

Update on Japanese mission

**Space Mission Planning Advisory Group (SMPAG), 22nd Meeting
31 January 2024@Online**

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Japanese missions related to the planetary defense

Current status : summary

- Hayabusa2 extended mission (Hayabusa2#)
 - The spacecraft is operating on schedule without any major problems.
- DESTINY+
 - The launch date has been changed to FY2025 because of two rocket-related accidents. (rocket = Epsilon Launch Vehicle)
 - Due to the above, there is a possibility that the Phaeton flyby timing will be changed from the nominal 2028 to 2030, and we are currently considering the impact of this on the system design.
 - Regarding the development of science equipment, there are no changes other than the schedule.
- Collaboration for Hera
 - JAXA has provided a thermal infrared imager (TIRI).
- Collaboration for RAMSES
 - under discussion

Activities related to the planetary defense in Japan

■ Planetary defense session in JpGU 2024 (international session)

- Japan Geoscience Union Meeting, May 26-31, 2024 @ Makuhari Messe, Chiba, Japan
- Session : International initiatives and cooperation in planetary defense

https://www.jpгу.org/meeting_e2024/sessionlist_en/detail/M-ZZ40.html

- Oral Session : Wed, 29 May, 2024 (9:00 ~ 12:15 JST)
- On-site Poster Core time : Wed, 29 May, 2024 (17:15 ~ 18:45 JST)
- in English, hybrid (in-person and online)
- Call for abstract : Final Deadline: 17:00 Thu, 15 Feb [JST]

■ Planetary defense symposium in ISAS/JAXA (domestic symposium in Japan)

https://www.isas.jaxa.jp/researchers/symposium/planetary_defense/fy_2023.html in Japanese

- Oral Session : Feb 19-20, 2024 at ISAS/JAXA, hybrid (in-person and online)
- This is a symposium for Japanese people, but it is welcomed to talk in English.

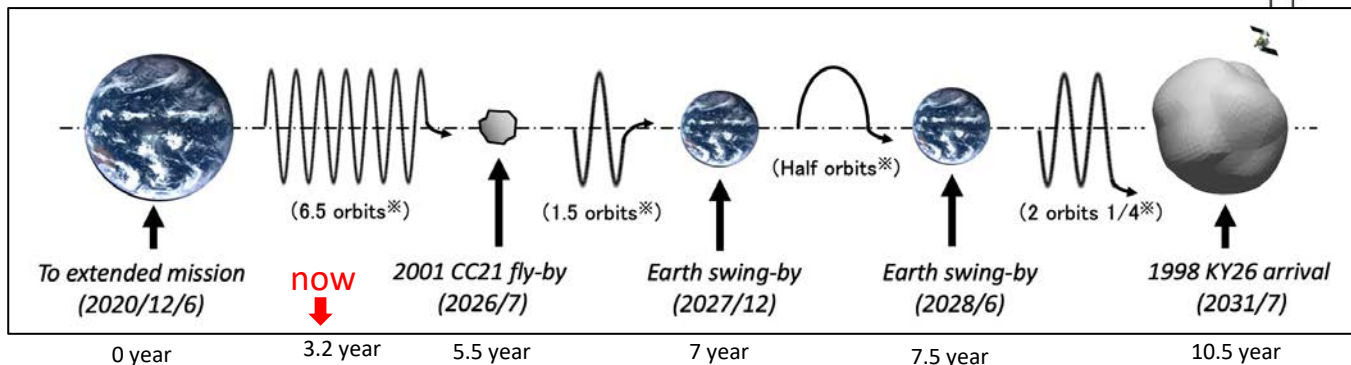
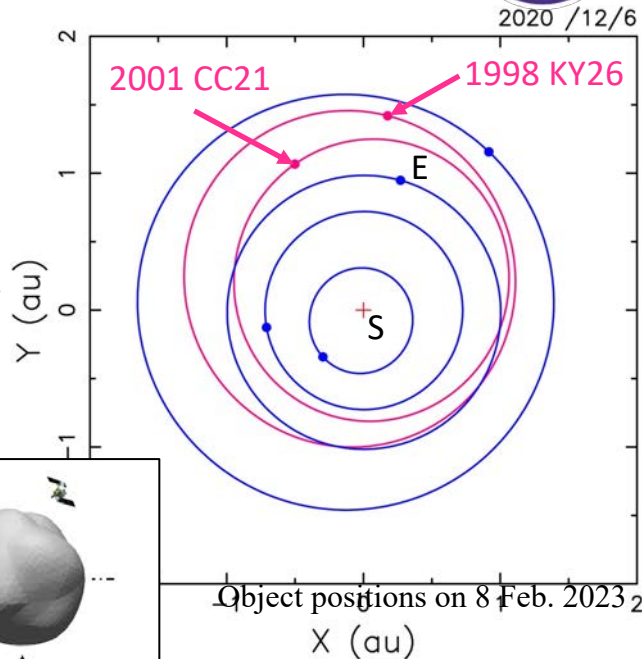
References

