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First results from WIND Spacecraft : An Introduction

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Introduction

Wind, launched on November 1, 1994, is the first of two Global Geospace Science (GGS) NASA spacecraft to support the International Solar Terrestrial Physics (ISTP) program (the other is Polar, which was launched into a polar orbit on February 24, 1996). Figure 1 shows the main features of the Wind spacecraft. Wind is equipped with sophisticated modern instruments to make comprehensive and quantitative measurements of particles and fields in interplanetary space, solar wind, and the neighborhood of the magnetosphere [*Acuna et al.*, 1995]. Since launch, Wind has accumulated a vast amount of high-quality scientific data. The papers in this special section cover a broad range of topics and represent the first of a stream of papers which will result from Wind observations. While each Wind instrument is capable of a high degree of productivity by itself, the emphasis of Wind is to make coordinated measurements with the other ISTP spacecraft. The ensemble of correlated observations will definitely increase our knowledge of the dynamics of the interplanetary medium, the Earth's bow shock, foreshock regions, magnetosheath, and magnetosphere.

Wind carries eight different experiments, six of which are designed to measure particles from a few eV to hundreds of MeV, and electric and magnetic fields from DC to tens of MHz (the other two instruments are cosmic gamma ray burst detectors). The capabilities of the Wind instruments are an order of magnitude better than those of instruments flown on previous missions (for example, ISEE) that studied the geospace phenomena. For example, sensitive Wind instruments can distinguish isotopic abundances of ions with a mass resolution $m/\Delta m \approx 100$ [*Gloeckler et al.*, 1995], obtain full 3D phase space distributions of particle fluxes from a few eV to several tens of MeV in one spin period of 3 seconds [*Lin et al.*, 1995], and even detect weak man-made signals in interplanetary space [*Kaiser et al.*, 1996]. Table 1 lists the Wind instruments and summarizes their capabilities. A detailed description of each of the Wind instruments is published in *Space Science Reviews* [71, 5–296, 1995].

The primary objective of Wind is to obtain information on the behavior of particles and fields in the solar wind. Figure 2 shows the trajectory of Wind during the first year of operation. Wind will eventually be place in the halo orbit at L1. By placing Wind in the halo orbit at L1, measurements of the solar wind will be made before it interacts with the geomagnetic field, yielding information which is required to quantify our understanding of the global solar-terrestrial dynamics. The spacecraft will reach the halo orbit at L1 in February 1997, where it will stay for a least a year. Other

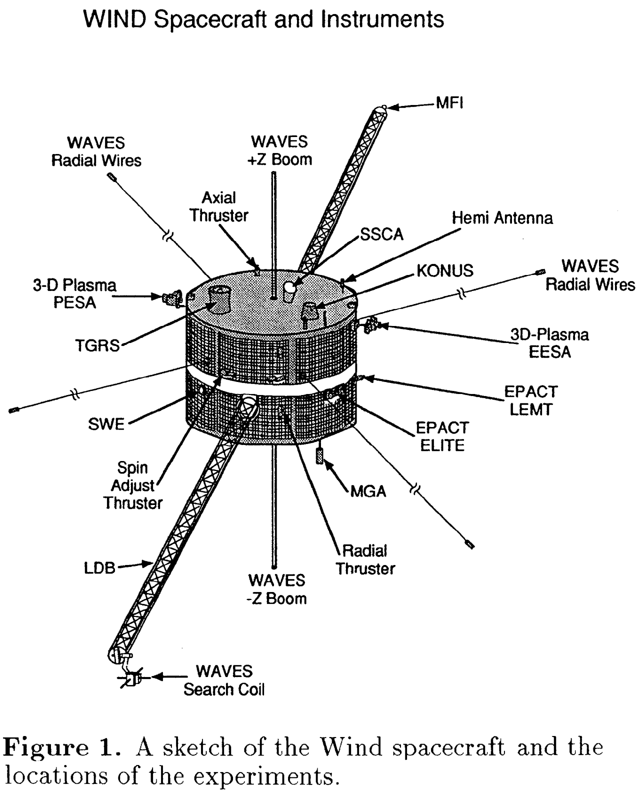

Figure 1. A sketch of the Wind spacecraft and the locations of the experiments.

