JAXA’s Strategic Mars Exploration Program (JSMEP) for Understanding Origin, Evolution, Inventory of Water on Mars

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The Mars-moon system is a promising target for exploration in the broad field of planetary science: e.g., geology, geochemistry, astrobiology, and comparative planetology. The international Mars science community has set a long-term goal toward achieving Mars sample return (MSR) and human exploration. MSR will address questions on the origin (e.g., source of building blocks), interior evolution (e.g., crust-mantle differentiation and mantle dynamics), the potential biological history (e.g., nature and extent of habitability and preservation of biosignature), and geologic history of Mars with an emphasis on the role of water. Previous Mars exploration missions have provided compelling evidence for the presence of liquid water during the earliest geologic era (Noachian: >~3.9 Ga) of Mars. Observations of dense valley networks, evaporites (e.g., gypsum) and hydrous minerals (e.g., clays) that are commonly formed by aqueous processes imply that, at some time in the past, Mars had an Earth-like active hydrological cycle with lakes, oceans, possibly also aquifers and groundwater, and had the potential for life.

According to the international trend for Mars exploration and potential significance for understanding the current and past surface/subsurface aqueous environments, JAXA plans a strategic Mars exploration program (JSMEP). JSMEP starts with a Martian moon’s sample return mission (MMX: Martian Moons Exploration) in 2024-2029, followed by a Mars orbiter (MO) in later 2020s and a Mars lander/rover (ML/R) mission in early 2030s. JSMEP’s goals are 1) to address questions of water on Mars [origin and delivery (MMX), distribution and inventory (MO), and chemical evolution (ML/R)], 2) to ensure expansion of the areas of human activities by exploring habitable subsurface world, and 3) to acquires key technologies including EDL (entry-descent-landing) with aerodynamic control, drilling and sampling on the surface, deep space telecommunication, transportation to/from the Mars orbit, and planetary protection.

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