

JAXA Space Science Program and International Collaboration

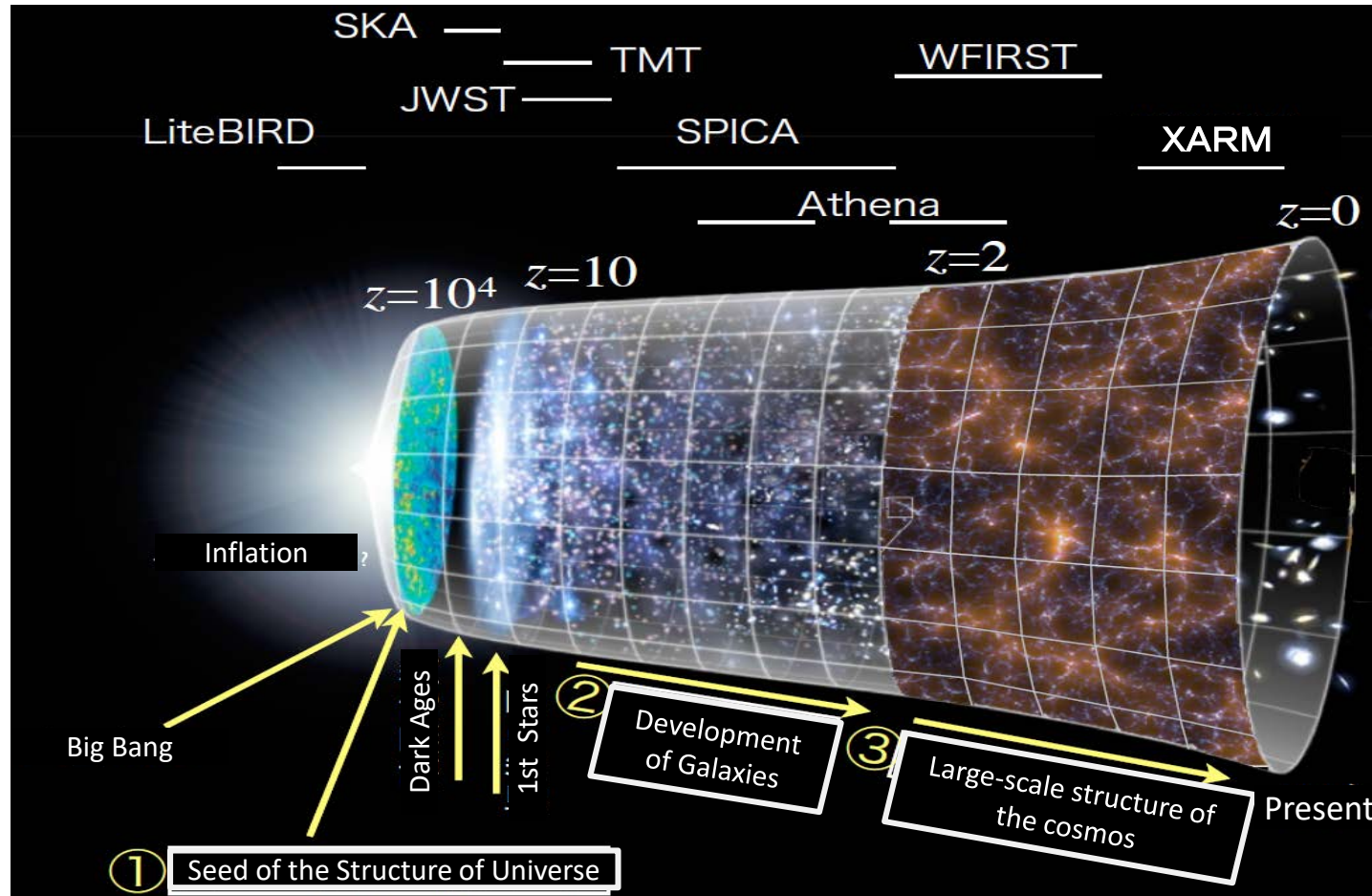
Institute of Space and Astronautical Science
Japan Aerospace Exploration Agency

March, 2018



Astrophysics Strategy and SPICA/LiteBIRD

By addressing following three questions and through international cooperation, Astrophysics Strategy aims to shed light on the origins of the universe and structural formation from a galaxy to planets. 1. How did the universe begin? 2. How did the universe evolve?, and 3. Elucidating formation process, diversity, and universality of the structure of universe.



