

Strategic Mars exploration: International MIM (Mars Ice Mapper) project and possible Japanese contribution

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Mars is an internationally important target for future exploration of the solar system, since it once retained a habitable environment in the past and lost it in the course of its evolution. Mars may still have the past ocean water in the form of subsurface frozen soil and hydrous minerals, which might have played an important role in life on the planet in the past. In other words, Mars is a planet where we observationally investigate the evolution of the aqueous environment as a consequence of the interaction between the subsurface hydrosphere, atmosphere, and space environment. We have considered plans to provide sub-payloads to the international Mars Ice Mapper (MIM) project (see below) with a focus on water storage, transport, and escape processes. There are two science objectives of this project: "Understanding the upper/lower coupling of the atmosphere and space environment effects important for the evolution of planetary atmosphere" and "constraining water dynamics at Mars including shallow subsurface and the origin of volatiles". In order to achieve the objectives, the plan sets three achievement goals and ten corresponding observation items. It will be achievable by provision of two science instrument packages onboard the MIM orbiter and a small EDL demonstration lander.

The International MIM project is a Martian orbiter mission to conduct reconnaissance observations for future manned exploration, which is under joint study by four space agencies: NASA of USA, CSA of Canada, ASI of Italy, and JAXA. SOI (Statement of Intent) was signed by the above four organizations in January 2021. In the SOI, Japan expressed its intention to be responsible for the MIM orbiter satellite system, a portion of the science payloads, and sub-payloads including a small lander. Subsequently, the international Measurement Definition Team (MDT) for the MIM project was selected through a global competition, and nine Japanese scientists were selected as MDT members. In the final report of the international MDT (<https://www.exploration.jaxa.jp/news/20220909.html>), the scientific observation items and related scientific instruments related to the upper/lower atmosphere coupling and space weather as well as a small lander, that are under consideration in Japan as stated above, are listed as candidates sub-payloads for MIM.

The Japanese participation in the MIM project also has the objective of achieving an exploration technology demonstration for the next full-scale landing exploration from an engineering perspective. It is considered as an important step in strategic Mars exploration in conjunction with international space exploration. In the presentation, an overview of the international MIM project and its current status will be reported.

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