt Feimer

In November 2003, the Voyager team announced it was seeing events unlike any in the mission's then 26-year history. The team believed the unusual events indicated Voyager 1 was approaching a strange region of space, likely the beginning of this new frontier called the termination shock region. There was considerable controversy over whether Voyager 1 had indeed encountered the termination shock or was just getting close.

The termination shock is where the solar wind, a thin stream of electrically charged gas blowing continuously outward from the sun, is slowed by pressure from gas between the stars. At the termination shock, the solar wind slows abruptly from a speed that ranges from 700,000 to 1.5 million mph and becomes denser and hotter. The consensus of the team is Voyager 1, at approximately 8.7 billion miles from the sun, has at last entered the heliosheath, the region beyond the termination shock.

Predicting the location of the termination shock was hard, because the precise conditions in interstellar space are unknown. Also, changes in the speed and pressure of the solar wind cause the termination shock to expand, contract and ripple.

The most persuasive evidence that Voyager 1 crossed the termination shock is its measurement of a sudden increase in the strength of the magnetic field carried by the solar wind, combined with an inferred decrease in its speed. This happens whenever the solar wind slows down.

In December 2004, the Voyager 1 dual magnetometers observed the magnetic field strength suddenly increasing by a factor of approximately 2 1/2, as expected when the solar wind slows down. The magnetic field has remained at these high levels since December. NASA's Goddard Space Flight Center, Greenbelt, Md., built the magnetometers.

Voyager 1 also observed an increase in the number of high-speed electrically charged electrons and ions and a burst of plasma wave noise before the shock. This would be expected if Voyager 1 passed the termination shock. The shock naturally accelerates electrically charged particles that bounce back and forth between the fast and slow winds on opposite sides of the shock, and these particles can generate plasma waves.

"Voyager's observations over the past few years show the termination shock is far more complicated than anyone thought," said Dr. Eric Christian, Discipline Scientist for the Sun-Solar System Connection research program at NASA Headquarters, Washington.

The result is being presented today at a press conference in the Morial Convention Center, New Orleans, during the 2005 Joint Assembly meeting of Earth and space science organizations.

Source: NASA