

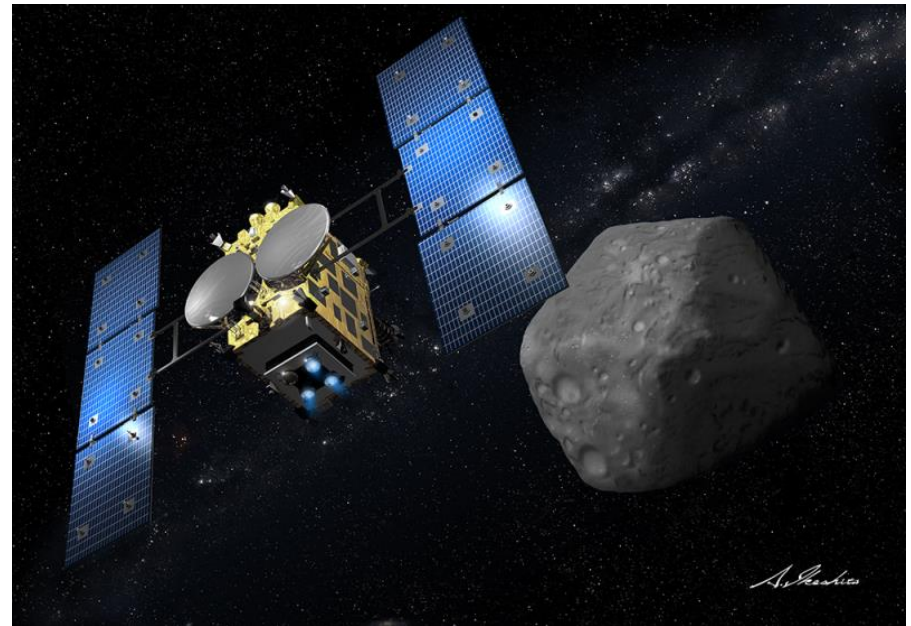
A composite image of space exploration. In the bottom left, the curved horizon of Earth is visible, showing blue oceans and white clouds. In the center-left, the reddish-orange planet Mars is shown. In the top right, the large, grey, cratered Moon is visible. The background is a dark blue space filled with numerous bright, multi-pointed stars.

