Books & Reports

FIDO-Class Development Rover

A report describes a rover-type robotic wheeled vehicle recently built for use as a testbed for development of software for future rover-type vehicles. This vehicle is a derivative of the Field Integrated Design and Operations (FIDO) rover, which is a prototype Mars-exploration rover that also serves as a terrestrial testbed.

The present vehicle was designed to be nearly functionally identical to the FIDO rover but to be built at much lower cost and to incorporate several improvements to increase utility for development work. Accordingly, considerable effort was made to use commercial off-the-shelf parts and other parts that could be fabricated easily and at low cost. Important features of this vehicle include six-wheel drive and six-wheel steering; onboard computer and power, control, and data-communication electronics having flexibility needed for development of software; significantly increased maximum speed (60 cm/s versus 6 cm/s for the FIDO rover); a rocker-bogey suspension with external differential link, functionally equivalent to that of the FIDO rover; and a hand-held remote controller that can be used to control vehicle motion manually without using the computer (or while waiting for the onboard computer to boot up).

This work was done by Herman Herman and Reid Simmons of Carnegie Mellon University and Richard D. Petras of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-45645

Tone-Based Command of Deep Space Probes Using Ground Antennas

A document discusses a technique for enabling the reception of spacecraft commands at received signal levels as much as three orders of magnitude below those of current deep space systems. Tone-based commanding deals with the reception of commands that are sent in the form of precise frequency offsets using an open-loop receiver. The key elements of this technique are an ultrastable oscillator and open-loop receiver onboard the spacecraft, both of which are part of the existing New Horizons (Pluto flyby) communications system design. This enables possible flight experimentation for tone-based commanding during the long cruise of the spacecraft to Pluto.

In this technique, it is also necessary to accurately remove Doppler shift from the uplink signal presented to the spacecraft. A signal processor in the spacecraft performs a discrete Fourier transform on the received signal to determine the frequency of the received signal. Due to the long-term drift in the oscillators and orbit prediction model, the system is likely to be implemented differentially, where changes in the uplink frequency convey the command information.

This work was done by Robert S. Bokulic and J. Robert Jensen of Johns Hopkins University Applied Physics Laboratory for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-14966-1