Asteroid explorer, Hayabusa2, reporter briefing

March 5, 2021

JAXA Hayabusa2 Project

Topics

Current status of the project（overview）

1. Curation work
2. Analysis of the re-entry capsule
3. Public viewing of the re-entry capsule
4. Memory chip data search system
5. Future plans

Project current status (overview)

■Spacecraft operation

- The spacecraft is progressing with the extended mission (steady operation).

■Curation work

- Proceeding with the weight measurement and acquisition of high-definition optical microscope images of the particles and bulk powder sample from Ryugu, focusing on the particles in chamber C recovered from the second touchdown point.
- The website for the Astromaterials Materials Science Research Group has been renewed: <https://curation.isas.jaxa.jp/>

1. Curation work

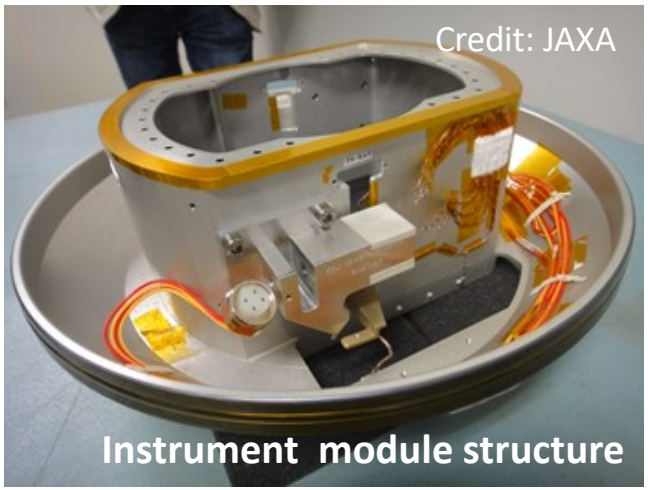
- The sample in chamber C was placed in observation containers (3 dishes in total: see figure below), and the weight measurement and optical microscope observations were started.

Container inner diameter is 21 mm

＊weight is the weight of the sample in each observation container. The weight of the separated pieces is not included.（image credit：JAXA）

2. Analysis of the re-entry capsule

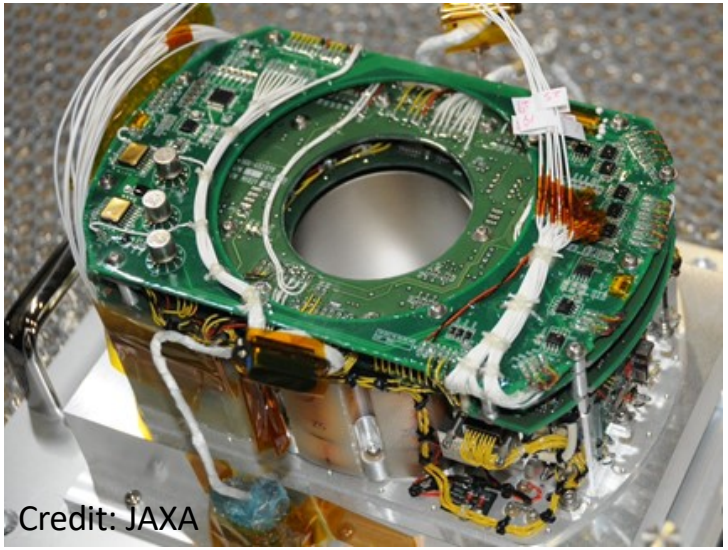
- Post-flight analysis is being conducted on the re-entry capsule collected in Australia to accumulate technology for future engineering research and missions.
- The condition of each capsule part is generally good. The onboard equipment has been confirmed to be functioning normally, even after returning to Sagamihara. Currently, a detailed analysis of the condition of the heat shield is underway.



2. Analysis of the re-entry capsule

- Engineering data from the “Reentry Environment Measurement Module” (REEM) that was mounted on the re-entry capsule has been recovered and confirmed to have been successfully collected. This was designed to measure the airframe motion and temperature of each part of the capsule during the high-speed re-entry into the atmosphere.