JAXA's Space Exploration Activities

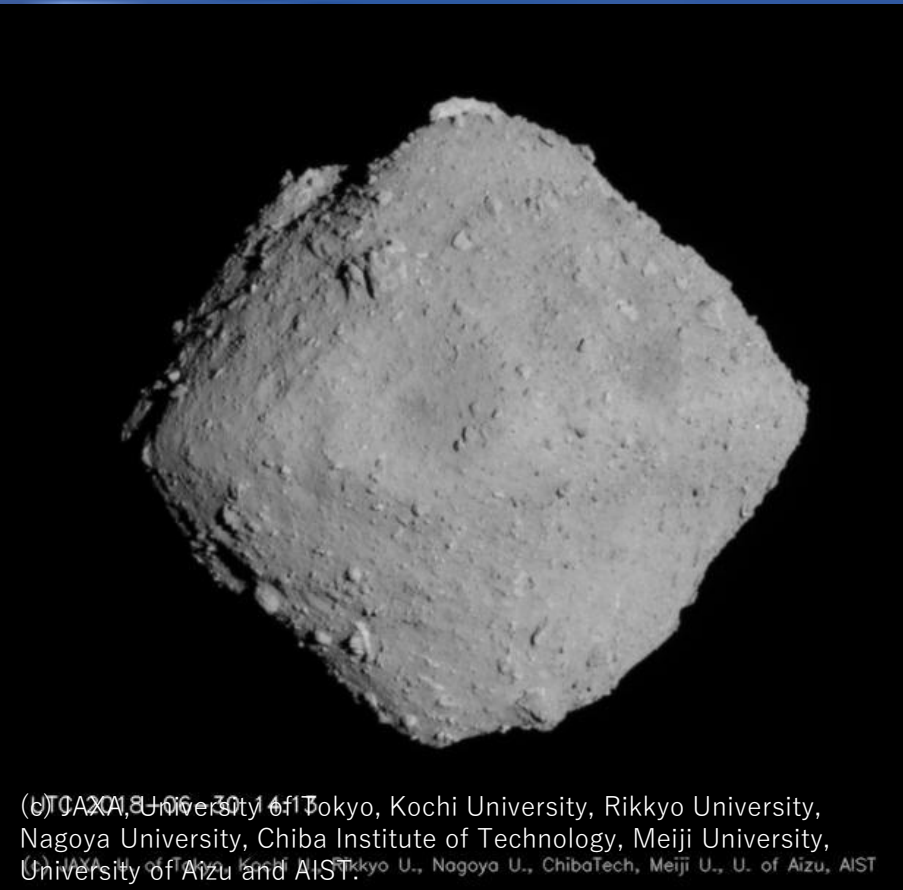
Jun Gomi,
Deputy Director General, JAXA

Hayabusa 2

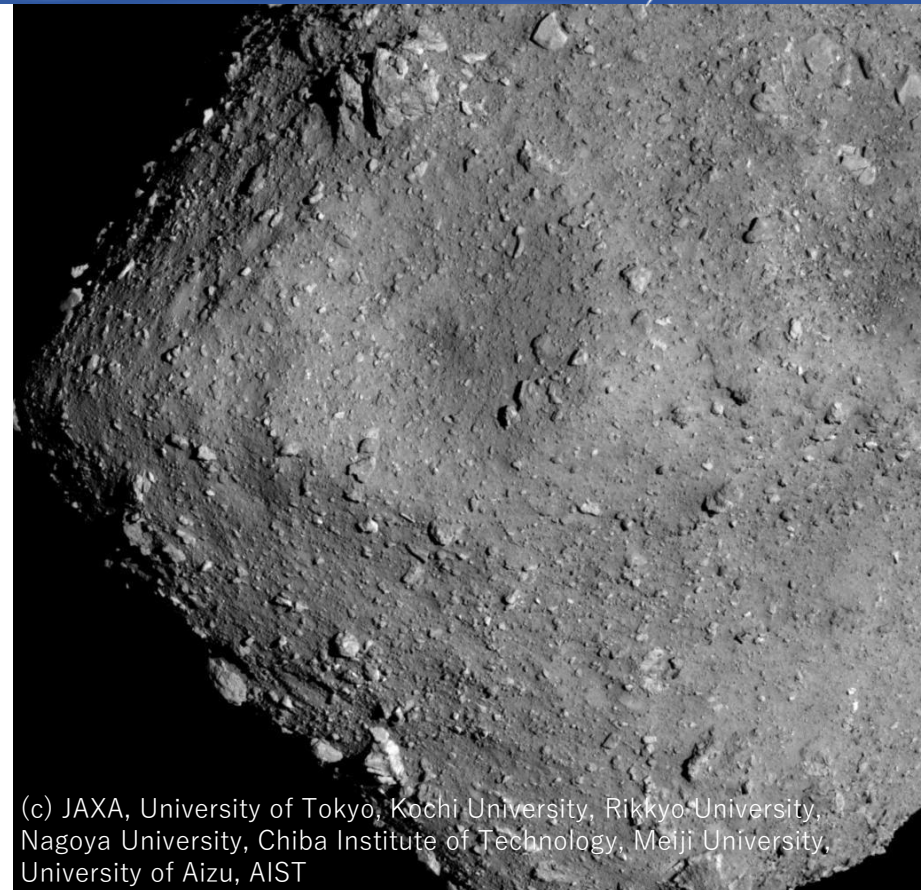
- ✓ **Asteroid Explorer** of the C-type asteroid
- ✓ Launched in December, 2014
- ✓ Reached target asteroid “Ryugu” in 2018
- ✓ First successful touchdown to Ryugu on February 22, 2019
- ✓ Return to Earth in 2020



Hayabusa 2



Asteroid Ryugu photographed from a distance of about **20 km**. The image was taken on June 30, 2018.



Asteroid Ryugu from an altitude of **6km**. Image was captured with the Optical Navigation Camera on July 20, 2018.