Hayabusa2 Extended mission : Hayabusa2#

(SHARP) : Small Hazardous Asteroid Reconnaissance Probe



- After returning to the Earth in December 2020, we continue to operate Hayabusa2.
- The next target is the fly-by of 2001 CC21 in July 2026.
- The final target is the rendezvous of 1998 KY26 in July 2031.



※ indicates the number of orbits around the Sun.

(Image credit: JAXA)

Hayabusa2# Mission Sequence

Timing	Event	Engineering Achievement	Science Achievement
2021/1~ 2026/7	Long-term deep space cruise	<ul style="list-style-type: none"> Acquisition of long-term operation technique of spacecraft under the resource-saving scheme in deep space 	<ul style="list-style-type: none"> Zodiacal light observation Exoplanet observation
2026/7	Flyby of 2001 CC21	<ul style="list-style-type: none"> Super proximity flyby to asteroid Precise targeting technique for the asteroid flyby contributes to Planetary Defense study 	<ul style="list-style-type: none"> Flyby observation of the asteroid
2027/12	Earth swing-by1	<ul style="list-style-type: none"> Completion of 1st leg of long-term deep space operation 3rd Earth swing-by 	<ul style="list-style-type: none"> Calibration of on-board science equipment by Moon observation
2028/6	Earth swing-by2	<ul style="list-style-type: none"> Completion of 2nd leg of long-term deep space operation 4th Earth swing-by 	<ul style="list-style-type: none"> Calibration of on-board science equipment by Moon observation
2031/7	Rendezvous to 1998 KY26	<ul style="list-style-type: none"> Completion of 3rd leg of long-term deep space operation Multi-rendezvous to asteroid Acquisition of exploration technique to the fast rotator, which also contributes to Planetary Defense study 	<ul style="list-style-type: none"> Clarification of formation and evolution of Fast Rotator Acquisition of the scientific knowledge which contributes to Planetary Defense study

Hayabusa2# Operations in 2023 -2024

- **2023**

- Jan. - Nov.: ONC observation x 26 (Milky Way, zodiacal light, exoplanet, star)
- Feb. 14: LIDAR health check
- April - August: TIR dark observation x 2
- May 30: NIRS3 Jupiter observation
- **Sep. 12 - 25:** **4th Term IES operation (2 weeks)**
- Nov. 14 – Dec.18: Solar conjunction operation

- **2024**

- Feb.: Rewriting on-board GNC software for new function
- June: Solar conjunction operation (2 months)
- Oct.: **5th Term IES operation (3 weeks)**

The target asteroids of Hayabusa2#

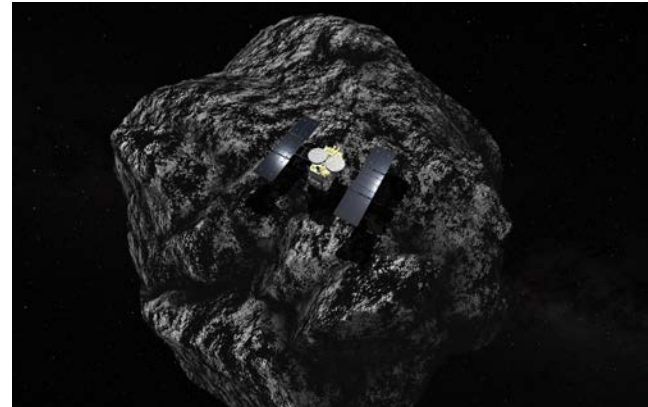
2001 CC21



Shape	elongated?
diameter	700 m (albedo 0.15 assumed)
Spin period	5.017 hours
Spectral type	L type → S type
Semimajor axis	1.03 au
Orbital period	1.05yr(383 day)

(artist's illustration by A. Ikeshita)

1998 KY26



Shape	Spherical (from radar observation)
Av. diameter	About 30 m
Spin period	10.7 min (0.178 hr)
Tumbling motion	No short-term variability detected
Spectral type	Possible carbonaceous asteroid
Semimajor axis	1.23 au
Orbital period	1.37yr(500 day)

Properties of 2001 CC21 (recent data)

- **Spin state**

- Spin axis ~ 90 deg according to lightcurve data
- Spin period = 5.02 h according to lightcurve data

- **Taxonomy**

- L-type according to earlier observations (though there were concerns about data quality and outcomes).
- S- or Sq-type according to latest spectroscopic and photometric observations (This is the current agreement).

