Abstract

MEASURE-Jupiter:
Low Cost Missions to Explore Jupiter in the Post-Galileo Era

MEASURE-Jupiter is a new mission concept for the exploration of giant planets, with initial application at Jupiter. By flying sets of lightweight spacecraft with highly focused measurement objectives, it is designed to break the apparent impasse in giant planet exploration beyond Cassini. The MEASURE-Jupiter concept is characterized by: 1) intensive exploration of a giant planet system, 2) multiple small missions flown in focused waves using spacecraft costing $100M to $200M, and 3) mission sets launched every 2 to 3 years.

Why Jupiter? Jupiter is the most complex planetary system in the Solar System with many scientifically intriguing bodies and phenomena to explore. The Galileo mission will scratch the surface of the exploration of Jupiter, posing many questions for the MEASURE-Jupiter missions to address, Jupiter is also the easiest planet in the Outer Solar System to reach, making possible flight times of 2 years and total mission durations of 3 years or less.

Concept design studies have uncovered a number of scientifically rewarding, simple, low-cost mission options. These options have the additional attraction of being able to launch on 2-year trajectories to Jupiter with low-cost Delta II expendable launch vehicles. A partial list of mission concepts studied to date include: 10 Very Close Flyby, Jupiter Close Polar Pass, Mini-Orbiters, and Galilean Satellite Penetrators.

Key to the realization of the MEASURE-Jupiter missions is the judicious use of new low power consuming advanced technology and applicable systems from the Pluto Fast Flyby mission spacecraft design. Foremost of the new technologies planned for inclusion are the elements of a hybrid solar array/battery power system which make it possible to perform the identified missions without the need of Radioactive Thermoelectric Generators (RTGs). This relieves the mission design of the attendant programmatic complexities, costs, and constraints attendant with the use of RTGs.

We will also discuss the technical challenges of the Jupiter environment, e.g., dust and radiation hazards. System and mission design solutions for dealing with these hazards are suggested.

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