Hayabusa 2



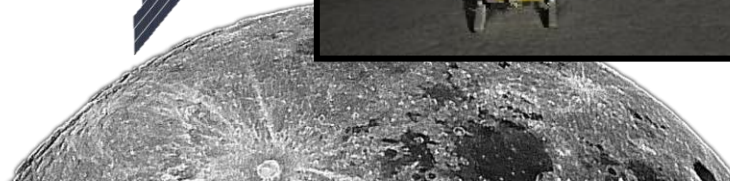
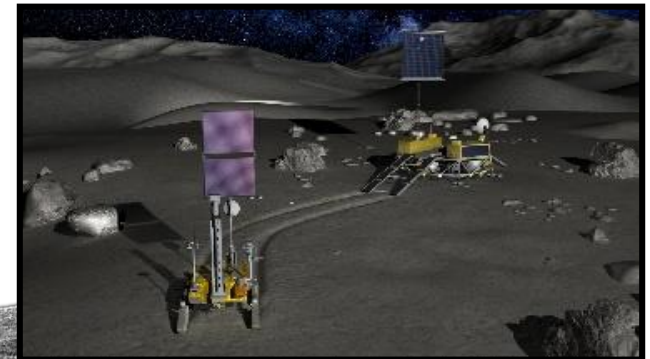
JAXA's Plan for Space Exploration

International Cooperation

- Utilization of ISS/Kibo
- Cis-Lunar Platform (Gateway)
- Lunar exploration and beyond

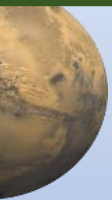
Industry & Academia Partnerships

- JAXA Space Exploration Innovation Hub
- Science Community discussions



JAXA's Overall Scenario for International Space Exploration

Mars, others



MMX: JFY2024



★ Initial Exploration

- Science and search for life



★ Full Fledge Exploration

- Utilization feasibility exam.

Moon

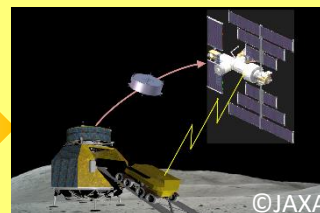


SLIM (JFY2021)



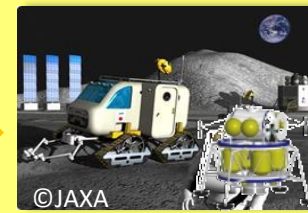
Traversing exploration (2023-)

- Science exploration
- Water prospecting



Sample Return (2026-)

- S/R from far side
- Technology demo for human mission



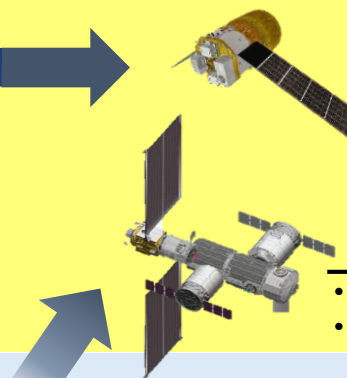
Full-fledged Exploration & Utilization

- Cooperative science/resource exploration by robotic and human

Earth



International Space Station

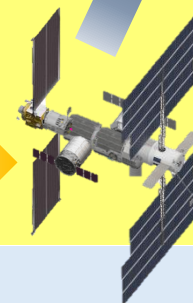


Gateway Phase 1 (2022-)

- Support for Lunar science
- Science using deep space

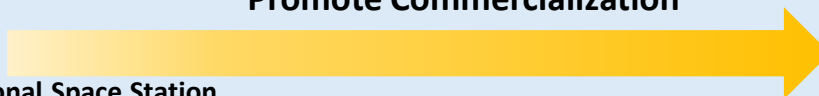
HTV-X der. (2026-)

- Small probe deploy, data relay etc.



