# Technical Aspects of the NASA-ISAS Collaboration on the ISAS MUSES C Asteroid Sample Return Mission

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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 September 2003. A NASA-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.

NASA and ISAS will cooperate on several aspects of the mission, including mission support and scientific analysis. In addition to providing the rover, NASA will arrange for the testing of the MUSES-C re-entry heat shield at NASA/Ames Research Center, provide supplemental Deep Space Network tracking of the spacecraft, assist in navigating the spacecraft and provide arrangements for the recovery of the sample capsule at a landing site in the U. S. Scientific co-investigators from the U. S. and Japan will share data from the instruments on the rover and the spacecraft. They will also collaborate on the investigations of the returned samples. The MUSES C spacecraft will carry a camera, LIDAR, an IR spectrometer, an X-ray Spectrometer and the sample acquisition mechanism.

With a mass of less than 1kg, the rover experiment will be a direct descendant of the technology used to build the Sojourner rover. 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. Due to the

microgravity environment on Nereus, the rover has been designed to right itself in case it flips over in low-gravity. Solar panels on all sides of the rover will ensure that enough power will always be available to the rover to activate the motors needed to turn over. 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.

This paper will describe the scope and state of the NASA-ISAS collaboration. The following topics will be included: 1) rover description and its intended operations on the surface of the asteroid, 2) ISAS and NASA scientific investigations on rover and orbiter instruments and sample analysis, 3) support to be provided by NASA in the areas of DSN tracking and navigation support, heat shield testing and recovery of the MUSES C sample capsule

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