■ REMM acquisition data overview
- Acquired data:
  Acceleration / angular velocity（125Hz）
  Temperature data at 9 locations within the capsule (1Hz)
- Acquisition period: 420 seconds before & after re-entry.
- Data volume: Approximately 1 MB



Equipment onboard the re-entry capsule (top is REMM)

2. Analysis of the re-entry capsule

- Analysis of the data acquired by REMM confirmed that the inside of the re-entry capsule (including the sample stored in the sampler) maintained a temperature environment that did not greatly exceed room temperature from re-entry to landing.
- Analysis of the REMM acquisition data will continue in detail and be utilized for the research and development of future re-entry vehicles.

3. Public viewing of the re-entry capsule

■**The re-entry capsule that returned to Earth can now be seen on display:**

- Sagamihara City Museum：2021/3/12～3/16
- National Science Museum：2021/3/27～4/11

※Exhibition contents：

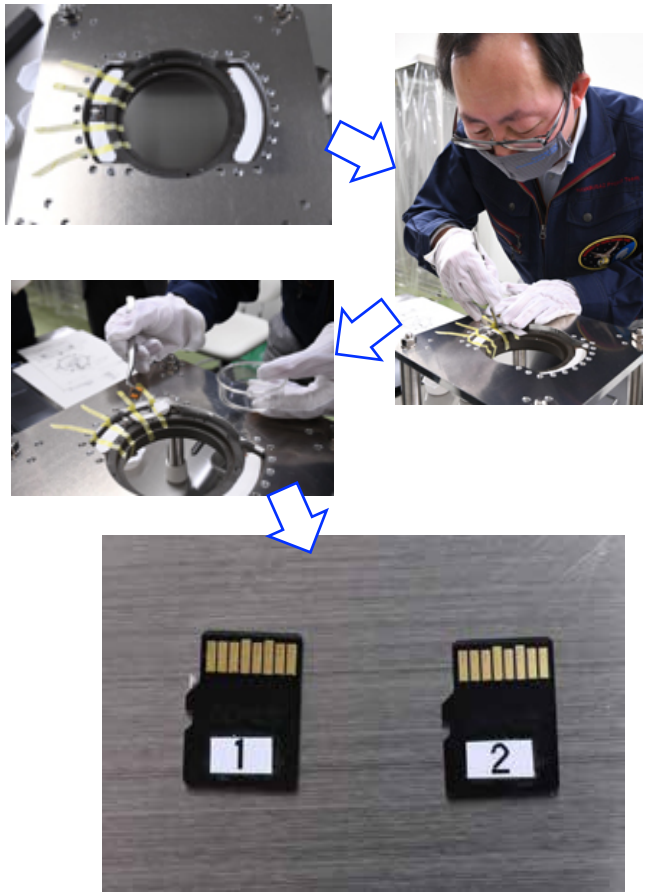
- Forebody heatshield
- Aftbody heatshield
- Instrument module
  （Excluding the sample container and on-board electronic equipment section)
- Onboard electronic equipment section
- Parachute

Capsule and parachute as found in the Woomera desert, Australia.

（image credit：JAXA）

4. Memory chip data search system

- The re-entry capsule was equipped with memory chips containing electronic files of names and messages.（see next page）
- On February 19, the memory chips embedded in the support ablator of the re-entry capsule were removed.
- When the contents of the extracted memory chips (2 chips) were read, the files on both chips could be accessed normally (the contents of both chips are the same).
- We are designing a system to allow you to search the written names and messages.

