

Target Launch Year: JFY2026

Overview and Recent Status of

MMX

Martian Moons eXploration



The world's first sample return mission from the Martian moon, Phobos

The mission objectives are to investigate the origin of the Martian moons, the planetary formation process and place new constraints on the transport of materials through the Solar System.

The mission also aims to acquire new knowledge about the Martian sphere's evolutionary history and develop technology that will benefit future space exploration.

Phobos: MMX's Major Target



Phobos is a small body orbiting 6,000 km above the Martian surface. It interests us as a minor body and a moon of Mars, but no full-scale exploration has been conducted. It is sometimes referred to as **the most important unexplored body in the solar system**.

Overview

- Mars's primary moon
- 6000km from the Martian surface
- Discovered in 1877
- 20~30km diameter (triaxial)



Phobos
(from ESA Mars Express)

Perspectives of exploration

As a minor body

- The origin of Phobos
- Delivery capsule of water and organics in the solar system

As a Martian moon

- Particles from the Martian surface
- Outpost for crewed exploration

The most important unexplored body in the solar system

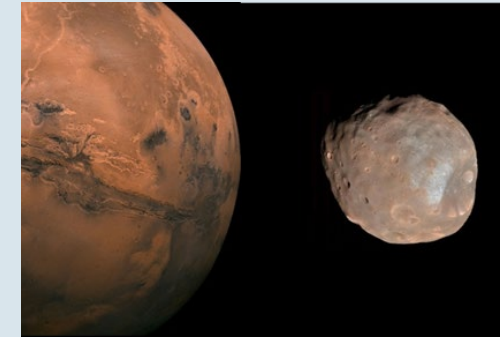
MMX Mission Objectives



The MMX mission objectives are composed of two aspects: planetary science and technology acquisition. They are clearly defined in the MMX mission requirements document.

Planetary Science, to uncover the origin of habitable environment in the solar system

1. To reveal the **origin of the Martian moons** and then to make progress in our understanding of **planetary system formation and primordial material transport** around the border between the inner and the outer parts of the early solar system.
2. To observe processes that impact **the evolution of the Mars system** from the new vantage point and advance our understanding of Mars' surface environmental transition.



Technology Acquisition for future exploration activity

To acquire spacecraft technology such as

1. **astronautics** capability to reach planetary moon system and achieve round trip to Martian system.
2. **robotics** capability to reach and stay on the surface of the Martian moon and perform sophisticated sample retrieval.
3. **deep space communication** capability optimized for the combination with the new ground station.



Three Additional Values to MMX Mission



In addition to the "outputs" obtained by achieving primary mission goals, outputs of the hosted missions and unintendedly obtained by-products in the mission compose "outcomes" and create new value for the mission.

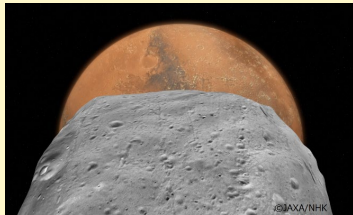
Pioneering crewed Mars exploration, Phobos as a bridgehead to Mars



Credit:
NASA/JPL-Caltech
University of Arizona

MMX will explore the possibility of using **Phobos as a natural space station** by establishing the technology required for a round-trip to the Martian sphere--essential for crewed Mars exploration--and by conducting detailed observations of Phobos's surface topography, ground information, and surface and surrounding environment.

Outreach from the Martian sphere, Ultra-high-definition image of SHV



Credit:
JAXA/NHK

JAXA and NHK jointly developed the "**Super Hi-Vision Camera (SHV)**" capable of filming 4K and 8K images in space. SHV acquires the world's first ultrahigh-definition motion pictures of Mars and its moons in proximity. Through vivid and inspiring media, SHV will convey this new horizon, which has never been seen in detail, to people worldwide.

Fragments of Martian meteorite on Phobos, Impurities in Phobos samples



CCredit:
Natural History
Museum Vienna

MMX will bring back inevitable impurities in Phobos samples. **Martian meteorites** were ejected from the Mars surface in meteorite impacts, and their fragments are sparsely deposited on the surface of Phobos. The fragments may interest some researchers to constrain the chemical state of the Martian surface layer and its transition.

Mission Profile



The mission is targeting the launch in 2026. **A five-year trip** is planned to retrieve samples back to Earth within three years of staying around Mars. The mission is full of critical and attractive events.