Gateway Phase 2

Promote Commercialization



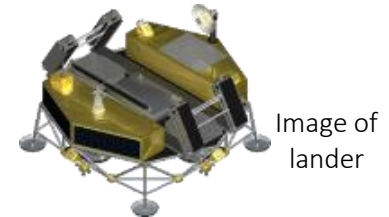
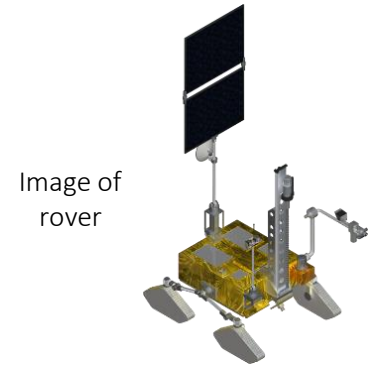
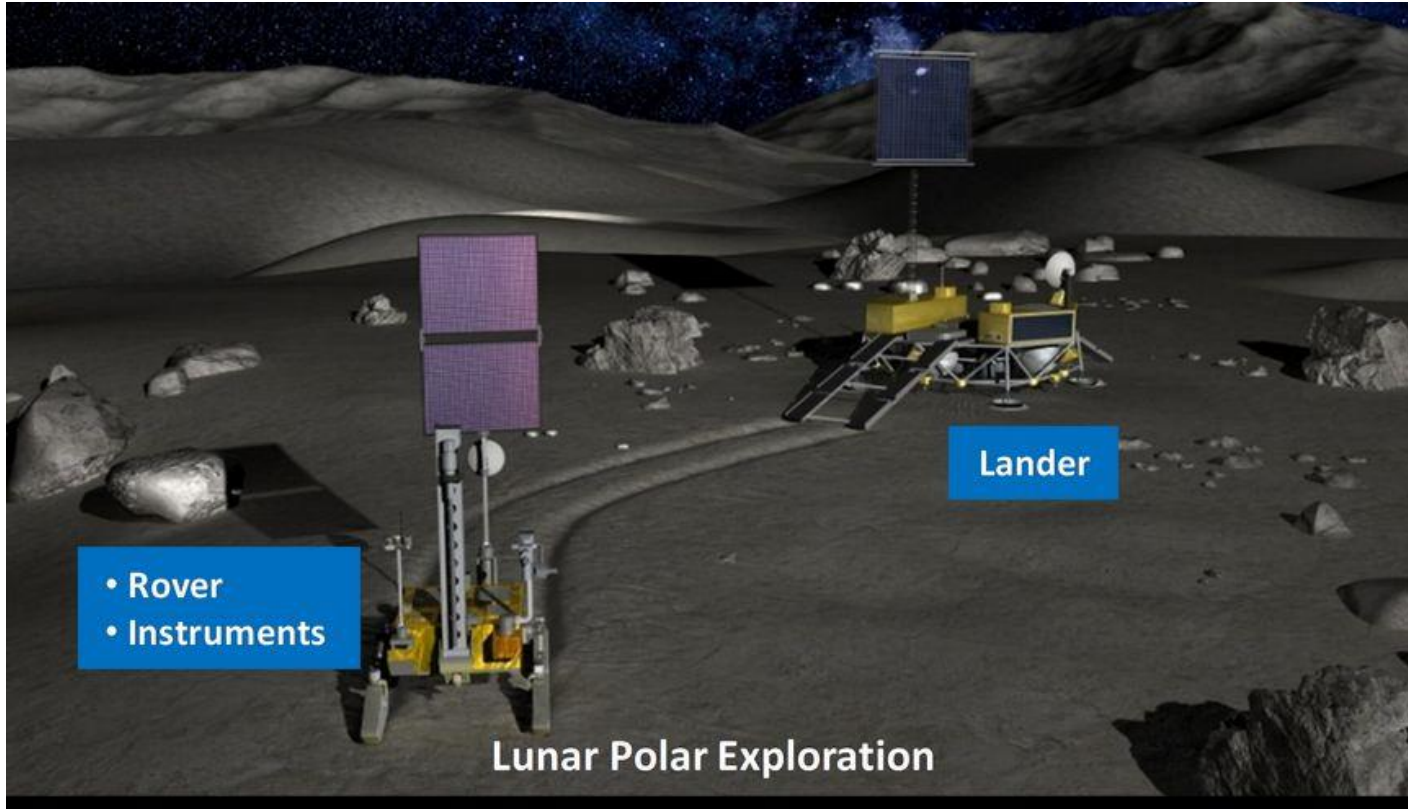
SLIM (Smart Lander for Investigating Moon)

- ✓ Demonstrate pin-point landing on the moon.
- ✓ Targeted launch in JFY 2021.