Credit: NASA / WMAP Science Team



X-ray Astronomy Recovery Mission (XARM)



Space Infrared Telescope for Cosmology and Astrophysics (SPICA)



Light satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection (LiteBIRD)



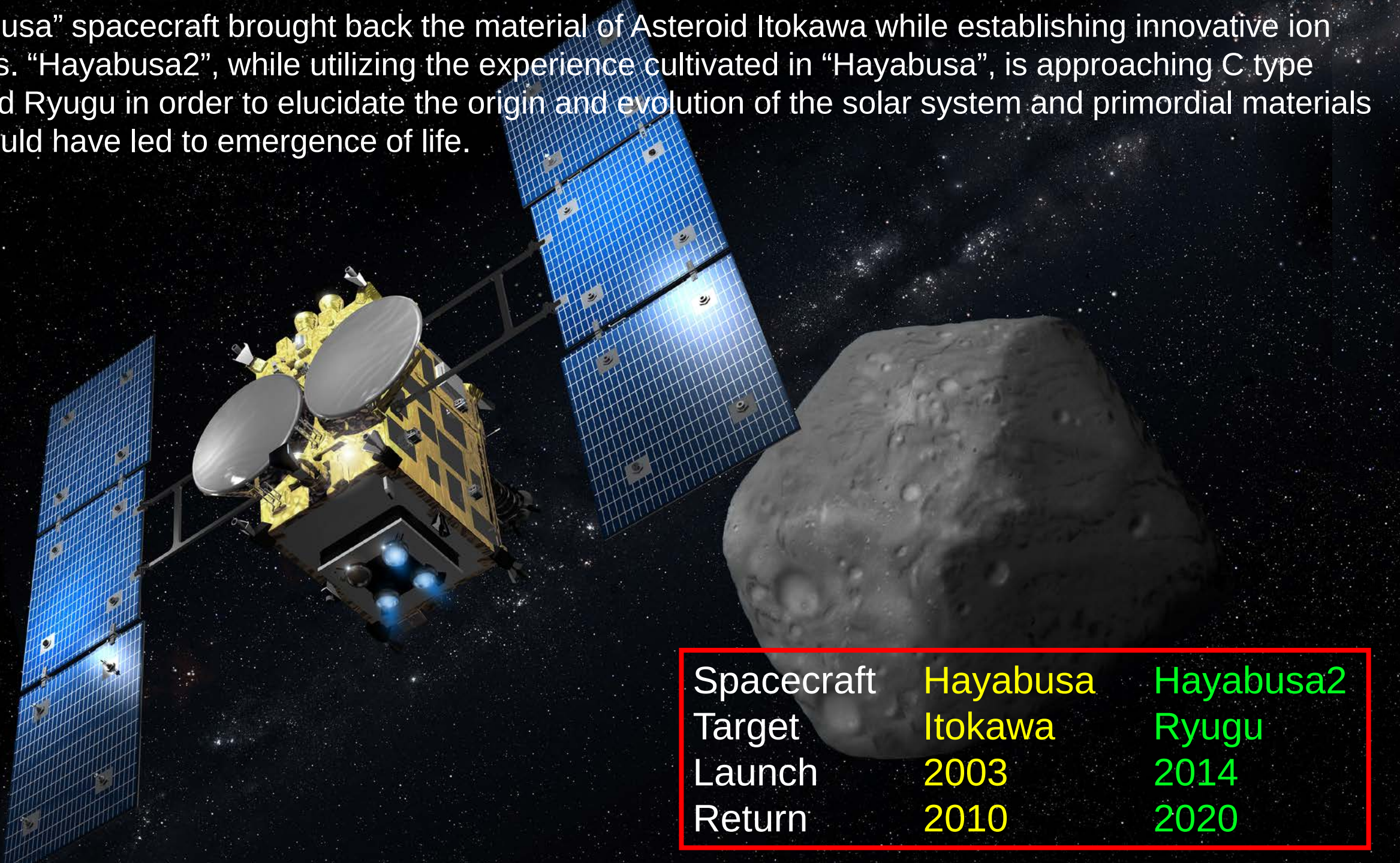
Recovery mission of the ASTRO-H installing Soft X-ray Spectrometer and Soft X-ray Imager.
Pioneering new horizon of the Universe with unprecedented high resolution X-ray spectroscopy.
International collaboration with NASA and ESA.



XARM

Investigating the X-Ray Universe

“Hayabusa” spacecraft brought back the material of Asteroid Itokawa while establishing innovative ion engines. “Hayabusa2”, while utilizing the experience cultivated in “Hayabusa”, is approaching C type Asteroid Ryugu in order to elucidate the origin and evolution of the solar system and primordial materials that would have led to emergence of life.