1. Launch

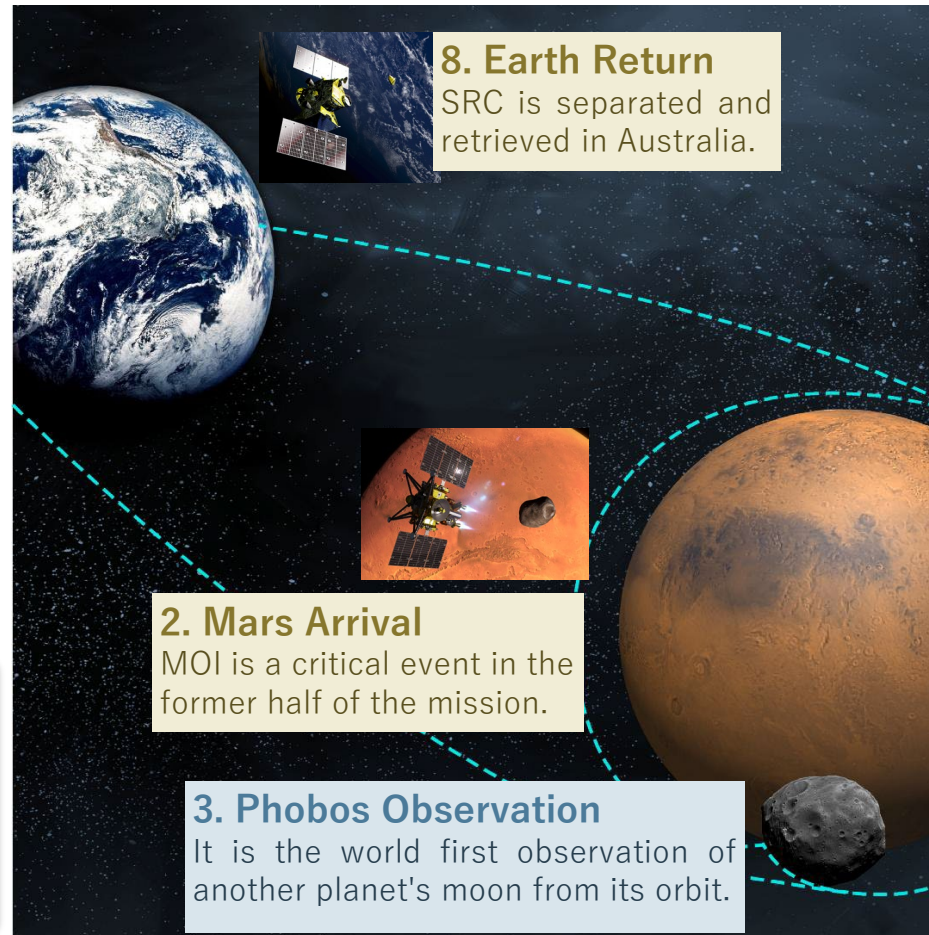
MMX is launched from Tanegashima with H3 launch vehicle.

Launch : Oct. 2026

Mars Arr. : Aug. 2027

Mars Dep. : Nov. 2030

Earth Arr. : Jul. 2031



8. Earth Return

SRC is separated and retrieved in Australia.

2. Mars Arrival

MOI is a critical event in the former half of the mission.

3. Phobos Observation

It is the world first observation of another planet's moon from its orbit.

7. Mars Departure

MOE is a critical event in the latter half of the mission.

6. Deimos Observation

Another moon Deimos is observed with flyby in the last phase around Mars.

5. Phobos landing

The climax of the mission is Phobos soft landing and sampling. Two attempts are planned.

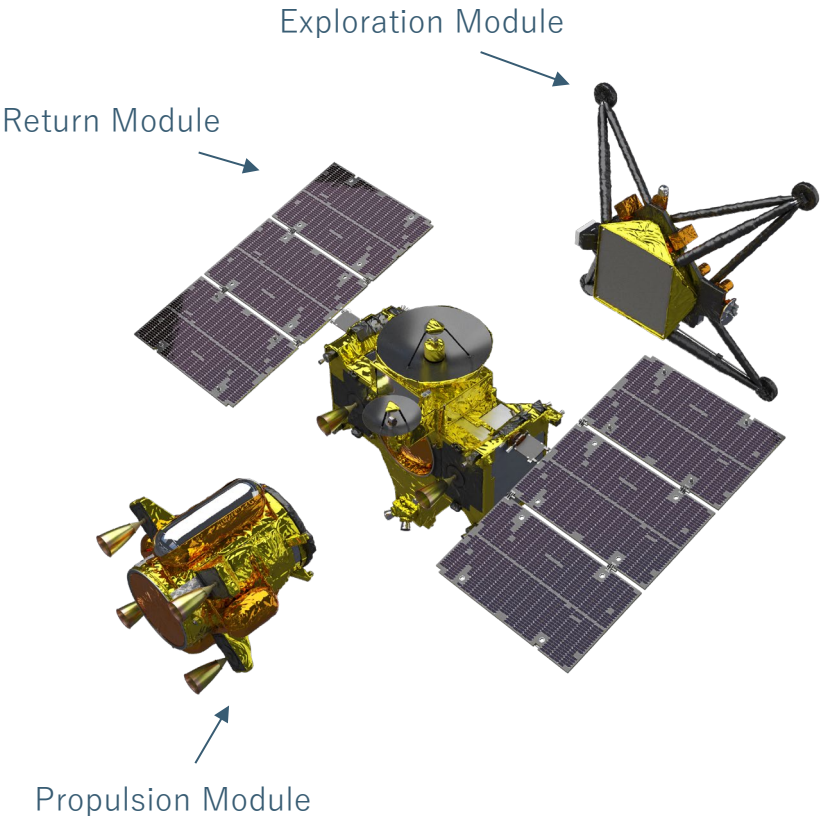
4. IDEFIX Deployment

Rover lands on Phobos and contributes to lander's safety and surface science.