Joint Lunar Polar Exploration Mission

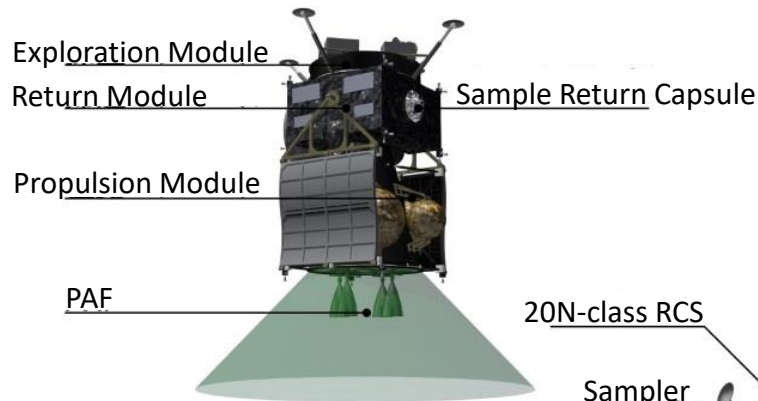
- ✓ JAXA-ISRO are conducting joint study on lunar polar exploration mission.
- ✓ Targeted launch in early 2020's.



Martian Moons eXploration (MMX)

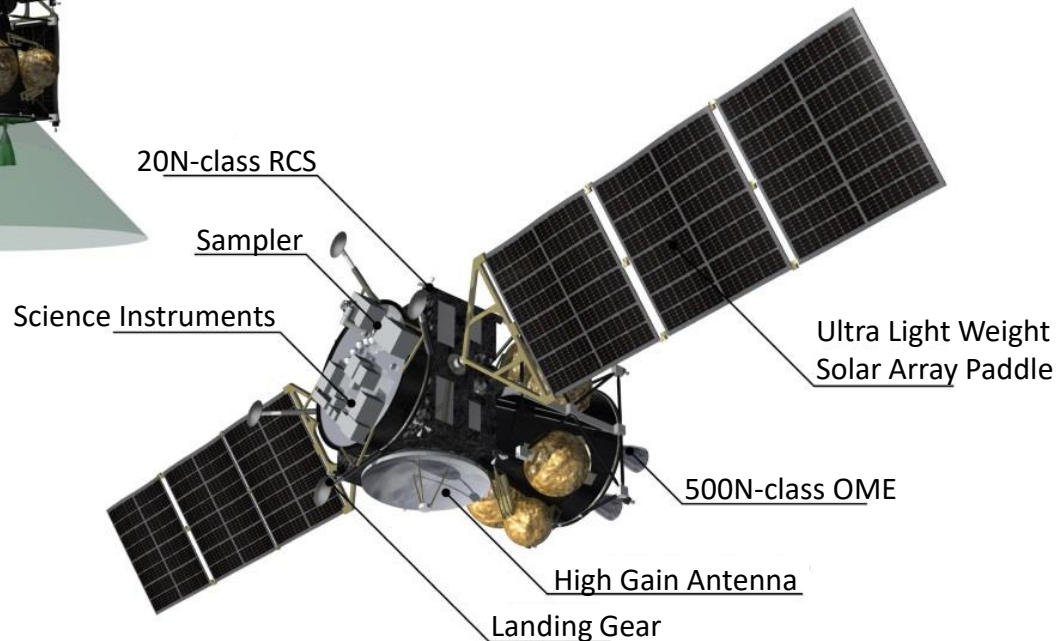
- ✓ Round trip to Martian system (Astronautics)
- ✓ Sophisticated sample retrieval technologies (Robotics)
- ✓ High rate mission data transmission (Communications)

