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SAMPLE RETURN ACCOMPLISHED: FLIGHT RESULT OF ASTEROID EXPLORER HAYABUSA2

Abstract

On December 6, 2020, the asteroid explorer Hayabusa2 returned to Earth, and samples from asteroid 162173 Ryugu has been successfully retrieved. At this point, the Hayabusa2 project has completed all the planned flight operation. Hayabusa2 was developed and operated by the Japan Aerospace Exploration Agency. It was launched on December 3, 2014 by the Japanese H2A launch vehicle. Following the successful return of Hayabusa from the asteroid 25143 Itokawa, Hayabusa2 aimed at a round-trip mission to Ryugu. Ryugu is a near-Earth asteroid, whose taxonomy is C-type (carbonaceous). The aim of the mission is, by in-situ scientific activities and sample return, to acquire fundamental information on the solar system formation as well as a clue to the delivery process of water and organics from the solar system to early Earth. In parallel with the scientific objective, the Hayabusa2 project was built to evolve the interplanetary round-trip technology and the small body-sample return technology based on the technical heritage of Hayabusa, such as high-specific impulse ion engine, autonomous optical navigation, sampling system and the interplanetary direct reentry technology. Hayabusa2 successfully arrived at Ryugu on June 27, 2018 after 3.5 years of the ion engine assisted-interplanetary cruise, and began the asteroid-proximity operation phase. During the asteroid proximity operation, Hayabusa2 succeeded in four mobile robots activity on the asteroid surface, two pin-point landings and sample collections, one artificial crater generation and three small objects orbiting around the asteroid. The terrain environment of Ryugu was found to be unexpectedly harsh, but the project successfully adjusted its operation strategy and refined the spacecraft performance to finally complete all the planned missions with a perfect success. Hayabusa2 left Ryugu on November 13, 2019, and began the terminal reentry guidance phase from October 2020. After conducting four fine trajectory correction maneuvers, the sample return capsule (SRC) was separated 12 hours before the reenty. The SRC worked perfectly and after deploying heat shields and a parachute, it finally landed on Woomera desert in Australia. The landed SRC was immediately transported to the curation facility in JAXA, Japan. The measured sample yields in total was 5.4g. Hayabusa2 is continuing its flight after the SRC separation, and the mission has been taken over to the extended mission, aiming at an asteroid 2001 CC21 flyby in 2026, and 1998 KY26 rendezvous in 2031. This talk will summarize the overall achievements of the Hayabusa2 mission from launch to Earth return.