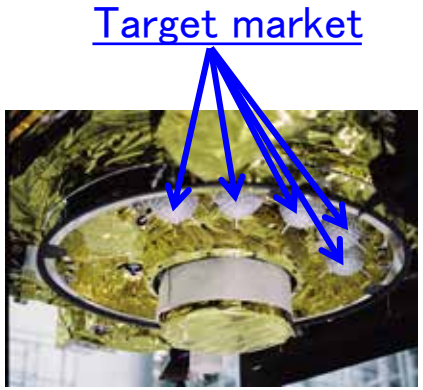


Removal of the memory chips

（image credit：JAXA）

Reference: Little Prince Million Campaign 2

Campaign poster
（the deadline was extended to August 9, 2013）



（image credit：JAXA）

Recruitment：2013/4/10 - 2013/8/9

1. Include a sheet of names inside the target markers
2. Include a memory chip with names, messages, illustrations and photo files in the re-entry capsule.

Submitted numbers:

	Total submissions	Area	
		Japan	Overseas
Target marker	183,174	123,661	59,513
Re-entry capsule	226,800	170,279	56,521
Total (net number of registrants)	409,974 (255,139)	293,940 (194,889)	116,034 (60,240)

5. Future plans

■ Operation schedule

2021/3～ Continue with regular operation

■ Press and media briefings

2021/3/19 Press briefing @ online

Reference

Overview of Hayabusa2

Objective

We will explore and sample the C-type asteroid Ryugu, which is a more primitive type than the S-type asteroid Itokawa that Hayabusa explored, and elucidate interactions between minerals, water, and organic matter in the primitive solar system. By doing so, we will learn about the origin and evolution of Earth, the oceans, and life, and maintain and develop the technologies for deep-space return exploration (as demonstrated with Hayabusa), a field in which Japan leads the world.

Expected results and effects

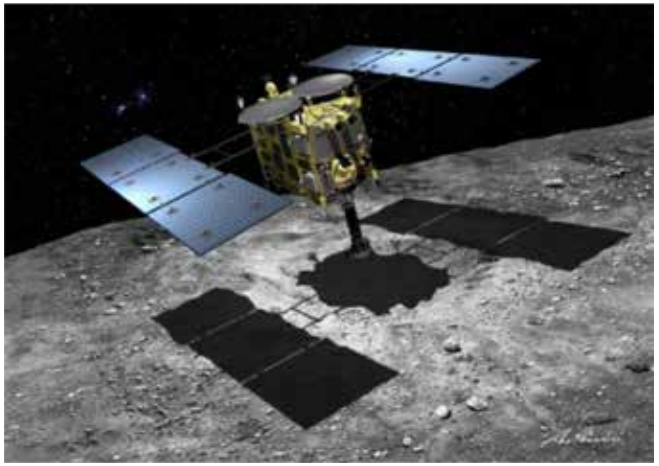
- By exploring a C-type asteroid, which is rich in water and organic materials, we will clarify interactions between the building blocks of Earth and the evolution of its oceans and life, thereby developing solar system science.
- Japan will further its worldwide lead in this field by taking on the new challenge of obtaining samples from a crater produced by an impacting device.
- We will establish stable technologies for return exploration of solar-system bodies.

Features:

- World's first sample return mission to a C-type asteroid.
- World's first attempt at a rendezvous with an asteroid and performance of observation before and after projectile impact from an impactor.
- Comparison with results from Hayabusa will allow deeper understanding of the distribution, origins, and evolution of materials in the solar system.

International positioning:

- Japan is a leader in the field of primitive body exploration, and visiting a type-C asteroid marks a new accomplishment.
- This mission builds on the originality and successes of the Hayabusa mission. In addition to developing planetary science and solar system exploration technologies in Japan, this mission develops new frontiers in exploration of primitive heavenly bodies.
- NASA too is conducting an asteroid sample return mission, OSIRIS-REx (launch: 2016; asteroid arrival: 2018; Earth return: 2023). We will exchange samples and otherwise promote scientific exchange, and expect further scientific findings through comparison and investigation of the results from both missions.