Launch Configuration



Launch Mass : 3400kg
Mission Duration : 5 years

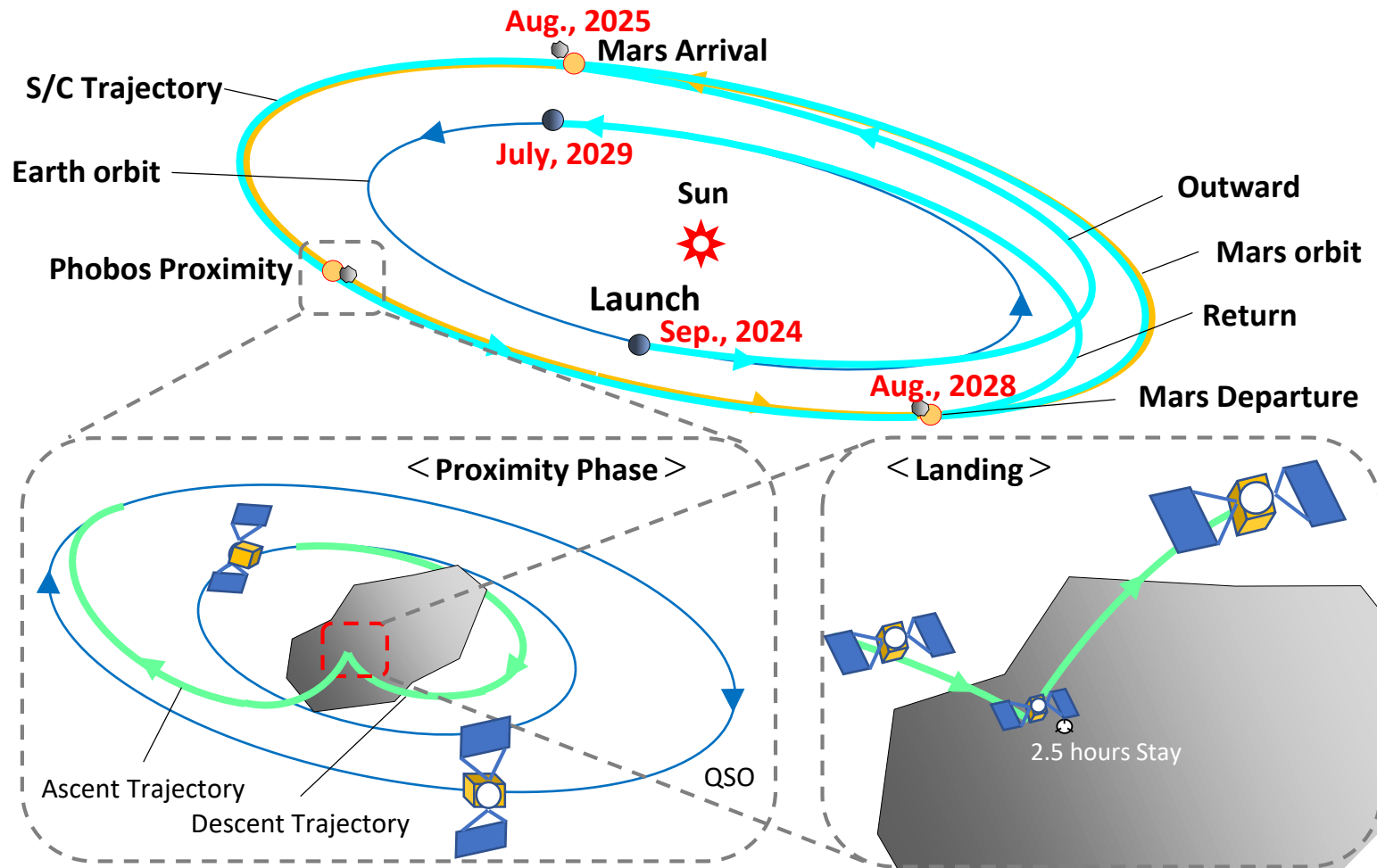
On-Orbit Configuration



(written above is an example, and could change in the future)

MMX Mission Profile

Interplanetary flight takes about 1 year for outward/homeward.
Trade-off study results in total **5 years trip**.



Open Innovative Explore Dual-use Technology to Ground and Space

Since 2015, JAXA and **private companies/research institutes** have brought together **cutting-edge technologies** for space exploration

- Exploration in a wide range of areas by distributed and collaborative multiple small spacecrafts
- Automatic and autonomous exploration
- In-situ resource utilization (ISRU)