Spacecraft	Hayabusa	Hayabusa2
Target	Itokawa	Ryugu
Launch	2003	2014
Return	2010	2020

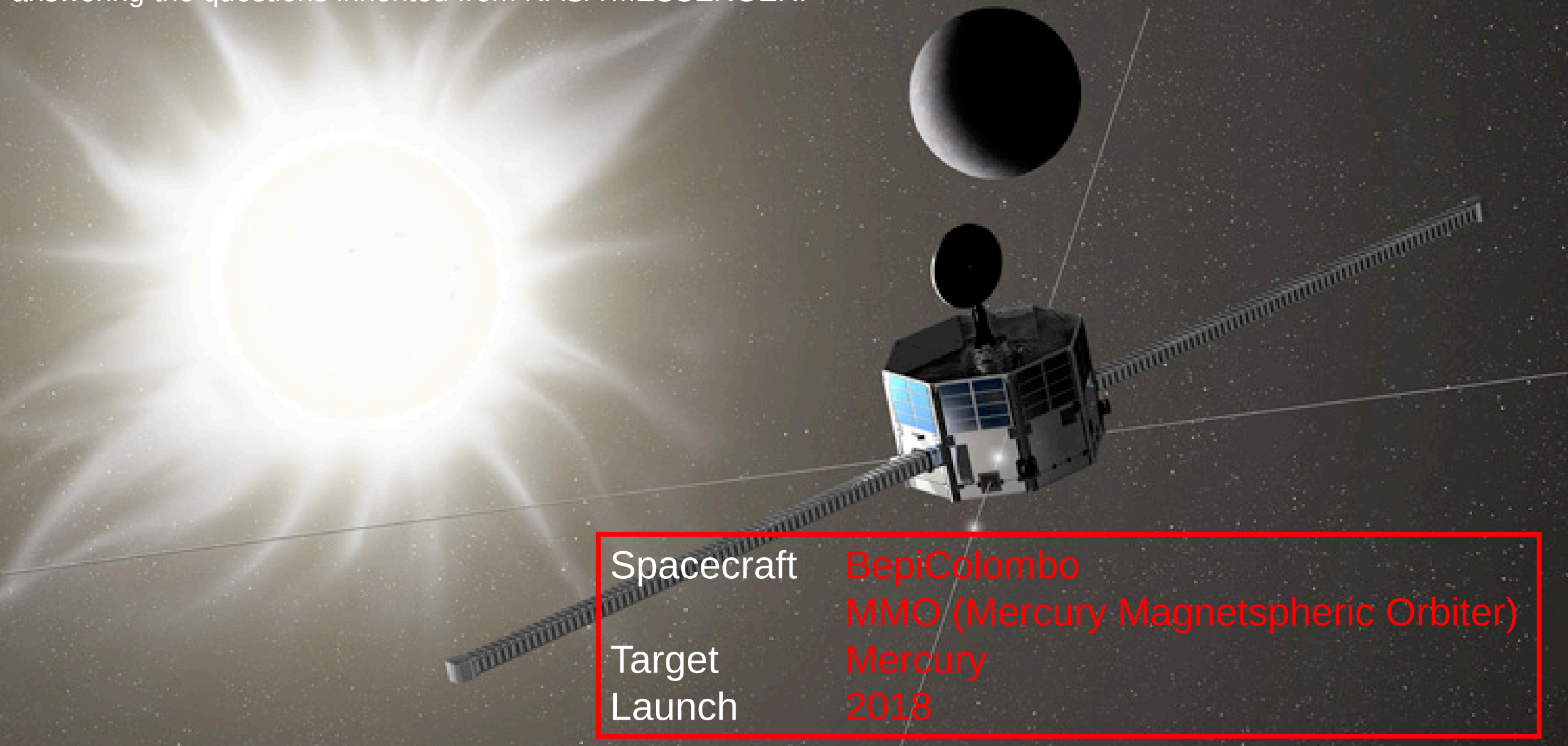
Hayabusa2 detected Ryugu asteroid through an onboard camera in Feb.



Hayabusa2, Launch on 2014, Rendezvous on 2018, Earth Return on 2020



MMO/BepiColombo is a probe to Mercury to elucidate its magnetic field and its interaction with the harsh solar wind in the close proximity to the Sun. Due to the technical difficulties (Mercury orbit insertion, intense thermal environment), Mercury remains mysterious. BepiColombo is a cooperative inter-disciplinary project between Japan and Europe for answering the questions inherited from NASA MESSENGER.