(Illustration: Akihiro Ikeshita)

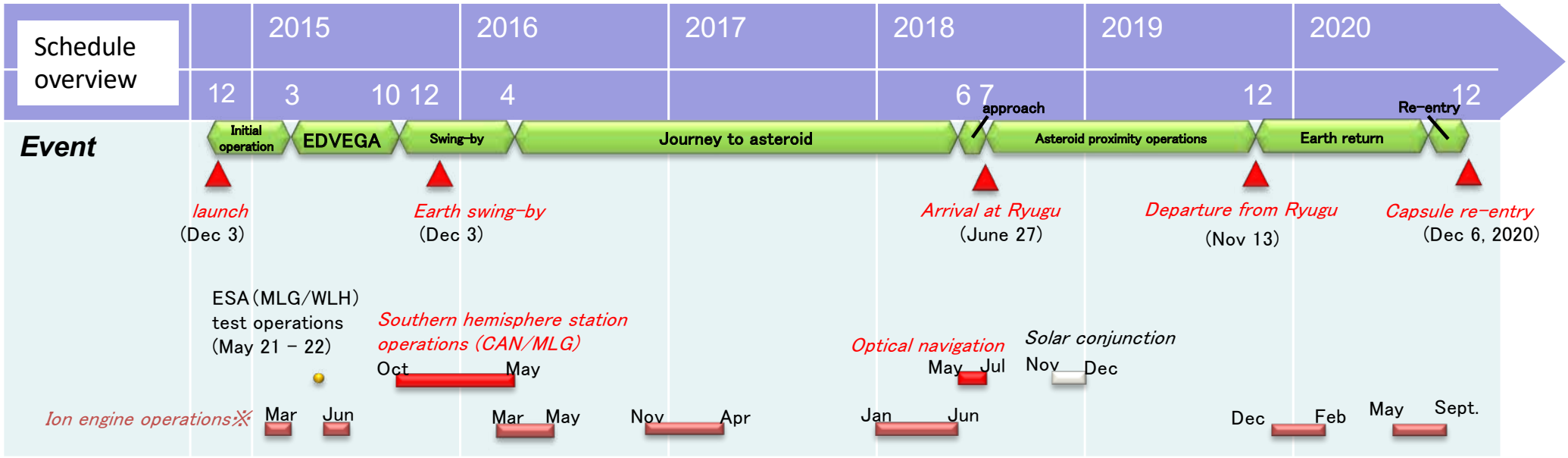
Hayabusa 2 primary specifications

Mass	Approx. 609 kg
Launch	3 Dec 2014
Mission	Asteroid return
Arrival	27 June 2018
Deoarture	13 Mov 2019
Earth return	6 Dec 2020 (plan)
Stay at asteroid	Approx. 18 months
Target body	Near-Earth asteroid Ryugu

Primary instruments

Sampling mechanism, re-entry capsule, optical cameras, laser range-finder, scientific observation equipment (near-infrared, thermal infrared), impactor, miniature rovers.

Current project status & schedule overview



(image credit：JAXA)

