UNIQUE ASPECTS OF THE ULYSSES MISSION*

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Abstract

The primary goal of the Ulysses mission is the exploration of the polar regions of the heliosphere. Ulysses is a five-year mission managed jointly by NASA'S Jet Propulsion laboratory and the European Space Agency (ESA). The Ulysses spacecraft now continues to travel farther south toward the Sun's southern pole. As of February 15, 1994, its latitude with respect to the equatorial plane of the Sun is -52.85 degrees and with respect to the ecliptic plane -45.72 degrees. Its distance from the Sun is 3.6 AU (astronomical units), In 130 days the spacecraft will reach -70 degrees solar latitude, when it will begin the south solar pass. Ulysses observations focus on structure and dynamics of the Sun's magnetic field, propagation of the solar wind, cosmic ray composition, and energetic charged particle and interstellar dust detection and measurements.

Some aspects of the Ulysses mission arc unique. This paper provides a mission chronology and talks about unique aspects of both the trajectory design and measurements during Ulysses flight events.

Introduction

For three decades scientists have studied various aspects of the solar corona, chromosphere and photosphere, but almost all measurements have been taken near the ecliptic plane. The Ulysses mission, by contrast, probes the heliosphere at practically all solar latitudes. The most important measurements, however, will be taken above 70 degrees. Scientists believe that the flow of the solar wind and the structure of the magnetic fields arc less complicated at high latitudes than near the sun's equatorial plane. Therefore interactions between the solar wind, magnetic fields, high-energy particles and cosmic rays that come from the galaxy will be easier to study at high solar latitudes. Data taken by the Ulysses instruments will help to construct a Complete and coherent model of the heliosphere. Progress in understanding the physics of the Sun should answer such fundamental questions often asked by scientists as: What mechanisms transport, store and accelerate energetic charged particles? What heats the solar corona? What accelerates the solar wind? and Where dots the solar wind come from? Wc await new insights into and possibly answers to these questions. For that purpose the Ulysses spacecraft left the ecliptic, the plane in which the planets orbit the Sun, and will make direct measurements of the space above and below the Sun.

Primary Mission Chronology

The Ulysses spacecraft was injected into a direct I;arth-Jupiter transfer orbit on October 6, 1990. A diagram of its resulting interplanetary trajectory is shown on Fig. 1. in this diagram Earth and Jupiter arc at the positions they will occupy When the spacecraft begins the south solar pass. The view in this figure is from 20

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