Spacecraft System

The prime contractor, **MELCO**, is responsible for the development of the spacecraft system. The MMX spacecraft weighs **4480kg at launch**, has a complex system, and is composed of three modules.



Item	Specification
Configuration	3 modules (Propulsion/Exploration/Return)
Launcher	H3-24L Launch Vehicle
Launch Year	FY2026
Duration	5 years
Launch Mass	4480kg
Propellant	Propulsion Module: 1840kg Return module: 1190kg
RF Link (@2.7AU)	X-band: 32kbps Ka-band: 128kbps
Power	High efficiency thin-film solar cells
Landing Nav.	Image-based Navigation (SLIM-derived technology)

Mission Instruments



13 mission instruments are grouped into three categories; remote/in-situ observation, sampling and retrieval, and hosted missions for exploration technology. Four of them are provided by international partners.

Remote sensing and in-situ observation

TENG00: TElescopic Nadir imager for GeOmOrophology

OROCHI: Optical RadiOmeter composed of Chromatic Imagers

MIRS: MMX InfraRed Spectrometer

MEGANE: Mars-moon Exploration with Gamma Rays and Neutrons

LIDAR: Light Detection And Ranging

IDEFIX: Rover

CMDM: Circum-Martian Dust Monitor

MSA: Mass Spectrum Analyzer

Sampling and retrieval

C-SMP: Coring Sampler

P-SMP: Pneumatic Sampler

SRC: Sample Return Capsule

Hosted Missions

IREM: Interplanetary Radiation Environment Monitor

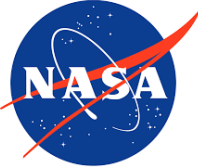
SHV: Super Hi-Vision camera

Four instruments **highlighted** is provided by international partners.

International Collaboration on MMX



International collaboration is established **with worldwide space agencies**. The items include onboard hardware, operation support, activity support for participating scientists, etc.

	• Gamma-ray and Neutron spectrometer (MEGANE) • Pneumatic Sampler (P-Sampler) • DSN and/or Navigation Support
	• Near-infrared Spectrometer (MIRS) • Rover (IDEFIX) (with DLR) • Flight Dynamics
	• Ka-band downlink communication system • Operation support by ESA tracking network
	• Rover (IDEFIX) (with CNES) • Experiments using the Bremen Drop Tower

Items in **bold font** are onboard instruments.

Project Implementation Structure



As Japan's largest exploration program, MMX has established a **broad-based cooperative and promotional framework** with overseas space agencies, companies, the scientific community, and other stakeholders to ensure the program's execution.

Space Agencies



Companies

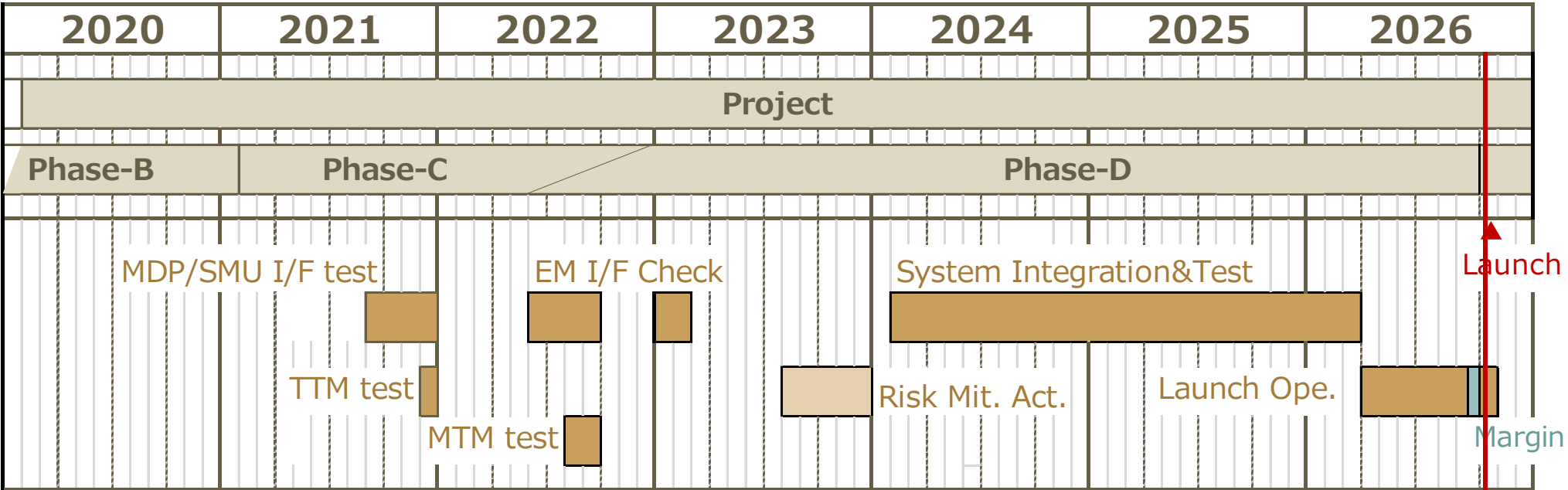


Science Community (affiliations of the science board members)

MMX Development Schedule



The System integration test began in February 2025 at Melco Kamakura Works and continued until March 2026. Final electrical tests were completed in June at the launch site. Development has progressed steadily toward a launch in FY2026.