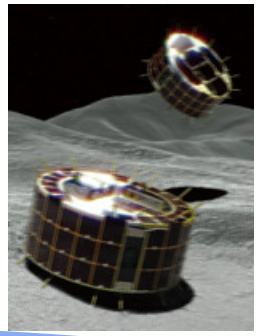
Mission flow

Launch
Dec 3, 2014

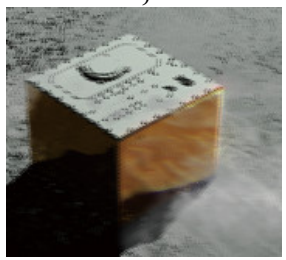
Earth swing-by
Dec 3, 2015

Ryugu arrival
June 27, 2018

MINERVA-II1 separation
Sep 21, 2018

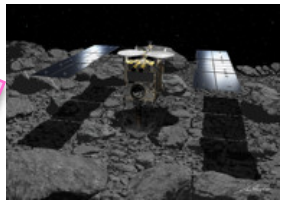


MASCOT separation
Oct 3, 2018

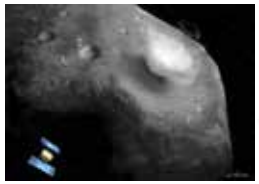


Target marker separation
Oct 25, 2018

First touchdown
Feb 22, 2019

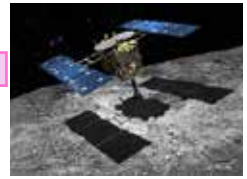


Impactor (SCI)
5 April, 2019

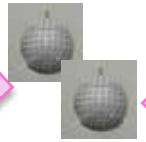


Target marker separation
May 30, 2019

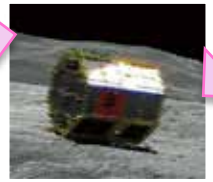
Second touchdown
July 11, 2019



Target marker separation
Sept. 17, 2019