Spacecraft

BepiColombo

MMO (Mercury Magnetspheric Orbiter)

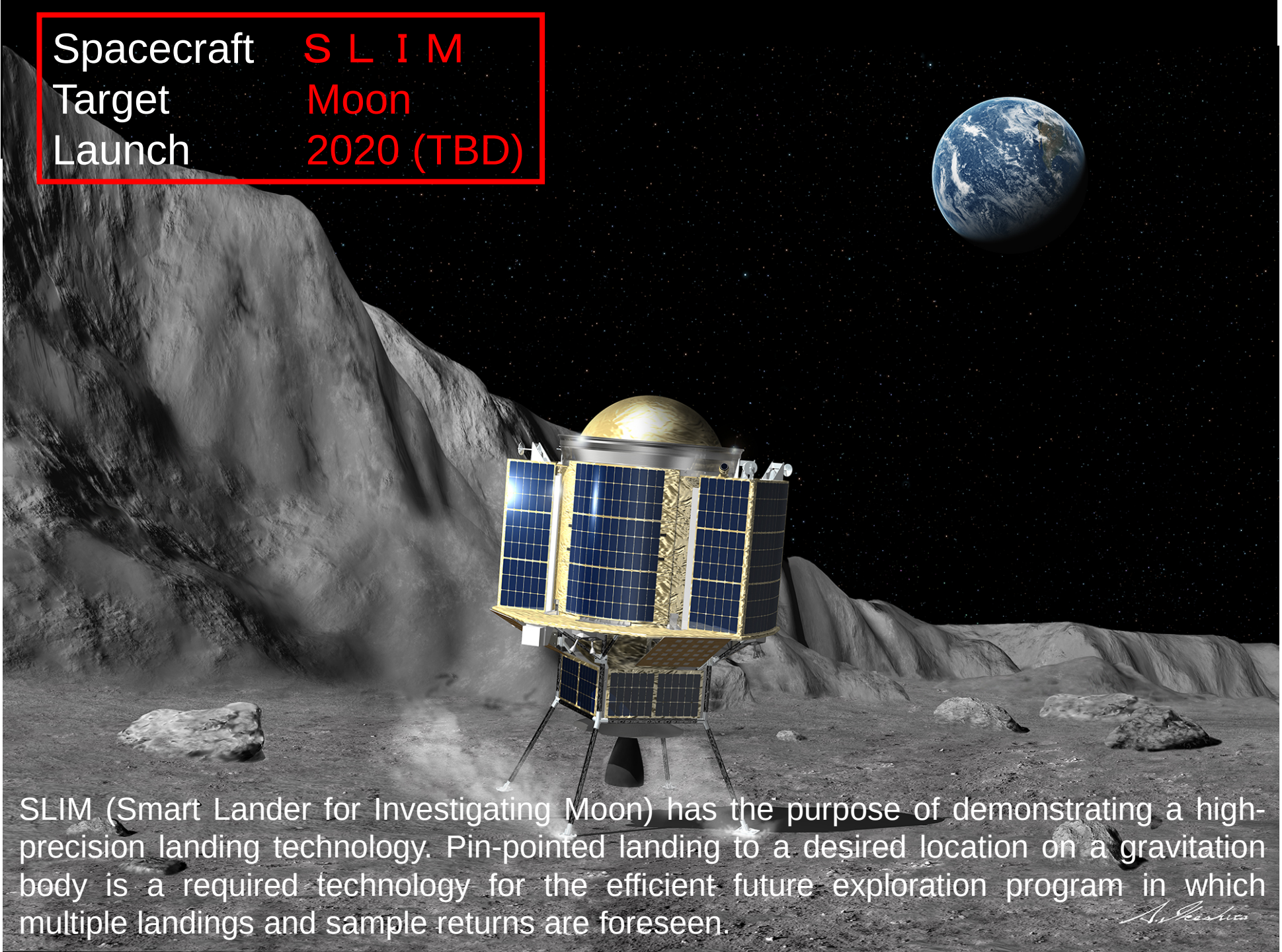
Target

Mercury

Launch

2018

Spacecraft	S L I M
Target	Moon
Launch	2020 (TBD)

