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Mitsubishi Electric Begins Developing Martian Moons Exploration Probe

Unprecedented round-trip mission to search for traces of water and organisms

TOKYO, February 21, 2020 – [Mitsubishi Electric Corporation](http://www.MitsubishiElectric.com) (TOKYO: 6503) announced today that it has been designated by the Japan Aerospace Exploration Agency (JAXA) as the contractor of the Martian Moons eXploration (MMX) space probe. Mitsubishi Electric, which has already initiated development activities for the project, will be responsible for the MMX's system design, manufacturing and operation, leveraging technologies that it first developed for the Smart Lander for Investigating Moon (SLIM) and the “Kounotori” H-II Transfer Vehicle (HTV). The MMX's mission is to determine the origins of Mars and its two moons, Phobos and Deimos, as well as discover how water and organic substances became part of the primordial solar system.



Rendition of MMX space probe

MMX Space Probe Features

1) Proven technology will support world's first round-trip mission to Martian moon

The MMX space probe will adopt existing space technologies, such as trajectory analysis and orbital deployment, which Mitsubishi Electric originally developed for the SLIM's high-precision landing system and the HTV's guidance, navigation and control systems.

2) *New precision landing technologies for touching down on unknown terrain*

To gather samples of one of the Martian moons, the descent and landing will use a built-in camera and pinpoint landing technology developed for the SLIM. Also, multiple landing attempts in low gravity will be possible using a newly developed shock-absorbing mechanism and unique landing gear.

3) *Lightweight design with three-module configuration*

A three-module design, consisting of a propulsion module for traveling to Mars' vicinity, exploration module equipped with research payload and return module for journey back to Earth, will enable the MMX to reduce its weight for more efficient operation by disengaging the propulsion module, and later the exploration module, once their purposes are finished. In addition, to design the MMX within the capacity of the launch vehicle (rocket), an optimum travel plan will be devised to minimize the amount of necessary propellant, which accounts more than half of the total launch weight.

MMX Space Probe Overview

Launch Date	Scheduled during Japanese fiscal year 2024 (April 2024 to March 2025)
Flight Profile	Single Earth-Mars round trip
Probe Weight	Approx. 4,000kg
Mission Duration	Approx. 5 years: <ul style="list-style-type: none">• Arrive in orbit around Mars in Japanese fiscal year 2025• Return to Earth in Japanese fiscal year 2029
Mission Objectives	<ul style="list-style-type: none">• Establish technologies required for round trip between Earth and Mars• Develop advanced techniques for sampling an astronomical object• Establish optimal communication technologies between Earth and the MMX probe using newly developed ground station• Understand how water and organic substances became part of our primordial solar system• Discover how Mars, Phobos and Deimos were formed and evolved

About the MMX Project

There are two different hypotheses regarding the origins of the two Martian moons, Phobos and Deimos. One is that they are asteroids captured after the formation of Mars, and the other one is that they were once part of Mars itself and separated after a large body collided with the mother planet, the so called giant-impact hypothesis. The Martian Moons Exploration (MMX) international project will help to determine the origin of the two Martian moons, as well as research the birth and evolution of Mars itself. Once the MMX space probe arrives in orbit around Mars, it will observe the planet and its two moons, and then collect samples from one of the moons to bring back to Earth. By identifying and analyzing any hydrated minerals, water, organic or other substances in the samples, the MMX international project will help determine how these substances

became part of the primordial solar system. The launch date is scheduled during the Japanese fiscal year of 2024 (April 2024 to March 2025) and the mission's duration will be five years. The project is expected to produce important new technologies for interplanetary round trips, high-precision planetary surface sampling and advanced communication using a new deep-space exploration ground station in Nagano, Japan, thereby contributing significantly to future space exploration.

Mitsubishi Electric's Space Systems Business

Mitsubishi Electric has contributed to Japanese space exploration and satellite technologies by participating in projects in which guidance, navigation and control technologies have played key roles. These include the Space Flyer Unit (SFU) reusable experiment and observation spacecraft, the outer space satellite rendezvous docking experiments using the Engineering Test Satellite VII's "Chaser" and the "Target" satellites, and the HTV avionics modules. Also, in addition to the SLIM, Mitsubishi Electric is developing the HTV-X service module as a next-generation unmanned cargo transport module that will deliver supplies to the International Space Station. Mitsubishi Electric's development of advanced technologies will help to establish guidance, navigation and control systems for satellites and space probes, which are envisioned to become key Japanese technologies that provide foundational support for international observation projects, starting with a manned station near the moon, a lunar surface mission and the exploration of Mars.

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About Mitsubishi Electric Corporation

With nearly 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded a revenue of 4,519.9 billion yen (US\$ 40.7 billion*) in the fiscal year ended March 31, 2019. For more information visit:

www.MitsubishiElectric.com

*At an exchange rate of 111 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2019