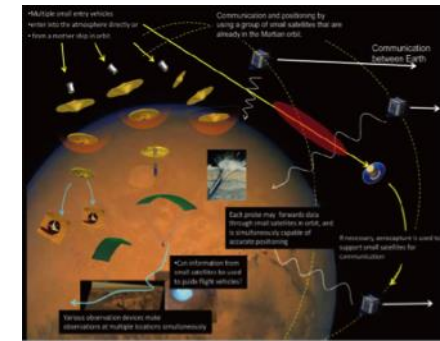
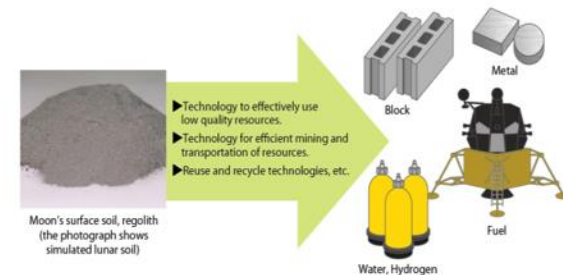
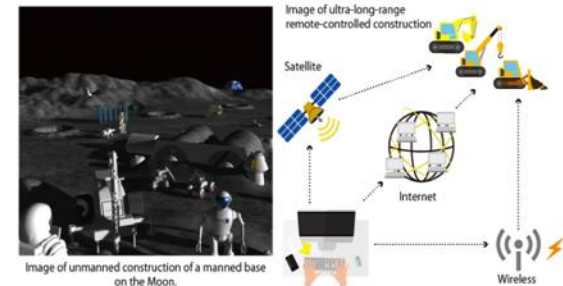
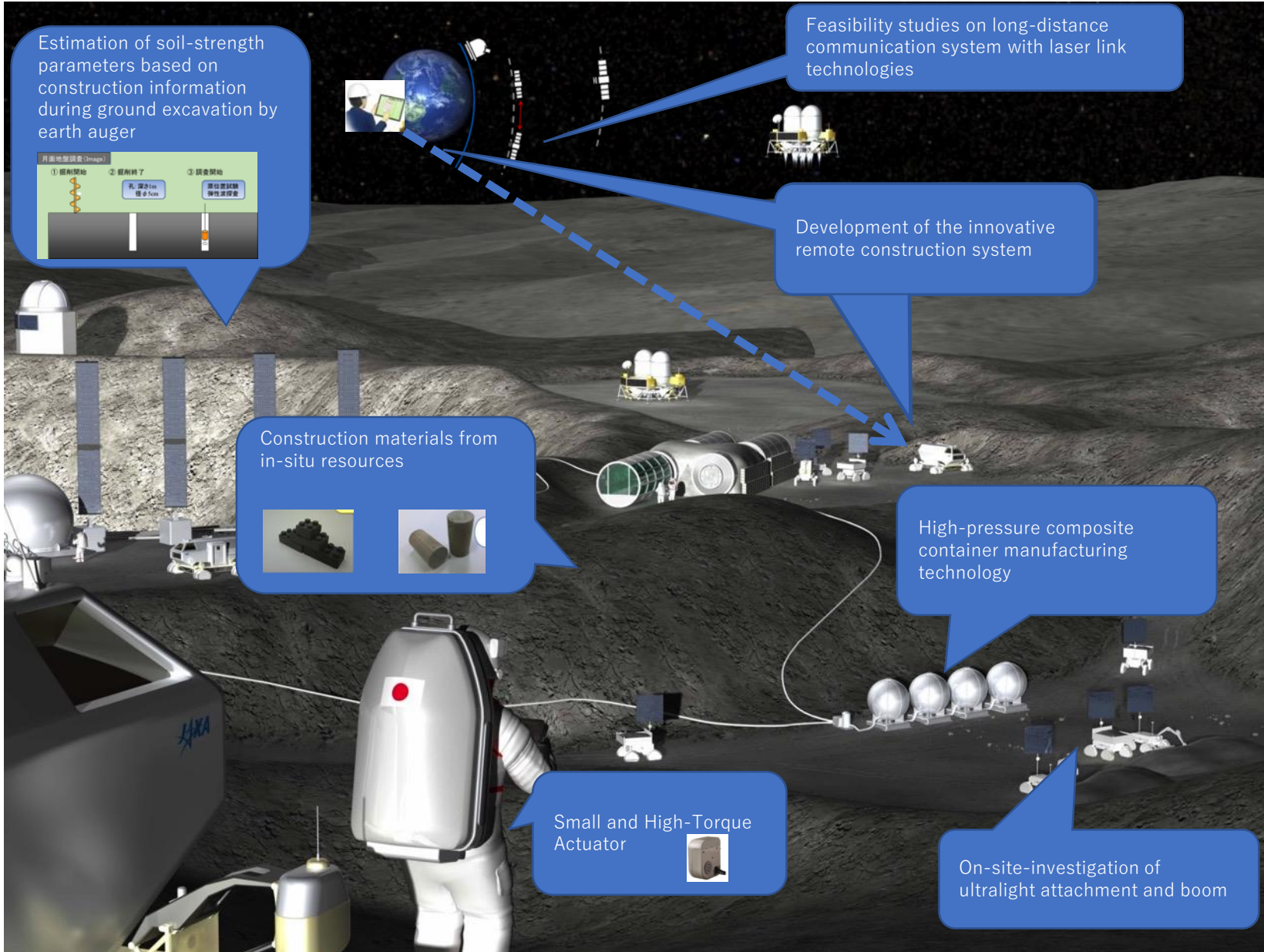