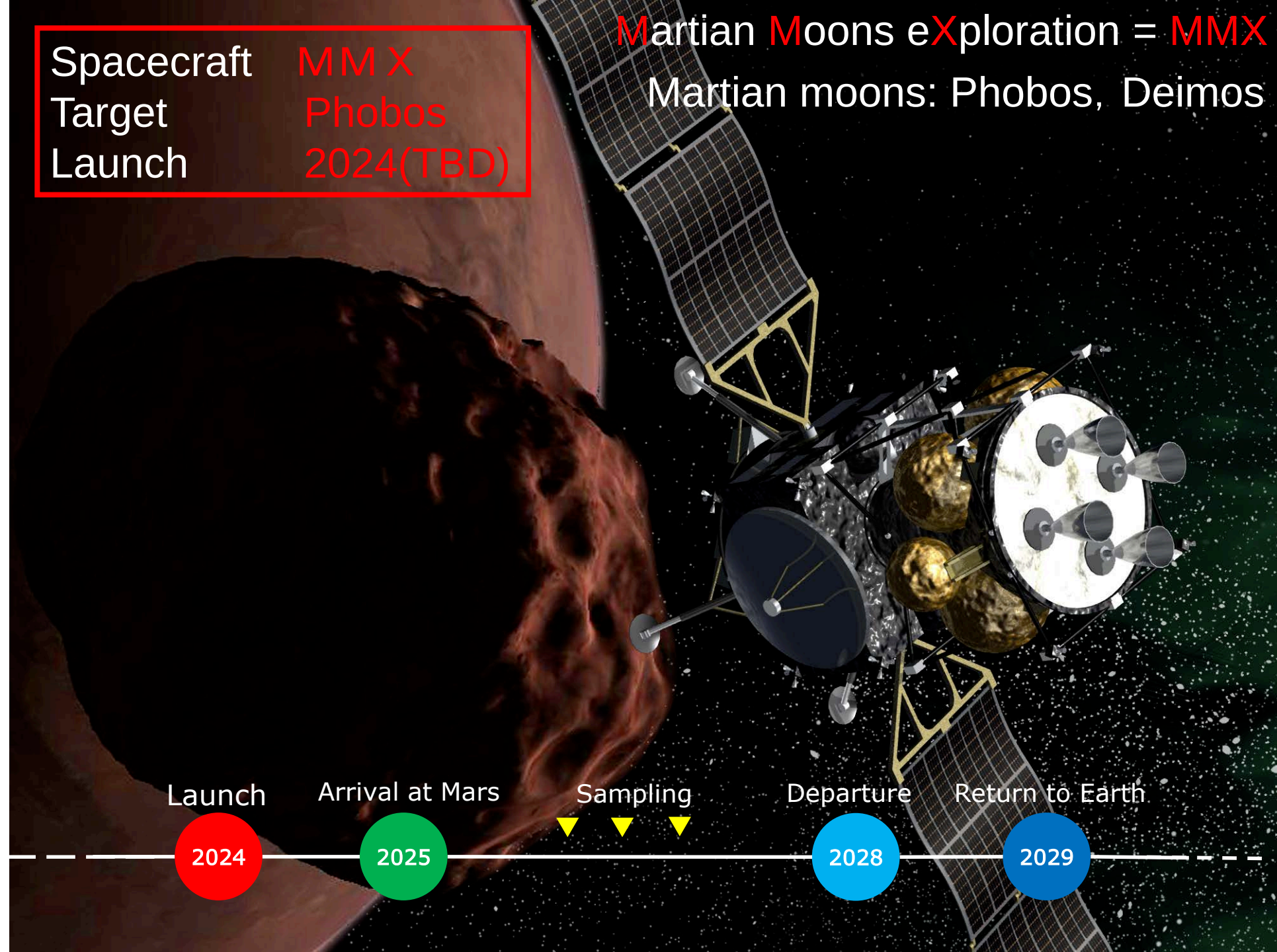
An artistic rendering of the SLIM (Smart Lander for Investigating Moon) spacecraft on the lunar surface. The lander is a small, boxy vehicle with a gold-colored dome on top and four blue solar panel arrays. It is positioned on a dark, rocky, and cratered lunar landscape. In the background, a large, dark, and craggy lunar hill rises on the left, and the Earth is visible in the black sky on the right. The lander's shadow is cast on the ground.

SLIM (Smart Lander for Investigating Moon) has the purpose of demonstrating a high-precision landing technology. Pin-pointed landing to a desired location on a gravitation body is a required technology for the efficient future exploration program in which multiple landings and sample returns are foreseen.