MINERVA-II2 separation
Oct. 3, 2019

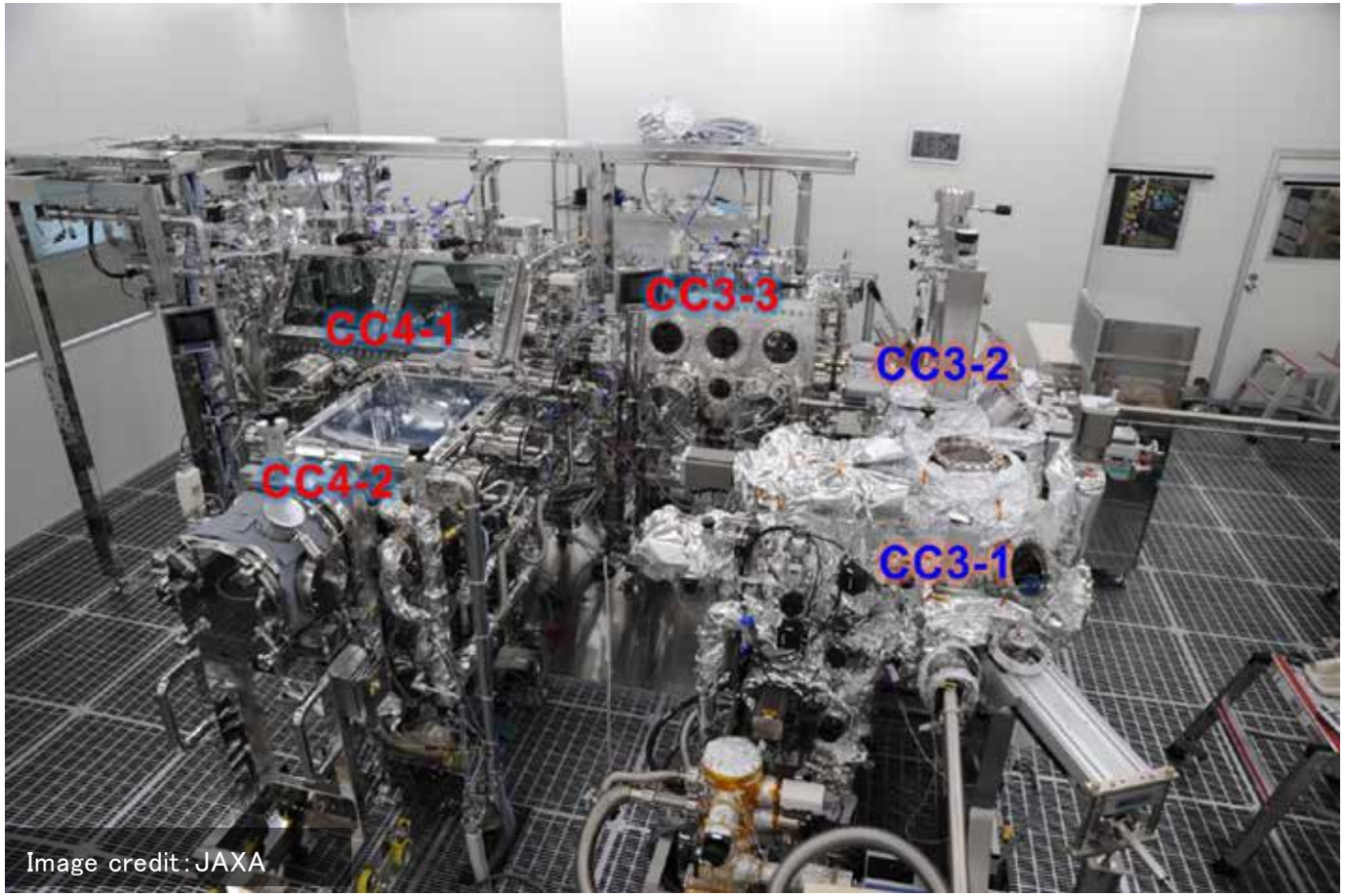


Ryugu departure
Nov 13, 2019

Earth return
Dec. 6, 2020

(image credit: illustrations including spacecraft by Akihiro Ikeshita, others by JAXA)

Clean chamber overview



CC3-1 :
Opening the sample container under vacuum environment

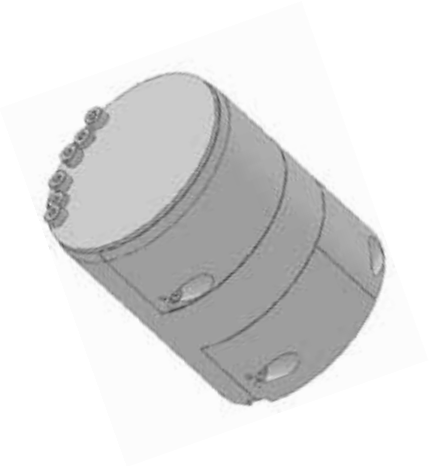
CC3-2 :
Sample collection under vacuum

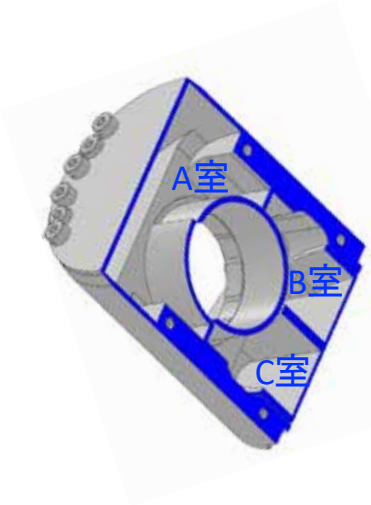
CC3-3 :
Transition from vacuum to nitrogen environment

CC4-1 :
Handling of submillimeter-sized particles

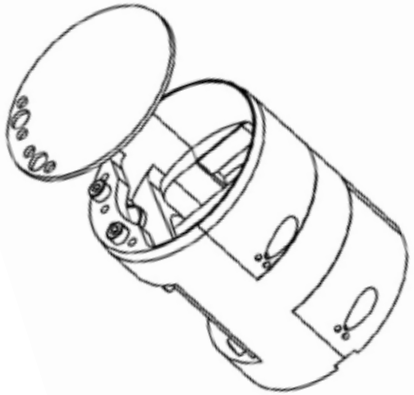
CC4-2 :
Handling / observation / sorting of relatively large particles (> mm)