Image of cooperative exploration with multilanders




More than 90% of the companies are **from non-space industries** such as construction, housing, machinery, material etc..

Our Vision in Image –to give you an idea



Estimation of soil-strength parameters based on construction information during ground excavation by earth auger



① 掘削開始 ② 掘削終了 ③ 調査開始

孔深2m 径5cm

掘削試験機 掘削調査機

Feasibility studies on long-distance communication system with laser link technologies

Development of the innovative remote construction system

Construction materials from in-situ resources



High-pressure composite container manufacturing technology

Small and High-Torque Actuator



On-site-investigation of ultralight attachment and boom

Construction

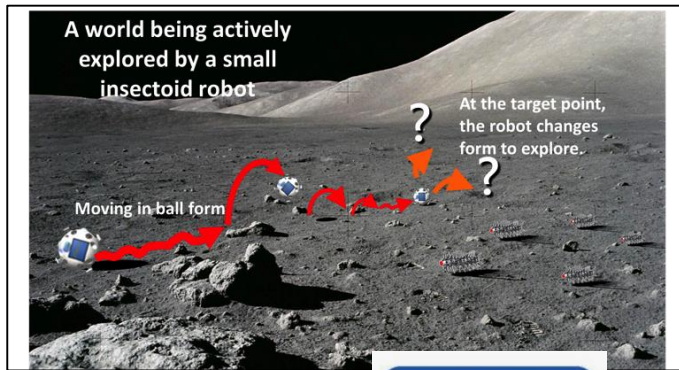
Mini Robots Tech

Agri Tech

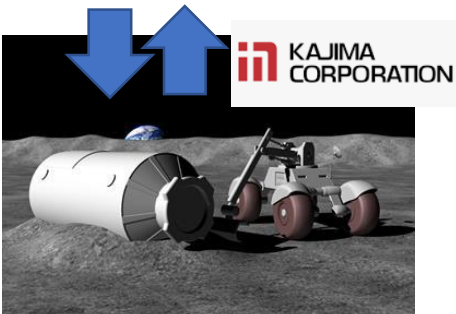


© Kajima Corp

At dam construction



袋培養設備



Artist's rendering of a lunar outpost construction

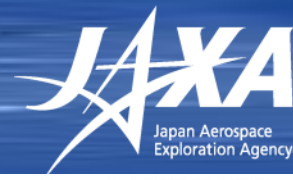
- Remote controlled construction

- Insectoid robot for lunar surface activities

- Concept Study for Lunar Plant Factory

International Cooperation

- Utilization of Kibo -



- ✓ As of today, more than 200 satellites have been successfully deployed from Kibo.
- ✓ This year, 8 CubeSats developed by **Egypt, Guatemala, Indonesia, Mauritius, Nepal, Singapore, Sri Lanka, and Rwanda** will be deployed from J-SSOD.

JEM Small Satellite Orbital Deployer: J-SSOD



CubeSats developed by Sri Lanka and Nepal were handed over to JAXA Tsukuba Space Center in February, 2019

Many countries have deployed their country's CubeSats from ISS/Kibo.



Successful example of international collaboration.

How about a similar collaborative framework on the moon?

- Sustainability in space exploration requires wide participation from many players, including space emerging countries.
- Especially lunar surface exploration needs many opportunities of observation to fully understand the scientific features. Contribution from space emerging countries by rover or sensors are welcome.
- JAXA hopes to further promote space exploration activities, together with new players.