

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – missions current and future (3A)

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INTERNATIONAL MARS ICE MAPPER MISSION: A MULTILATERAL MODEL FOR FUTURE
MARS EXPLORATION

Abstract

The International Mars Ice Mapper (I-MIM) mission concept is being developed by the Italian, Canadian, Japanese, and US space agencies (ASI, CSA, JAXA, and NASA), with a primary goal of characterizing adequate, accessible water ice in the upper 0-10 m and its overburden. Conceptually, the mission maximizes dual science benefits: • science for human exploration (measurements supporting human-led surface science, human-class landing/launch, ISRU, and civil engineering); and, • fundamental science related to the geologic and climatological evolution of Mars and its potential for past or present habitable environments. Based on community inputs from its competitively selected international I-MIM Measurement Definition Team, Agency partners are pursuing an updated mission architecture that includes three spacecraft with complementary ice-related science payloads. A JAXA-provided bus would host two radar instruments: a CSA-provided polarimetric L-band (930 MHz) Synthetic Aperture Radar (SAR) and an ASI-provided Very High Frequency (VHF) Shallow Radar Sounder (700-1000 MHz). An ASI-provided Large Deployable Reflector (LDR) would support the SAR and act as part of the ASI-provided telecommunications subsystem. It would provide direct-to-Earth support for the above orbiter and relay for a JAXA-provided demonstration lander and a NASA-provided, free-flying smallsat with a high-res imager. JAXA might also provide atmospheric sensors. NASA would provide the launch vehicle and delivery system for all. Together, these contributions would reveal the near surface of Mars, study the role of ice in geologic and climatological change, and identify ice-rich candidate sites for human missions to Mars. Innovative collaboration practices include: • a multilateral governance structure of co-equal partners that emphasizes consensus-based decision-making, while empowering each space Agency to use

its own system of mission management; • the cultivation of an international science community that forges deepening relationships between Mars scientists and human mission planners; and, • the ability to deliver multiple spacecraft through rideshare opportunities, leveraging rapidly developing commercial capabilities. Reflecting the 2023 IAC Global Challenges and Opportunities theme, the I-MIM model advances international collaboration in making Mars missions affordable and achievable. For each Agency, the cost of a small mission results in shared “Big Science.” This approach offers lessons for effective multilateral missions, paving the way for even more complex cooperation across Agencies, universities, companies, and disciplines that will be necessary for a future sustained human-robotic presence at Mars.