

## Operation Status of Hayabusa2 in the Proximity of Asteroid Ryugu

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The Japan Aerospace Exploration Agency launched an asteroid sample return spacecraft "Hayabusa2" on December 3, 2014 by the Japanese H2A launch vehicle. Following the successful return back of Hayabusa from the asteroid 25143 Itokawa, Hayabusa2 aims at the round trip mission to the asteroid 162173 Ryugu. Ryugu is a near-Earth C-type asteroid, which is believed to contain organic and hydrated minerals. Thus it is expected that its successful sample return may provide fundamental information regarding the origin and evolution of terrestrial planets as well as the origin of water and organics delivered to the Earth.

On June 27, 2018, Hayabusa2 successfully arrived at Ryugu and began the asteroid-proximity operation, which is to last for 18 months. The spacecraft established "Home Position (HP)-hovering" at 20km distance from the asteroid using optical navigation. In-situ instruments check-out and the initial characterization of Ryugu were all performed as planned.

The first attempt to bring the spacecraft to low altitude is in "Box-C operation", with which the lowest altitude of 6.5km was achieved, providing the first close-up view of Ryugu. From July 31 until August 2, the first fine-guided descent was attempted in the "Mid-altitude Descent Operation". This operation applied the asteroid shape/landmark-based optical navigation called "GCP-NAV" and achieved 8 hour (i.e. >one rotation period of Ryugu) continuous hovering at 5km altitude. From August 5 until 7, the "Gravity Measurement Descent Operation" was conducted. This operation includes the free-fall down to the altitude of 851m (above surface), and thus identified the gravity of the asteroid. Meanwhile number of Ryugu images taken by ONC-T and other important scientific observation data by LIDAR, TIR and NIRS3 are down-linked to the ground in timely manner using Hayabusa2's X/Ka-band high-speed downlink capability. All these data were effectively used for the landing site selection (LSS) activity conducted from July to August, 2018. The LSS decision meeting was held on August 17 participated by the whole international project team, and concluded to select three landing site candidates (1 primary, 2 backups), 1 MINERVA-II-1 landing site and 1 MASCOT landing site.

From September through November 2018, Hayabusa2 is to attempt two rover release operations (MINERVA-II, MASCOT), and two touch-down rehearsal descents, and one touch-down based on the conclusion of the LSS decision meeting. Hence at the time of the Hayabusa2 symposium, we expect to be able to report some results of these critical milestones for the Hayabusa2 missions.