OSIRIS-REx spacecraft current status and forward plans

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The NASA New Frontiers OSIRIS-REx spacecraft executed a flawless launch on September 8, 2016 to begin its 23-month journey to near-Earth asteroid (101955) Bennu [1]. The primary objective of the OSIRIS-REx mission is to collect and return to Earth a pristine sample of regolith from the asteroid surface. The sampling event will occur after a two-year period of remote sensing that will ensure a high probability of successful sampling of a region on the asteroid surface having high science value and within well-defined geological context. The OSIRIS-REx instrument payload includes three high-resolution cameras (OCAMS), a visible and near-infrared spectrometer (OVIRS), a thermal imaging spectrometer (OTES), an X-ray imaging spectrometer (REXIS), and a laser altimeter (OLA).

As the spacecraft follows its nominal outbound-cruise trajectory, the propulsion, power, communications, and science instruments have undergone basic functional tests, with no major issues. Outbound cruise science investigations include a search for Earth Trojan asteroids as the spacecraft approaches the Sun-Earth L4 Lagrangian point in February 2017. Additional instrument checkouts and calibrations will be carried out during the Earth gravity assist maneuver in September 2017. During the Earth-moon flyby, visual and spectral images will be acquired to validate instrument command sequences planned for Bennu remote sensing.

The asteroid Bennu remote sensing campaign will yield high resolution maps of the temperature and thermal inertia, distributions of major minerals and concentrations of organic matter across the asteroid surface. A high resolution 3d shape model including local surface slopes and a high-resolution gravity field will also be determined. Together, these data will be used to generate four separate maps that will be used to select the sampling site(s). The Safety map will identify hazardous and safe operational regions on the asteroid surface. The Deliverability map will quantify the accuracy with which the navigation team can deliver the spacecraft to and from specific sites on the asteroid surface. The Sampleability map quantifies the regolith properties, providing an estimation of how much material would be sampled at different points on the surface. The final Science Value map synthesizes the chemical, mineralogical, and geological, observations to identify the areas of the asteroid surface with the highest science value. Here, priority is given to organic, water-rich regions that have been minimally altered by surface processes.

Asteroid surface samples will be acquired with a touch-and-go sample acquisition system (TAGSAM) that uses high purity pressurized N_2 gas to mobilize regolith into a stainless steel canister. Although the mission requirement is to collect at least 60 g of material, tests of the TAGSAM routinely exceeded 300 g of simulant in micro-gravity tests. After acquiring the sample, the spacecraft will depart Bennu in 2021 to begin its return journey, with the sample return capsule landing at the Utah Test and Training Range on September 23, 2023.

The OSIRIS-REx science team will carry out a series of detailed chemical, mineralogical, isotopic, and spectral studies that will be used to determine the origin and history of Bennu and to relate high

spatial resolution sample studies to the global geological context from remote sensing. The outline of the sample analysis plan is described in a companion abstract [2].

[1] Lauretta, D. S., et al. Meteoritics & Planetary Science 50.4 (2015): 834-849. [2] Connolly H. C. Jr. et al. (2017) JPGU abstract (this volume).