

Hayabusa2 Extended Mission : Hayabusa2#

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ABSTRACT

The asteroid explorer Hayabusa2 successfully returned the samples of asteroid Ryugu to the Earth in December 2020. This is the second asteroid sample return mission in the world following Hayabusa, which brought the samples of asteroid Itokawa back to the Earth in 2010. It has passed more than two years since the capsule of Hayabusa2 was returned to the Earth. Up to now a lot of analyses of the Ryugu samples were carried out, and many interesting materials such as amino acids, liquid water, hydrated minerals, etc. were found.

The spacecraft itself was healthy without any serious problems and there were enough fuel, so we decided to continue the mission, and we call it Hayabusa2 Extended Mission, whose nickname is Hayabusa2#. The character # (SHARP) is the acronym of "Small Hazardous Asteroid Reconnaissance Probe," which indicates that Hayabusa2# is related to the planetary defense deeply.

The final target of Hayabusa2# is near-Earth asteroid 1998 KY26. This asteroid is very small; the diameter is just about 30m. And it is rotating very fast; the spin period is about 11 min. We have never been to such a tiny asteroid, so scientifically it is very interesting. In addition to this, we must take care of the Earth collision by such small objects, because the probability of collision of this size objects is about once in 100 years. Hayabusa2 spacecraft will arrive at 1998 KY 26 in July 2031. Before arriving at 1998 KY26, Hayabusa2 will flyby near-Earth asteroid 2001 CC21 in July 2026. The flyby velocity is about 5km/s, and we need very precise navigation technique. This is also important for the planetary defense, because if we want to deflect an asteroid which is on a collision orbit to the Earth by impacting spacecraft to it, we need navigation in very high accuracy. Therefore, one of the important purposes of Hayabusa2# is to contribute to the planetary defense activities by getting information of a tiny near-Earth object and by acquiring the technique of the precise navigation.

In Hayabusa2#, the spacecraft will be operated for 11 years or more after the original mission, so the long-term deep space cruising technology is important. To investigate time effects for the hardware of the spacecraft and to get technique of resource-saving operation are also the important purpose. Scientific studies for L-type asteroid 2001 CC21 and very small and fast-rotating asteroid 1998 KY26 are another important purpose of Hayabusa2#.

In this paper, we report the operation status up to now and the future operation plans of Hayabusa2# and summarize the objectives of the mission.