Catcher opening operation





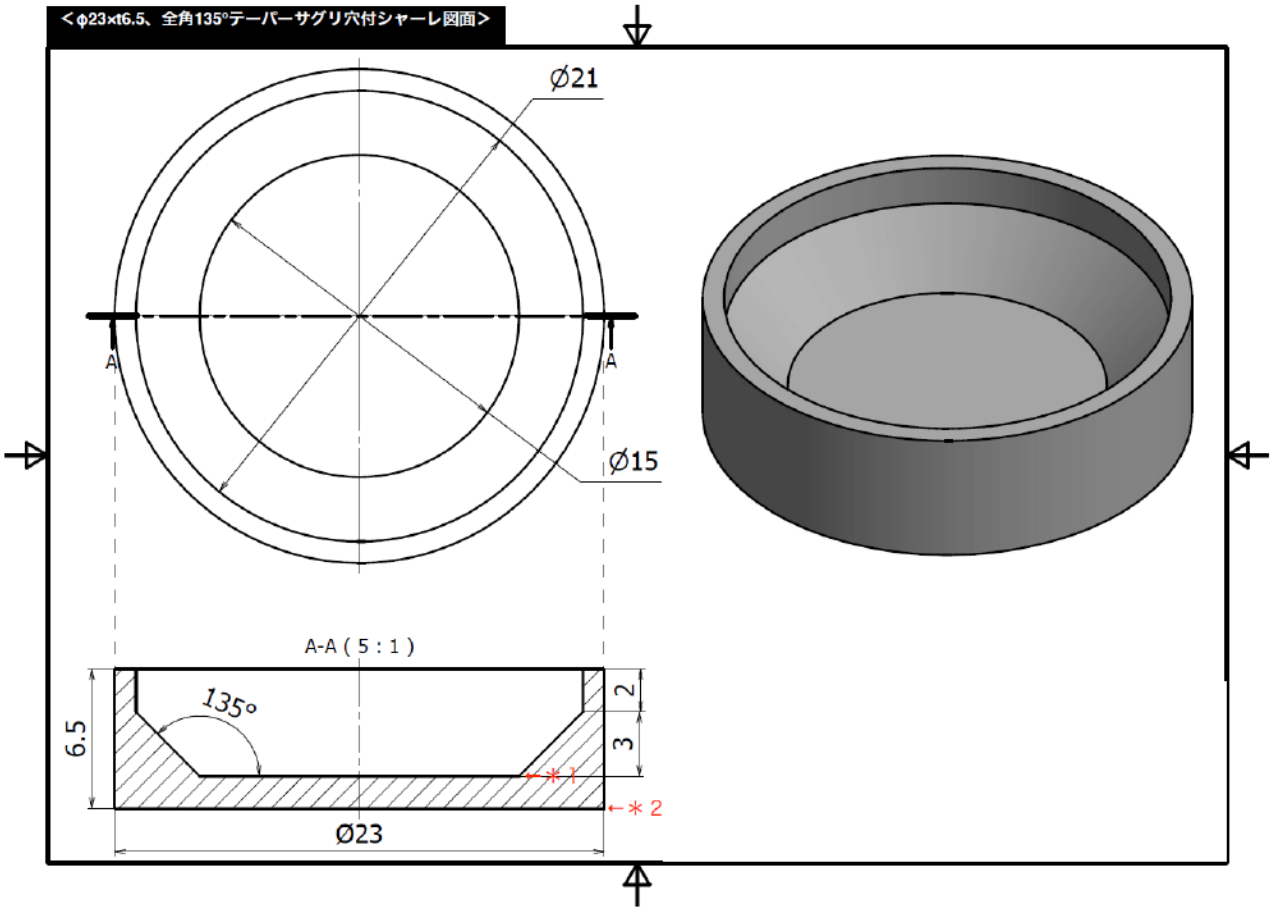
Particles are confirmed from above chamber A



- The sample catcher was moved to clean chamber CC3-2, and the lid of sample catcher chamber A was opened in vacuum conditions.
- Many particles are confirmed to be in chamber A. This is thought to be the sample collected during Touchdown #1 on Ryugu.
- Part of the sample was picked up in Chamber A to be stored in vacuum in its present condition.
- From here, we will move to chamber CC3-3, remove the samples from chamber A in a nitrogen environment, and open chambers B and C.