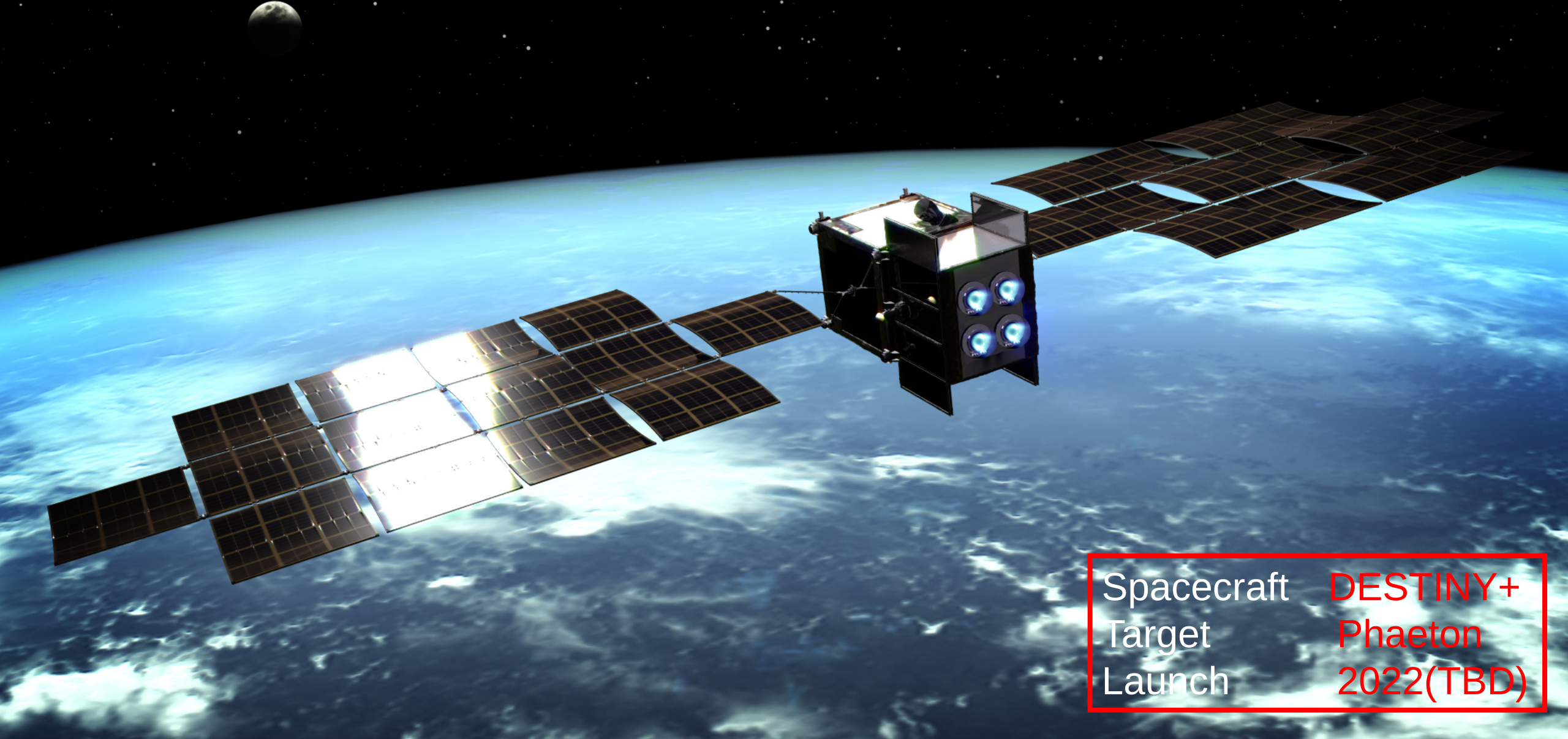
Spacecraft	MM X
Target	Phobos
Launch	2024(TBD)

Martian Moons eXploration = MMX

Martian moons: Phobos, Deimos



DESTINY+ (Demonstration and Experiment of Space Technology for Interplanetary Voyage Phaethon flyby) is a planned mission to demonstrate the small platform concept for planetary exploration. Its science is dust-oriented: it will be from dust in-situ analysis during interplanetary cruise and from flyby observations of the Geminid meteor shower parent body 3200 Phaethon.