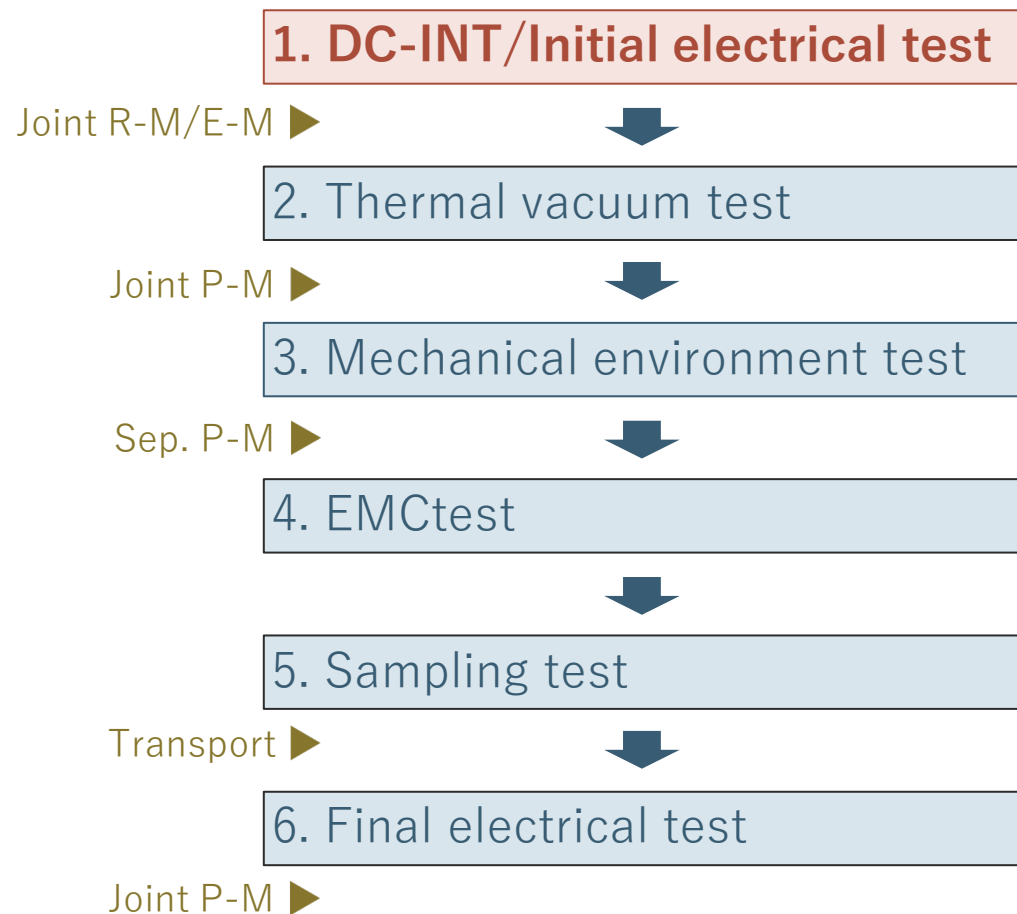


October, 2026

System Integration & Test



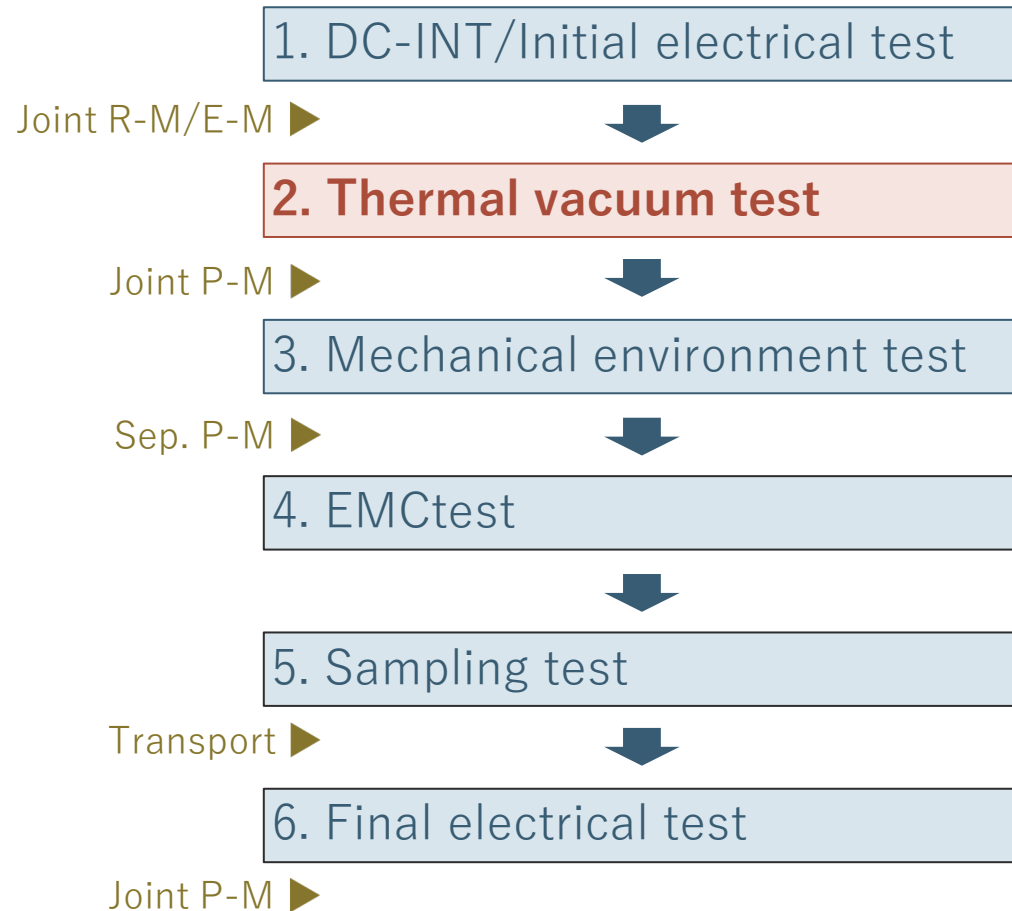
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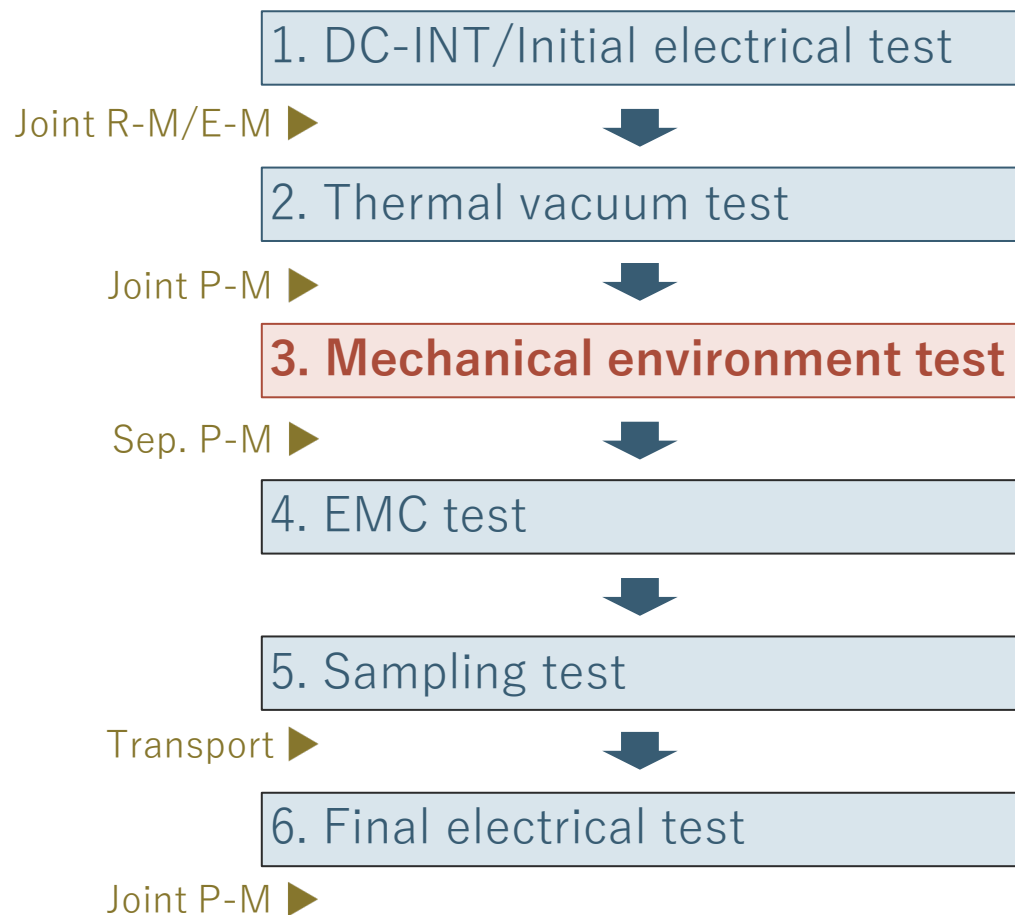
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