Books & Reports

Spacecraft Orbits for Earth/Mars-Lander Radio Relay

A report discusses a network of spacecraft, in orbit around Mars, used to relay radio communications between Earth stations and mobile exploratory robots (rovers) as well as stationary scientific instruments that have been landed on the Mars surface. The relay spacecraft include two already in orbit plus several others planned to arrive at Mars in the years 2004 through 2008. A major portion of the report is devoted to the orbit of the G. Macroni Orbiter, which is in the midst of an iterative design process and is intended to be the first Mars orbiter designed primarily for radio relay. Candidate orbits are analyzed with a view toward choosing one that maximizes the amount of time available for communication with surface units, taking account of visibility as a function of position, the limit on communication distance at low power, and the fact that surface units can transmit more easily when they are in sunlight. Two promising new orbits for Mars relay satellites are identified: a 1/2-sol apoapsis-at-constant-time-of-day equatorial orbit and a 1/4-sol apoapsis-at-constant-time-of-day, critical-inclination orbit.

This work was done by Gary Noreen, Roger Diehl, and Joseph Neelon of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1)*
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Self-Inflatable/Self-Rigidizable Reflectarray Antenna

A report describes recent progress in a continuing effort to develop large reflectarray antennas to be deployed in space. Major underlying concepts were reported in two prior *NASA Tech Briefs* articles: "Inflatable Reflectarray Antennas" (NPO-20433), Vol. 23, No. 10 (October 1999), page 50 and "Tape-Spring Reinforcements for Inflatable Structural Tubes" (NPO-20615), Vol. 24, No. 7 (July 2000), page 58. To recapitulate: An antenna as proposed would include a reflectarray membrane stretched flat on a frame of multiple tubular booms that would be deployed by inflation. The instant report discusses design concepts and relevant basic mechanical principles. Among the concepts are alternative configurations of booms for holding the reflectarray membrane and its radio-frequency feed horn and the use of catenaries and constant-force springs to stretch the reflectarray membrane on the frame at the required tension. Some emphasis is placed on the need to keep the deployed frame rigid without depending on maintenance of inflation in the presence of impinging micrometeors that could cause leaks: for this purpose, the booms could be made as spring-tape-reinforced aluminum laminate tubes like those described in the second-mentioned prior article.

This work was done by Houfei Fang, Michael Lou, and John Huang of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
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