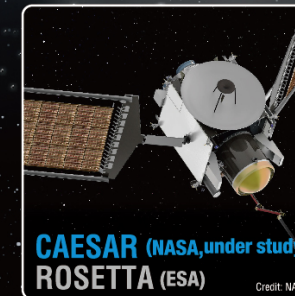
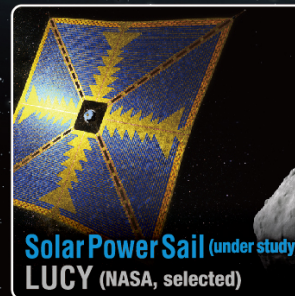
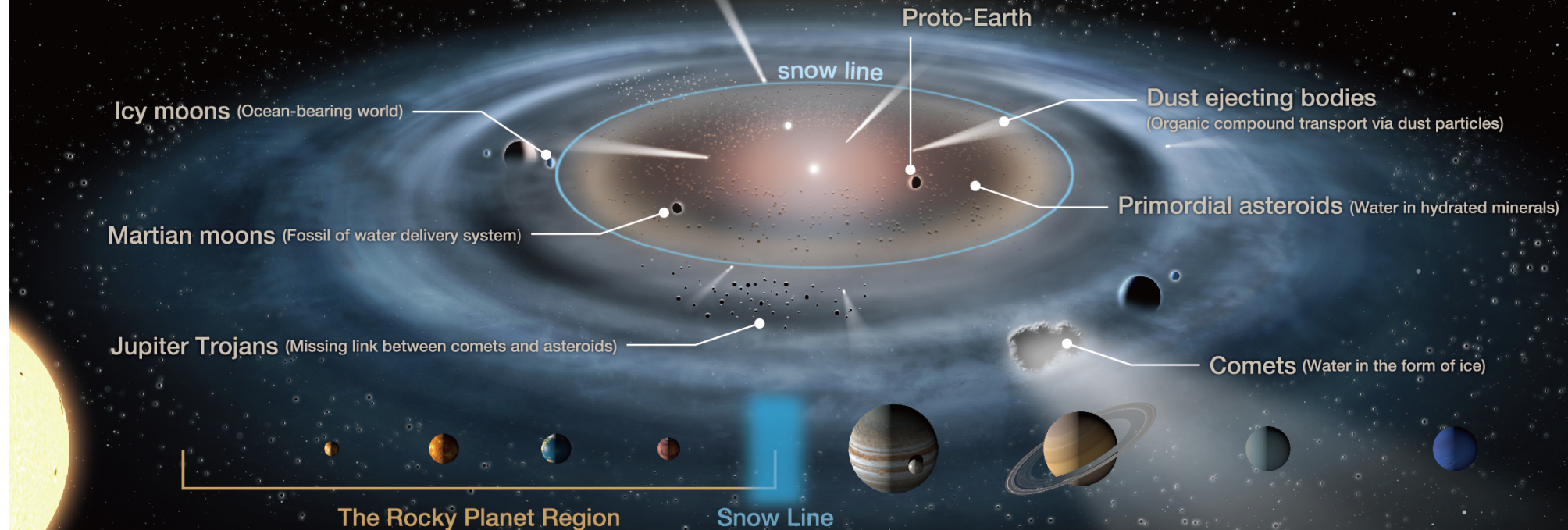


Spacecraft	DESTINY+
Target	Phaeton
Launch	2022(TBD)

ISAS Small Body Exploration Strategy

Many small bodies are born outside the snow line. These are initially comet-like but can evolve to show a variety of faces. By delivering water and organic compounds, these small bodies may have enabled the habitability of our planet.

When, who and how?



The fleet of ISAS small body missions explores these questions

Summary

2018 Highlights of ISAS/JAXA

- Hayabusa 2 arrival and touchdown on Ryugu asteroid with CNES/DLR Lander
 - Bepi Colombo launch and departure for 7-year journey to the Mercury with ESA.
- ISAS/JAXA puts the highest priority on international collaborations.
 - Foreign Partners join ISAS/JAXA lead Missions
 - ISAS/JAXA joins Foreign Agency lead Missions
 - Joint missions between ISAS/JAXA and other agencies
 - ISAS/JAXA continues to promote international collaborations in order to maximize the outcome from the missions in efficient manner within allocated resources.
- 1) Realize highest outcome of the space science missions in efficient manners
 - 2) Maximize the opportunities to conduct/participate Missions
 - 3) Promote proactive communications among international space science community