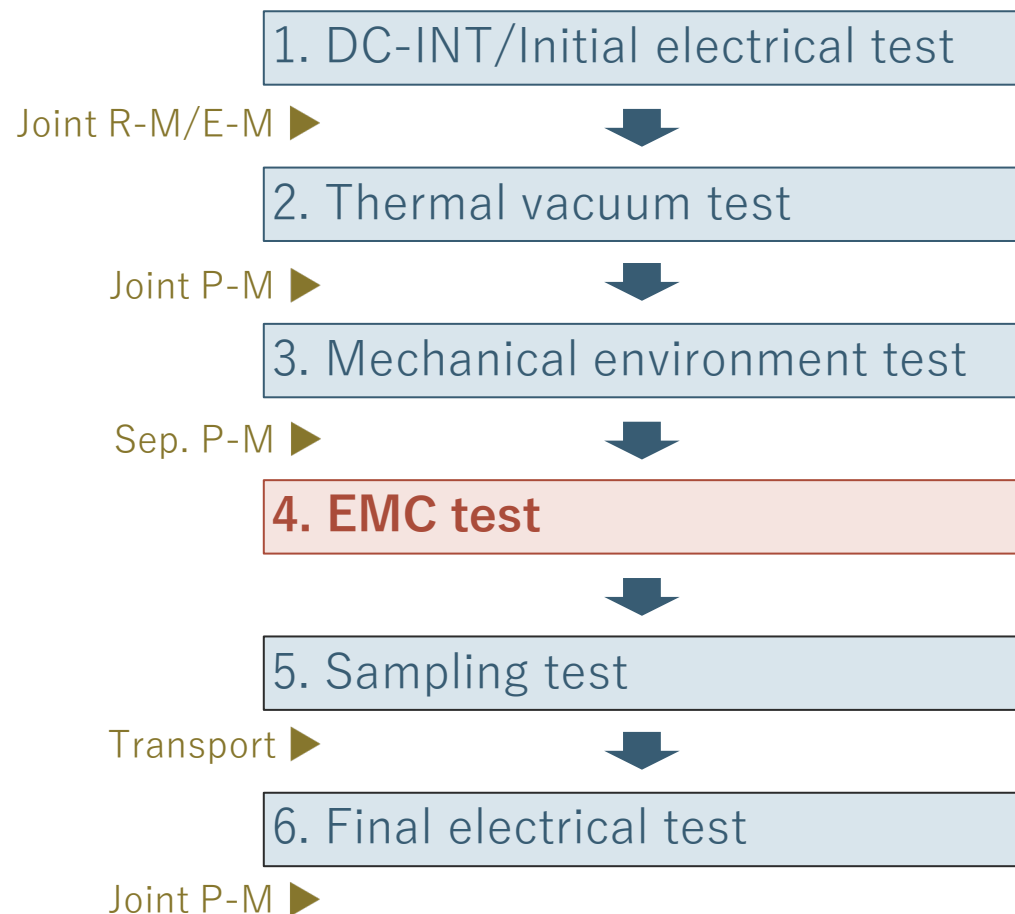
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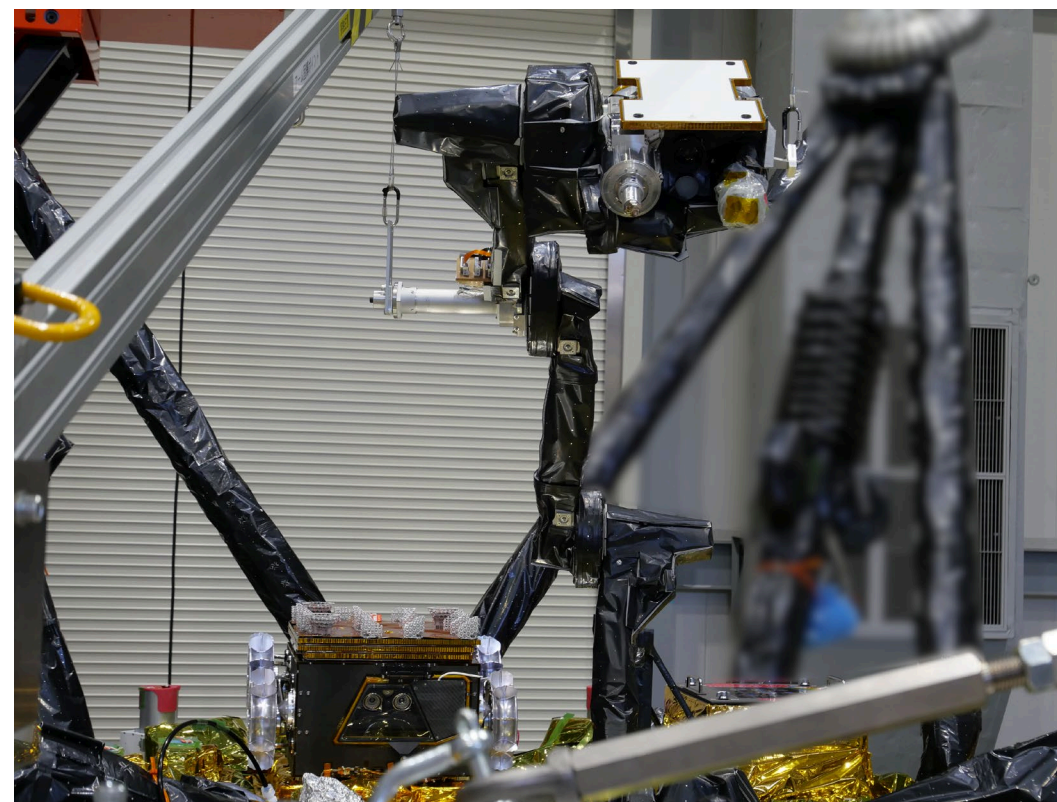
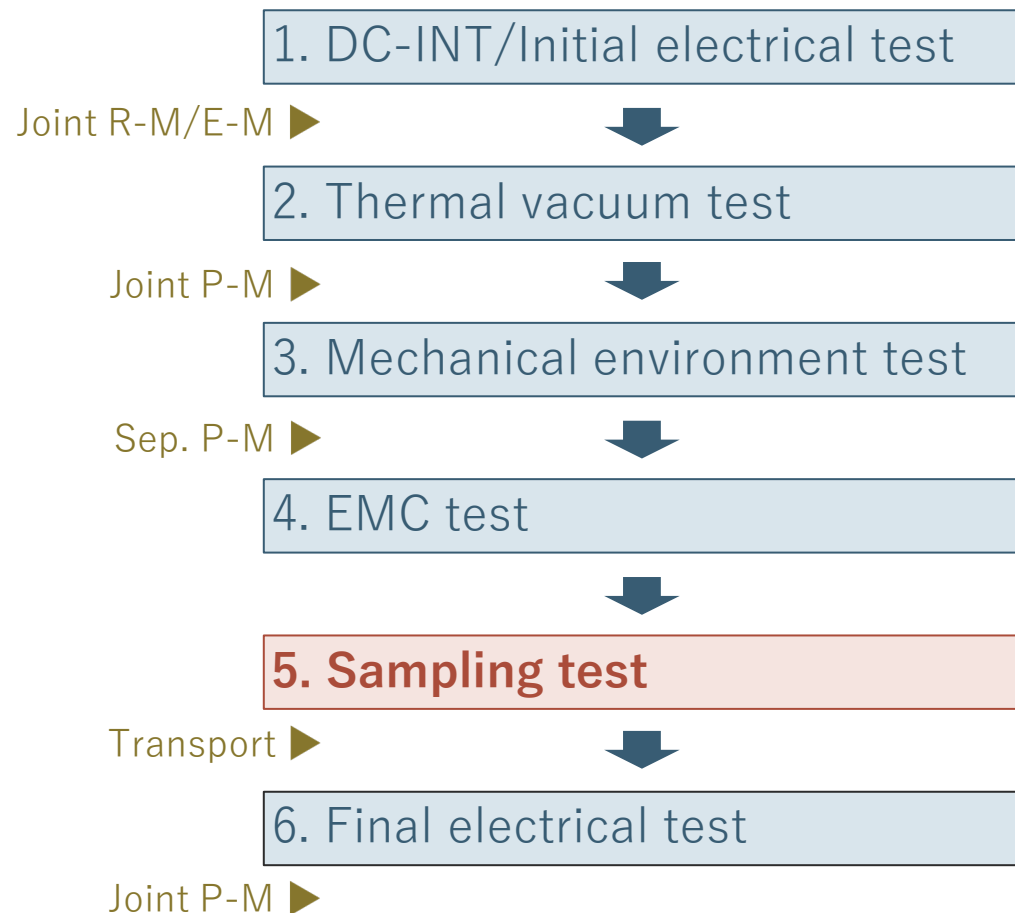
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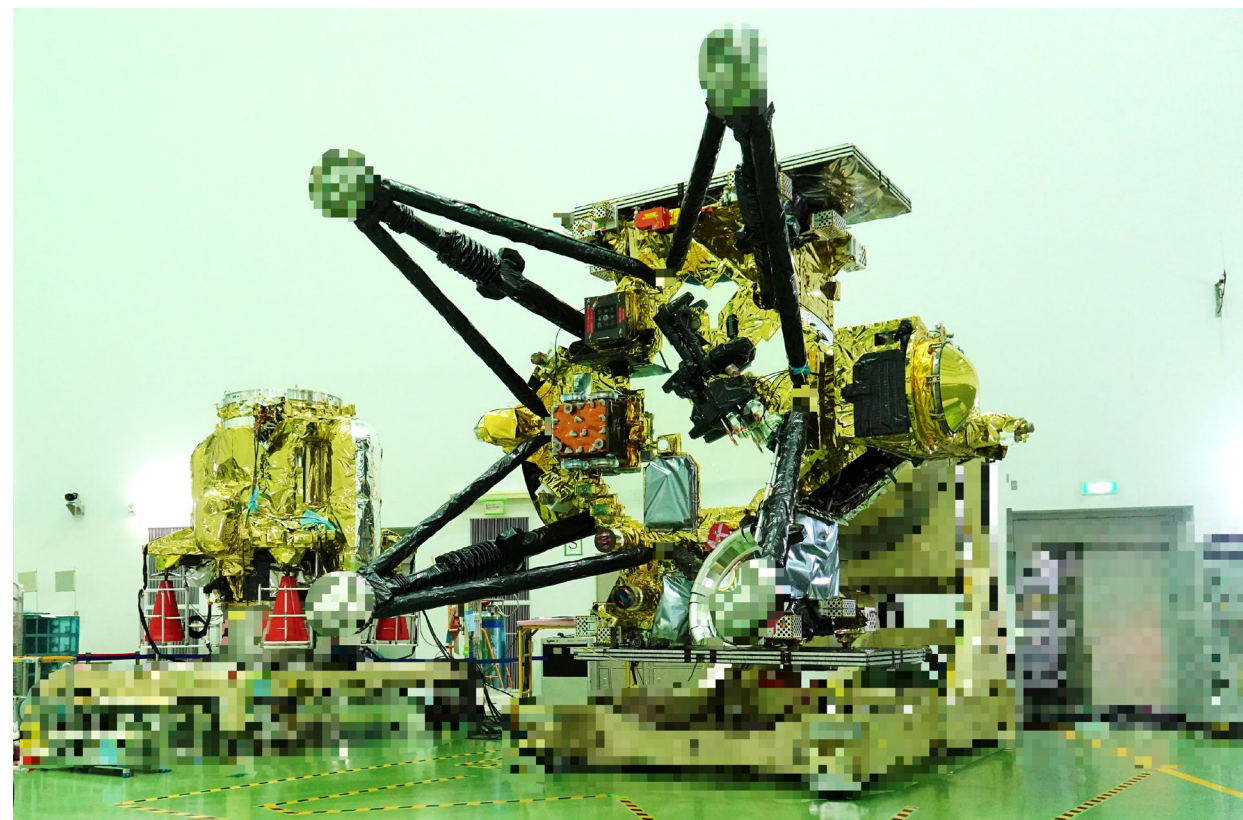