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Table 1. Summary of the WIND laboratory instruments

Instrument	Description	PI	Institute
Magnetic field (MFI)	DC Mag. field	R. Lepping	NASA/GSFC
Radio and plasma wave Experiment (WAVES)	AC EM fields 8 Hz-16 MHz	J. Bougeret	Obs. de Paris
Solar Wind Experiment (SWE)	Mass, energy, direction of low energy ions and electrons, 7 eV-22 keV	K. Ogilvie	NASA/GSFC
3-D Plasma (3D Plasma)	Distribution and Energy of ions and electrons 3 eV-30 keV, 20 keV-11 MeV	R. Lin	U.C. Berkeley
Energetic Particles: Acceleration, Composition (EPACT)	Mass, energy, direction of ions, 0.2 - 500 MeV	T.von Rosenvinge	
Solar wind/mass Superthermal ion composition	Mass, energy, direction of ions, 0.5 - 500 MeV	G. Gloeckler	U. of Maryland
Transient Gamma ray spectrometer (TGRS)	High spectral resolution gamma-ray detector 15 keV-10 MeV	B. Teegarden	NASA/GSFC
KONUS (Russian Instrument)	High-time resolution gamma-ray detector	E. Mazels	IOFFE Russia

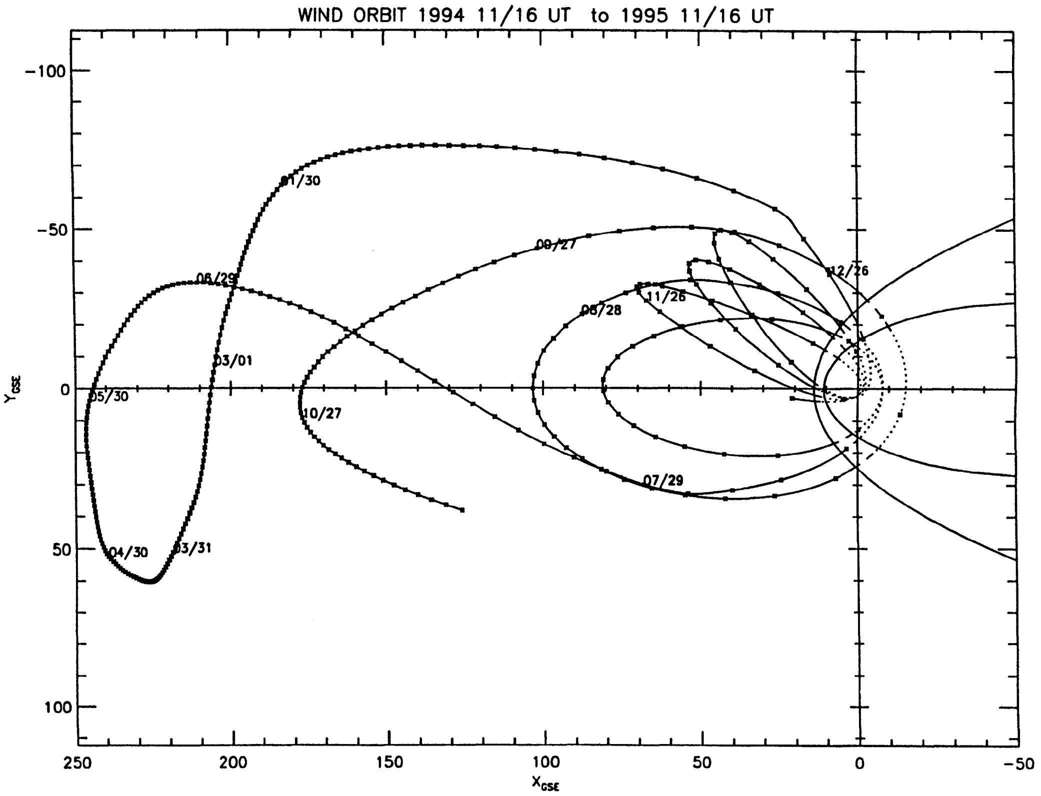

Figure 2. A sketch of the Wind trajectory in the GSE X-Y plane during the first year of operation. Wind will be eventually placed on the halo orbit at L1.

ISTP spacecraft will make coordinated measurements, augmented with ground-based observations, in strategic regions of geospace (the bowshock, the foreshock, the magnetosheath and the geomagnetic tail, as well as the magnetosphere). These correlated measurements will then be analyzed using theoretical models and magnetohydrodynamic and particle simulation tools. The solar wind measurements from Wind will form the basis for predictive studies of "space weather forecasting".

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