JAXA Lead Mission

XARM

w/ NASA, ESA



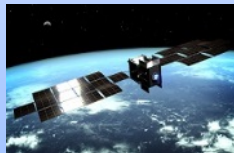
MMX

w/ NASA, CNES,
ESA, DLR



DESTINY+

w/ DLR



Join Foreign Lead Mission

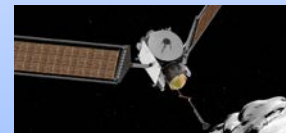
JUICE

by ESA



CAESAR

by US



Joint Mission

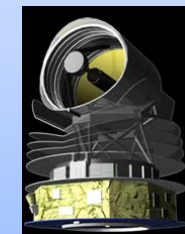
Bepi Colombo

ESA/JAXA



SPICA

ESA/JAXA



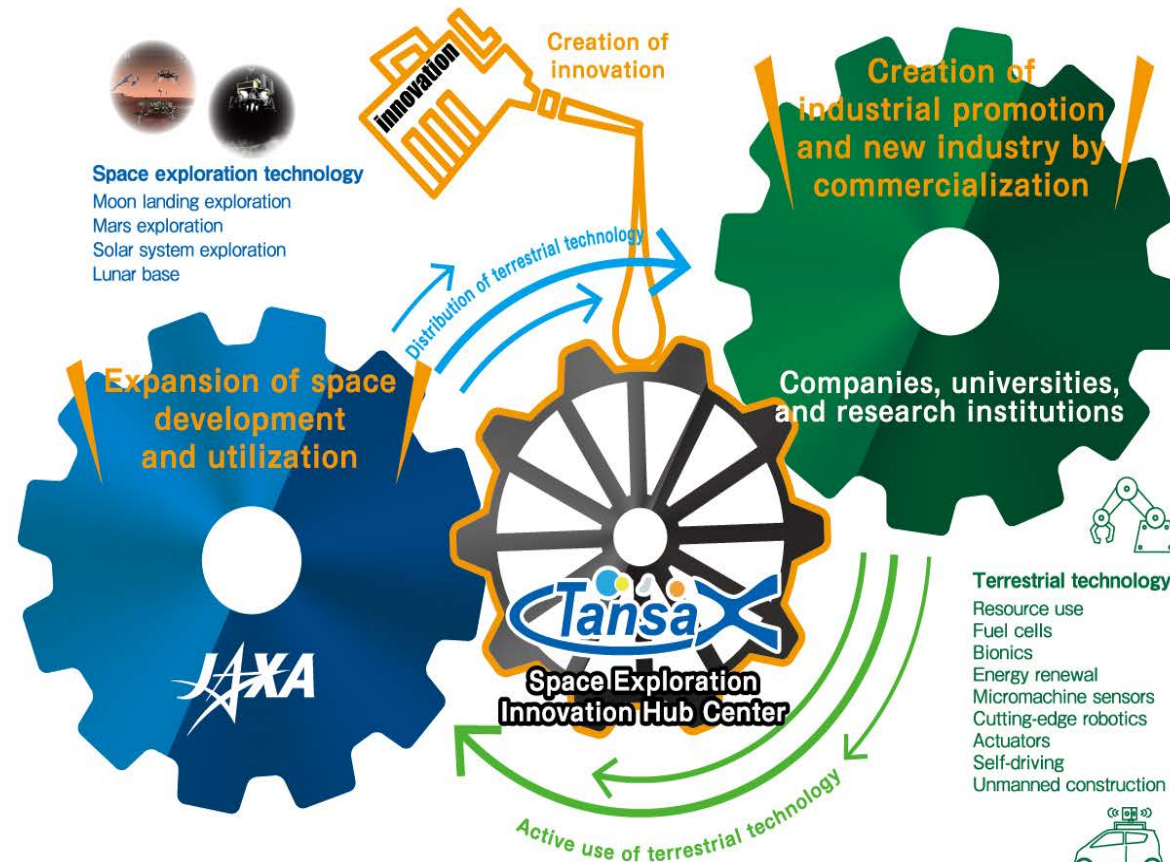
Innovations in Space and on Earth

- **Space exploration technology**

- Expansion of space development and utilization.
- Active use of terrestrial technology.

- **Terrestrial technology**

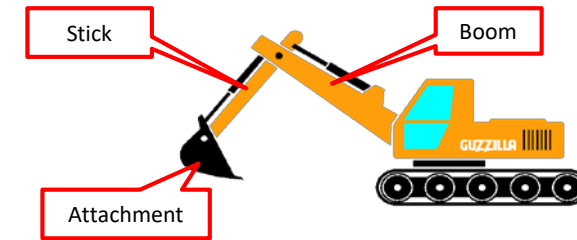
- Creation of industrial promotion and new industry by commercialization.
- Distribution of space exploration technology.



Outline of “ Development and on-site-investigation of ultralight attachment and boom ” (Taguchi Industrial Co., Ltd.)

[Background]

- In order to construct a lunar base or a Mars base, construction machinery is transported from the ground, and from the transportation cost aspect, it is required to have "general versatility" and "ultralightweight" that can perform multiple operations with one unit.
- On the ground, due to ultralightweight construction, both construction machinery and attachments are expected to greatly improve transportability, workability, fuel economy, etc., and demonstrate superiority at the construction site.



Hydraulic excavator

[Research goals]

- We adopted a highly versatile “hydraulic excavator” as a construction machine to reduce weight, and started weight reduction of its components such as “stick” and “boom.”
- The current "stick" and "boom" are made of "iron" as the main material, but we will manufacture them with lightweight metals or composite materials to achieve weight reduction.
- By making them from two kinds of materials respectively, we will conduct comparative study not only from strength and rigidity but also from various aspects such as manufacturing.