- **Shape**

- $b/a \sim 0.5$ according to lightcurve data – photometric shape available

- **Size**

- $D \sim 500 - 700$ m according to lightcurve data
- $D = 449 \pm 12$ m according to occultation, though the lightcurve behavior suggesting it may be a bit larger along the long axis (if elongated).
- $D = 440 - 530$ m from ALFOSC
- $D = 440 - 520$ m from MuSCAT

These data were compiled
by Masatoshi Hirabayashi.



I'll meet you at 5km/s,
with a gift of your name.

Asteroid 2001 CC21 Naming Campaign



We are seeking a name for asteroid 2001 CC21,
which is scheduled for flyby exploration in July 2026 during the
Hayabusa2 Extended Mission

Application Period

2023. 12/6 [Wed] » 2024. 5/9 [Thu]

Application Requirements

- Entry Rules: Please suggest a name that in accordance with the International Astronomical Union rules for naming asteroids.
- Note: Only one entry per person (in case of multiple entries, only the last entry is valid).
- How to apply: Please see the "Asteroid 2001 CC21 Naming Campaign" website and submit your suggestion using the application form (QR codes on right). (※ Any personal information submitted will not be used for any purpose other than this campaign.)
- Selector's Specials: Those who select the final name choice will receive a commemorative gift from the Hayabusa2 Extended Mission team.
(※ Winning applicants will be notified by email)

Hayabusa2 Extended Mission
<https://www.hayabusa2.jaxa.jp/en/>



Campaign site



Application form

Name selection process

Selection

Priority will be given to names that have a high number of suggestions (although the name with the most proposals will not necessarily be selected).

Elementary and junior high school students nominated by the YAC (Japan Space Youth Association) and KU-MA (Children, Space, Future Association, an NPO) will help with the selection process.

Proposal to the International Astronomical Union

The proposed name will be submitted to the International Astronomical Union (IAU) by the US LINEAR (Lincoln Near-Earth Asteroid Research) team, who discovered 2001 CC21, in the summer of 2024.

Decision

Announcement from the IAU Minor Planet Center (MPC); JAXA will also make an announcement.)

DESTINY⁺ (by Takeshi Takashima)

- DESTINY⁺ is a science and technology demonstration mission to asteroid (3200) Phaethon, the parent body of the Geminids meteor shower.
- It will explore the asteroid during a flyby (>33km/s), and conduct scientific observations of cosmic dust, which is considered to be a source of the organic matter on Earth.
- This mission will demonstrate technologies that will enable future low-cost and high-frequency deep space exploration.
- Launch : **FY2025**, Phaethon fly-by : **2028 → 2030 ?**



(Image credit: JAXA)



artist's illustration of Phaethon (©JAXA)

International collaboration

- DLR : Development of Dust Analyzer
- US (Sean Marshall [Arecibo observatory/Univ. of Central Florida]) : Shape model of Phaethon
- US (IOTA(International Occultation Timing Association), JPL, Minor Planet Center) : Orbit determination of Phaethon

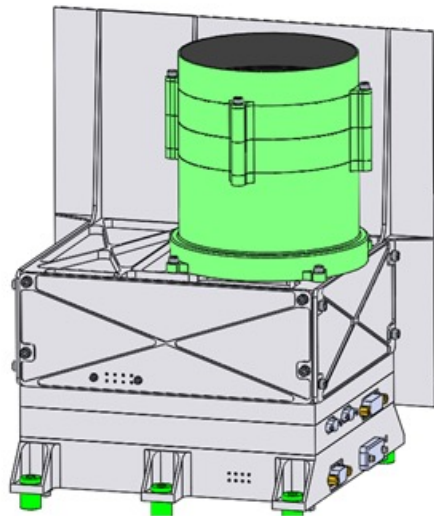
Collaboration with Hera

(by Tatsuaki Okada)

JAXA has provided a thermal infrared imager (TIRI) to Hera.

TIRI is developed based on TIR of Hayabusa2.

Hera TIRI



Detector	Lynred PICO1024
Wavelength	7-14 [μm], with 6 narrow bands
Pixels	1024 x 768
FOV	13.3 x 10.0 [deg]
IFOV	0.013 [deg]
Temperature	150-400 [K]
NETD(@300K)	< 0.1 K
Mass	4.0 +/- 0.4 kg
Power	17 +/- 3 W