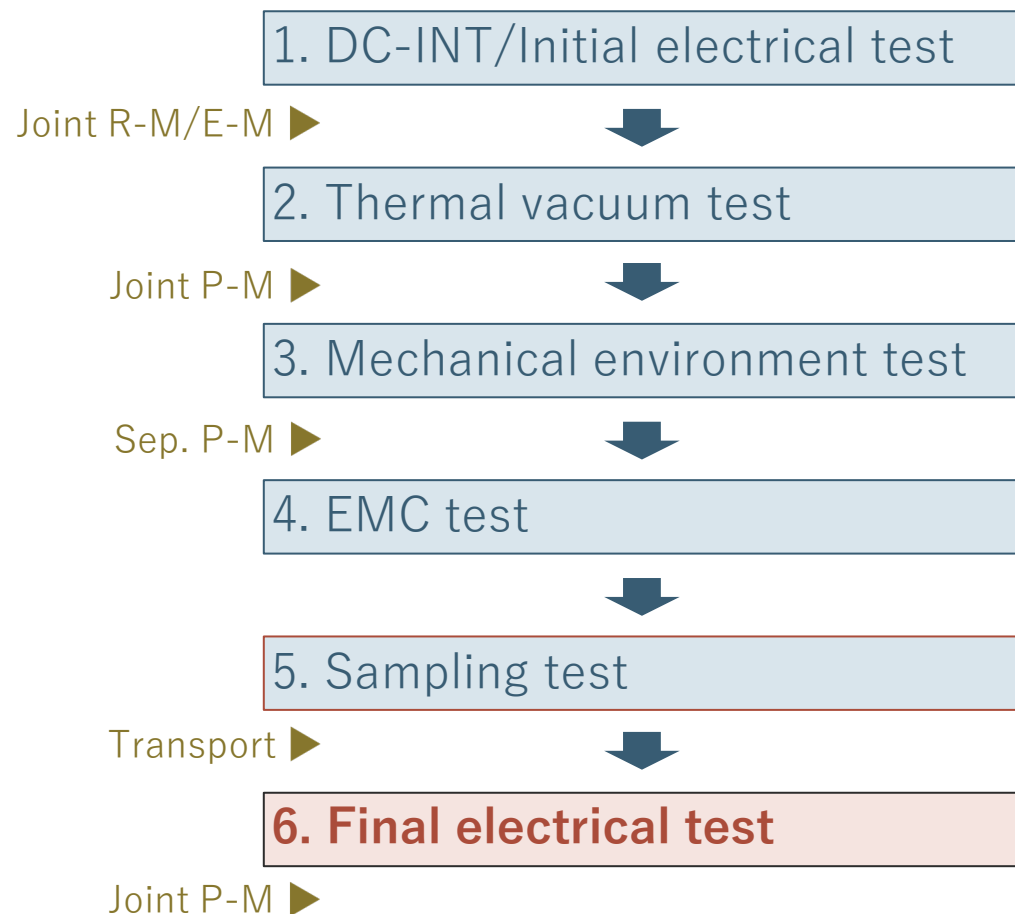
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- MMX will launch in FY2026, achieving **the world's first sample return from Martian moon Phobos**. The mission will advance science on Mars' moons, the Martian surface, and future crewed Mars exploration. MMX is **Japan's unique Martian system exploration mission**.
- The prime contractor, **MELCO**, is responsible for the development of the spacecraft system. The MMX spacecraft weighs **4480kg at launch**, has a complex system, and is composed of three modules.
- **International collaboration is established with worldwide space agencies**. Items include onboard hardware, operational support, and activity support for participating scientists.
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