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Small Bodies Missions and Technologies (Part 1) (4A)

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## HAYABUSA2 MISSION STATUS: LANDING, ROVING AND CRATERING ON ASTEROID RYUGU

**Abstract**

The Japan Aerospace Exploration Agency launched the 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 matters 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. 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. In the asteroid-proximity operation phase, we first established a stable hovering at 20km distance from the asteroid using an optical-radio metric hybrid navigation. Then a series of low altitude descent operations were performed for higher resolution observations and asteroid-relative precision guidance practice. Based on the initial observations, the project generated an integrated set of the asteroid shape model, gravity model, surface morphology and chemical/thermal maps, and then determined the landing target for the three rovers and a sampling site for the mother spacecraft. On September 20-21, 2018, the Rovers Deployment Descent was conducted. Two rovers named MINERVA-II-1A and MINERVA-II-1B were successfully delivered to the asteroid surface. They became the world-first mobile rovers on the small body. On October 2-4, 2018, a 10kg lander named MASCOT, developed by DLR and CNES, was deployed and succeeded in 17 hours of surface activity. These three surface robots took many close-up pictures and gave precious information on the micro structure of the Ryugu surface. On February 20-22, 2019, after two landing practice descents, the spacecraft finally succeeded in landing on the equator of Ryugu and collecting sample. In this talk, the overall achievements of the Hayabusa2 during the asteroid proximity phase, including successful landing, three rovers delivery to the surface and the result of artificial crater forming attempt, will be covered.