（image credit：JAXA）

Observation container

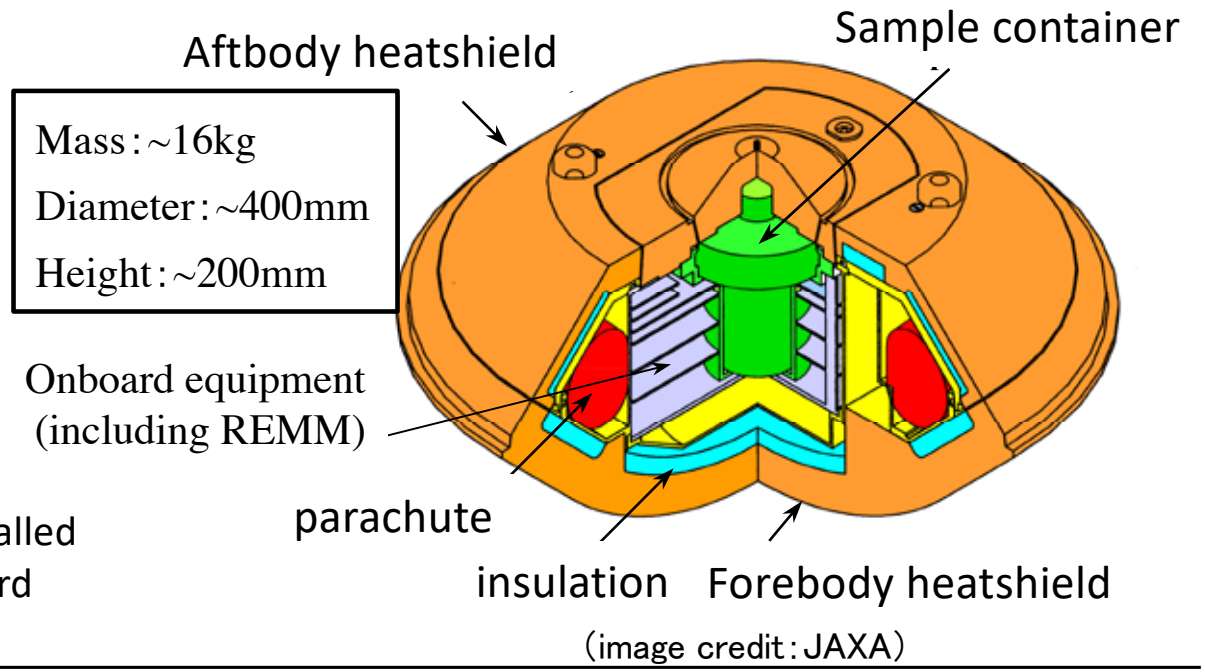


Re-entry capsule overview

- The re-entry capsule carrying a container holding the asteroid samples will re-enter the Earth's atmosphere at a speed of 12 km/s and is recovered on the ground.
- The capsule separates from the spaceship while spinning at one revolution per 3 seconds. It can withstand the aerodynamic heating during re-entry, and opens a parachute at an altitude of about 10 km, allowing it to gently descend and land while emitting a radio wave beacon signal for positional search.

- The basic design follows that of Hayabusa, but in addition to improving the reliability of the on-board equipment, the parachute opening trigger (signal) method, and related equipment, a new re-entry environment measurement module (REMM) were installed.

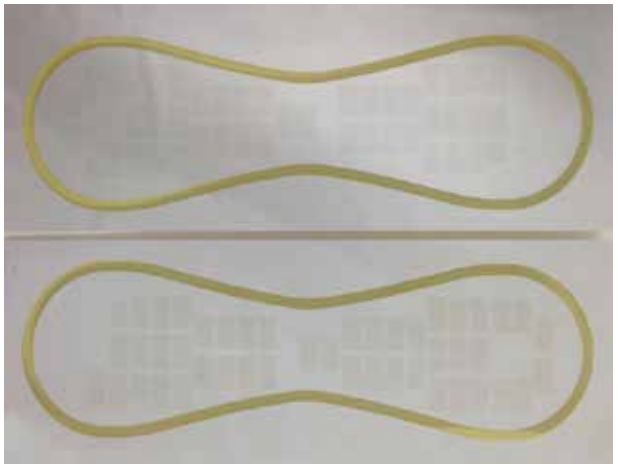
※ The entire part of the re-entry capsule that is suspended by the parachute and slowly descents is called the "instrument module" (sampler container, on-board equipment etc, are stored inside)



(image credit : JAXA)

Searching for names mounted in the target markers

- You can search for your name on the sheets mounted within the target markers.
- https://www.haya2-campaign.jp/



Sheets mounted within the target markers

The block chart showing the location of your name.

（image credit：JAXA）