Martian Moons eXploration MMX: Current Status Report 2020

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The small Martian moons Phobos and Deimos are likely a byproduct of the formation of Mars, a potentially habitable rocky planet comparable with the Earth. Owing to the lack of definitive evidence, their origin is still under debate between two leading hypotheses: the capture of volatile-rich primordial asteroid(s) and the in-situ formation from a debris disk that generated by a giant impact onto early Mars. Whichever theory is correct, the Martian moons are expected to preserve key records of volatile material transport that would make the terrestrial planets habitable in the early solar system. Through close-up observations of both moons and sample return from Phobos, MMX will settle the controversy of their origin, reveal their evolution and constrain the early solar system evolution around the region near the snow line. Monitoring of global circulation and escape of the Martian atmosphere will be also conducted to reveal basic processes having shaped and altered the Martian surface environment. After the start of the conceptual study in 2015, MMX took a series of review processes and now proceeds to phase B as a project of JAXA. The MMX sample return has been classified as unrestricted through the last year’ s COSPAR review because ejecta materials from Martian impact craters are probably mixed in Phobos regolith but estimated to be sufficiently sterilized. Survey and analysis of such Martian materials from returned samples are expected to provide us unique constraints for the long-term evolution of the Martian surface environment. MMX is planned to be launched in 2024, arrive at the Martian system in 2025, conduct close-up observations, landing and sampling targeting Phobos for ~3 years, depart the Martian system after Deimos multi-flyby in 2028 and return to Earth in 2029. To acquire observation data and samples enough to achieve scientific objectives, MMX will be equipped with 11 science instruments includes 7 sensing instruments, 2 sampler systems, a return capsule and a rover. MMX also has technological contributions to expanding future human activity toward deep space under international collaboration. The realization of a round trip to the Martian system is part of such contributions by this mission. As other technological contributions, MMX is planned to carry two additional sensing instruments: an interplanetary radiation environment monitor to obtain data useful for planning future human missions and a high vision camera for outreach objectives.

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