

Asteroid Explorer Hayabusa2 Setting the next stage of space exploration

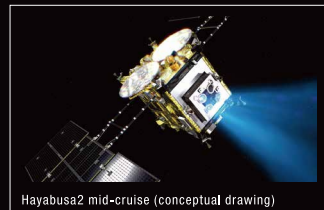
Japan's history with space exploration began in the 1950s with Dr. Hideo Itokawa and his successful pencil rocket test launch. His and his team's fervor for space exploration has been carried on into subsequent generations, and now Japan is a global leader in the field of deep space round-trip probe missions.

On December 3, 2014, the highly followed Asteroid Explorer Hayabusa2 launched from the Tanegashima Space Center with its sights set on the Ryugu asteroid (162173). It has since set a course back through the great vacuum of space to bring a sample of the asteroid back to Earth.

This project began as a sort of comeback attempt after the near failure of Asteroid Explorer Hayabusa (see reverse side); as of today, it is followed and supported by a great number of people. Faith in the success of the Hayabusa2 Project took a dive as well when funding turned into a sizeable problem, but the people who supported it raised their voices, began a signature-collecting campaign, and did what they could to keep the project afloat.

In June of 2018, Hayabusa2 defied all odds and landed on Ryugu, clearing the good name of Hayabusa and dusting away the many hardships faced by the original project. In reality, this was an incredibly challenging technological feat—akin to throwing a baseball from Tokyo and having it strike a 6-centimeter target in Brazil. Add that to the proper deployment of the rovers and it was a rousing series of miraculous successes. The technology necessary for space flight was not the only thing that Hayabusa2 gained from its predecessor; it also received the unwavering dedication, ingenuity, and imperturbable judgment of Japan's space exploration community.

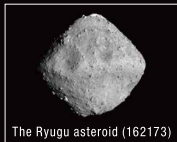
Hayabusa2's space adventures will go on. It carries with it the ever-developing spirit of Japan's space exploration and will no doubt make further progress in the years to come. We hope that the beloved Hayabusa2 will make it safely back to Earth, delivering the samples of Ryugu that may yet lead us closer to discovering the origins of life.



Hayabusa2 mid-cruise (conceptual drawing)



The control room for operating Hayabusa2



The Ryugu asteroid (162173)

Lipovitan D—always cheering you up by your side



Only a few people know, but Lipovitan D was never more than an arm's reach away from the team members of JAXA's Hayabusa Project as they endeavored in their research.

Lipovitan D's story begins in 1962 during the great space race of the 1960s, when Yuri Gagarin would become the first man to break the bonds of Earth's atmosphere and Apollo 11 would put man's footsteps on the moon.

Regardless of the times, the dream has always been to have Lipovitan D be there for people as they strove to accomplish their goals, to give them the push they needed to succeed.

We all have faced moments in our lives when, despite our best efforts to move forward, we become disheartened and lose the will to keep at it. It is then that we aim to stick right by your side, revitalize you, and prop you up to carry on the fight.

Our near future carries vast potential for further progress—to the moon, Mars, and even further beyond. We are excited to discover how Lipovitan D will contribute to people in the future. But for now, we will join in with the rest of the world to cheer on those of us who continue to challenge the vast frontier of space.



Around Earth: a potential view of future activities in and around the planet's Low Earth Orbit



A commemorative photo of Norishige Kanai and the rest of the crew of Expedition 55 taken in the pressurized module of the Kibo ("Hope") Japanese Experiment Module on the ISS.

Asteroid Explorer Hayabusa2

The Origin Story



On May 9, 2003, a small probe took flight aimed at a teeny little asteroid rocketing around way away from Earth. That probe's name was Asteroid Explorer Hayabusa. It makes you wonder just who imagined the seven-year-long, six-billion-kilometer journey that little probe was going to set out on.

Hayabusa shouldered the hopes and dreams of a great many people—the curiosity of its scientists, the pride of its engineers, and the prayers of its supporters. Hayabusa started its journey to the asteroid, gaining velocity not only from the gravitational energy of Earth but also from the cheering voices of the people.

In 2005, around when Hayabusa first caught a glimpse of the Itokawa asteroid (25143), the control unit that kept the probe in the proper positioning began malfunctioning, among other troubles. Pressured by newly complicated operations, the MINERVA (Micro-Nano Experimental Robot Vehicle for Asteroid) rover deployed as scheduled but failed to land on Itokawa and was regrettably abandoned in space. However, the time for mourning was naught; the climax of the mission—Hayabusa's touchdown—was at hand.

~The longest yard~

When the probe first looked upon the shape of the Itokawa asteroid, it was more oddly misshapen than anyone had anticipated. People even compared its shape to a floating sea otter. On November 20, the day of the touchdown, the Hayabusa Project team crossed their fingers as they sent the landing signals to the probe.

Yet, upon detecting obstacles in its landing path, Hayabusa initiated evasive maneuvers and ricocheted off the asteroid twice before landing. For 30 minutes, the probe laid sideways on the surface of Itokawa. The project team knew that the probe would build up dangerous levels of heat from the direct contact with the asteroid's surface, and so they quickly commanded it to begin takeoff. After several moments struggling and spinning around itself, Hayabusa managed to separate from the asteroid.

This was no way to give up the mission. Hayabusa locked in on Itokawa one more time to try and collect a sample of the asteroid. The project team set up for one more touchdown attempt, believing with all their might that "this time it'll succeed." And on November 26, succeed it did.

~Communication breakdown~

Celebrations were short-lived; something strange began happening to Hayabusa. The shock of the landing caused a fuel leak, and the probe's positioning system fell into disorder. Suddenly there were fears about its ability to return safely to Earth...

After leaving the asteroid, Hayabusa's altitude control malfunctioned. Despite the Hayabusa Project team's countless triumphs over adversity, the probe went dark in the vast expanse of space.



Asteroid Explorer Hayabusa flying toward the Itokawa asteroid



The sideways landing

~Homeward bound~

In January of 2006—roughly two months after communications were lost—the Hayabusa Project team caught a faint signal from Hayabusa far out in space. The probe's body was in tatters, but that didn't deter anyone. The team fired up the probe's ion thrusters and propelled it out of Itokawa's orbit to make its way back to Earth.

Hayabusa's ion thrusters were nearing the end of their run by November 2009. With nothing left to lose, the team used the combined thrust from two of the probe's broken engines as a makeshift propulsion system and continued flight operations.

June 13, 2010—homecoming. More than 40 people crammed in the control room and watched with bated breath as Hayabusa approached Earth. Everyone knew, though, that a return to Earth would disintegrate Hayabusa's body. Smashing into the planet's atmosphere at 43,200 kilometers per hour would burn the probe up in the blink of an eye. Yet at the very least, the Hayabusa Project team wanted to let Hayabusa see its home one more time. The team detached the capsule from the probe and activated the camera before it hit the atmosphere; the last picture it would take was Hayabusa's wondrous view of our planet.



Hayabusa's last photograph of Earth

Upon reentering the atmosphere, Hayabusa burst into flames and its six-billion-kilometer round-trip adventure into the reaches of space came to a close. The capsule carried by Hayabusa landed safely in South Australia's Woomera Desert. Inside the capsule, there was a particle of the Itokawa asteroid.

Even now, research teams around the world are making countless discoveries from that tiny little grain of rock that Hayabusa brought back from the reaches of space.



Hayabusa (atmospheric reentry of the probe body and return capsule)



Researchers safely recovering the capsule



A look at the control room after the seven-year-long operation