

The MUSES CN Rover

**Brian H. Wilcox, Michael A. Newell, Jan A. Tarsala, Allen R Sirota,
Michael R. Johnson, Arthur D. Thompson, Ross Jones
Jet Propulsion Laboratory**

NASA and Japan's Institute of Space and Astronautical Science (ISAS) have agreed to cooperate on the first mission to collect samples from the surface of an asteroid and return them to Earth for in-depth study. Known as MUSES-C, the mission will be launched on a Japanese M-5 launch vehicle in January 2002 from Kagoshima Space Center, Japan, toward a touchdown on the asteroid Nereus in May 2003. A NASA/JPL-provided miniature robotic rover will conduct in-situ measurements on the surface. The asteroid samples will be returned to Earth by MUSES-C via a parachute-borne recovery capsule in January 2006.

With a mass of less than 1kg, the MUSES CN rover will have most of the functions of a spacecraft except a propulsion subsystem which uses an expendable propellant. The MUSES CN rover will be a direct descendant of the technology used to build the Sojourner rover only about a factor of 20 smaller. The rover will carry three science instruments: a visible imaging camera, a near-infrared point spectrometer and an alpha x ray spectrometer. The solar-powered rover will move around the surface of Nereus collecting imagery data which is complimentary to the spacecraft investigation. The imaging system will be capable of making surface texture, composition, and morphology measurements at resolutions better than 1 cm. The rover will transmit this data to the spacecraft for relay back to Earth.

The rover consists of a rectangular body which is 14x14x6 cm. The mobility subsystem of the rover, the four wheels, four struts, and hubs, is designed to support nominal mobility and body-pose functions in full Earth gravity for testing. The rover will be able to right itself in case it flips over in low-gravity and is also designed to allow significant hops in the expected microgravity environment of 10 microgees on the surface of the asteroid. The posable struts will allow the rover to position its chassis such that the camera can be pointed straight down at the surface or straight up at the sky. Each of the six faces of the rover body has solar cells affixed to it so that some power can be generated when the rover is illuminated by the sun from any angle. The top face has the elements needed to radiate the radio signal from the RF communication subsystem. The main chassis of the rover is a rectangular space frame of tubular elements. Data, command and telemetry processing will be provided by a 32-bit RISC processor which is low power, radiation hard, has 1 Mbyte of EEPROM and 1 Mbytes of RAM.

This paper will describe the scope and state of the JPL MUSES CN rover design. The following topics will be included: 1) rover system description and its intended operations on the surface of the asteroid, 2) rover electrical subsystems and 3) rover mechanical subsystems.

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