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ANNOUNCEMENT OF OPPORTUNITY FOR MEMBERSHIP OF THE SCIENCE STRATEGY TEAMS OF THE JAXA MARTIAN MOONS EXPLORATION MISSION (MMX)

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1. INTRODUCTION

The Martian Moons eXploration (MMX) mission is a JAXA-led mission that will fly to Mars orbit to investigate Phobos and Deimos, and that will sample > 10 g of material from the surface of Phobos for return to Earth for scientific analysis.

The key scientific goals of MMX are:

- To reveal the origin of Mars' moons, and to improve our understanding of planetary system formation and of primordial material transport around the border between the inner and outer regions in the early Solar System.
- To observe processes that have impact on the evolution of the Mars system and to advance our understanding of Mars' surface environmental transition.

Following approval by the European Space Agency (ESA) Science Programme Committee (SPC) at their 158th meeting held in November 2018 of a Mission of Opportunity (MoO) participation by the Science Programme in the MMX mission, ESA has already appointed, in 2019, two members to the MMX 'Science Board'.

Through this Announcement of Opportunity (AO) ESA solicits proposals for membership of the Science Strategy Teams (SSTs) of the JAXA-led MMX mission.

The timeline associated with this AO is reported in Table 1.

Table 1: AO Schedule

Date	Event
13 February 2023	Release of this AO
22 March 2023 (12:00 CET - noon)	Proposals due
May 2023	Appointment of selected scientists

2. BACKGROUND INFORMATION

2.1. MMX Mission Summary

MMX builds on the technical and operational experience that JAXA has developed in the field of sample return from small bodies with the Hayabusa missions. The MMX mission is scheduled for launch in September 2024.

The MMX spacecraft is planned to arrive at Mars in August 2025 and perform a series of manoeuvres for Mars orbit insertion and approach of Phobos. During a 'proximity science phase' MMX will make close up observations of Phobos with its remote sensing instrument complement. The spacecraft will also make observations of Mars' atmosphere and surface, and characterise the cis-Mars environment.

Remote-sensing instruments on board the MMX mission include:

- The TElescopic Nadir imager for GeOmOrphology (TENGOO), a narrow-angle camera;
- The Optical RadiOmeter composed of CHromatic Imagers (OROCHI), a wide angle multi-spectral camera;
- A LIght Detection And Ranging (LIDAR) instrument, to measure altitude and albedo;
- An MMX Infra-Red Spectrometer (MIRS), for mineralogical studies;
- The Mars-moon Exploration with GAMMA rays and Neutrons (MEGANE) instrument;
- The Circum-Martian Dust Monitor (CMDM), to measure particle size $\geq 10 \mu\text{m}$;
- An ion mass spectrometer (Mass Spectrum Analyzer, MSA).

Following characterisation of Phobos' surface, touch down for sampling of Phobos material is foreseen. The sampling system comprises a coring sampler (with two core tubes plus one backup, each of which can contain $> 10 \text{ g}$ regolith) and a pneumatic sampler.

This phase also foresees deployment of the MMX rover. The MMX rover is equipped with a Raman spectrometer (RAX), an infrared radiometer (miniRAD) and four visible wavelength imagers.

Later mission phases will involve a fly-by of Deimos to carry out remote-sensing studies prior to entering a Mars to Earth transfer orbit in August 2028. On approach to Earth a re-entry capsule containing the Phobos sample is planned to be released for terrestrial atmospheric entry and landing in July 2029.

Following receipt of the capsule containing the samples, they will be transferred to the sample receiving facility at JAXA ISAS for curatorial activities, before objective-driven scientific analyses are performed at JAXA ISAS and external laboratories.

Please refer to publications in AO-D1 for further information about the MMX mission.

2.2. MMX Science Strategy Teams

The Science Working Team (SWT) of MMX contains five dedicated Science Strategy Teams (SSTs) (formerly called Sub-Science Teams) formed to address a set of science objectives that are derived from the overall mission science goals. The members of SSTs are part of the SWT.

The 5 SSTs cover the following themes:

- Origin of Phobos and Deimos;
- Early Solar System evolution;
- Surface science and geology;
- Mars science;
- Geodesy.

The MMX SSTs meet two times per year in person to discuss mission status, relevant science topics, and to plan mission science related activities. Other interactions are scheduled via teleconferences, and activities are expected to intensify as launch approaches.

SST members will have access to data acquired during mission operations to achieve their science objectives. It is expected that all members will participate in the analysis and publication of mission data.

Please refer to AO-D2 for further information about MMX Science Management.

2.3. Supporting Documentation

The following supporting documents are provided with this AO:

- | | |
|-------|-----------------------------|
| AO-D1 | MMX Publications List |
| AO-D2 | MMX Science Management Plan |

3. ELIGIBILITY AND APPOINTMENT CONDITIONS

This AO regards the selection of up to two members for each of the MMX SSTs and is open to scientists affiliated with institutes within the ESA Member States.

The ESA-appointed SST members will serve for a renewable term of three years.

Early career scientists are specifically encouraged to apply.

Proposals should demonstrate the candidate's expertise in one or more of the MMX science objectives and indicate the SST the proposal is intended for. The proposals should also include an explicit mention of the time commitment to the MMX-related activities and letter(s) of endorsement and financial support from the Head of the applicant's institution and/or the respective funding institution to their application.

Following evaluation of the proposals by ESA, the Director of Science will appoint, in concurrence with JAXA, successful candidates as ESA-appointed members of the SSTs of the MMX mission. The appointments will be *ad personam*.

Selected candidates are expected to attend the meetings and participate in activities of the MMX SSTs. The cost of travel and subsistence in connection with these meetings and activities must be borne by the proposers based on funds provided by national institutions and/or agencies.

ESA-appointed scientists will be required to submit short annual reports of their MMX-related activities to ESA. Before the end of the three-year term, if an ESA-appointed scientist wishes to renew their appointment, the report should also include a proposal for continuation of their work.

The Director of Science will decide, in concurrence with JAXA, whether or not to extend the appointment for a further term. The Director of Science may decide to discontinue the appointment at any time, based on the evolution of the MMX mission.

4. FORMAT AND CONTENTS OF THE APPLICATION

Proposals submitted in response to the AO are limited in length to 7 A4 pages (minimum font size 11 pt), excluding the Letters of Endorsement, and must contain the following information:

- A cover letter stating the proposer's name, title/position, affiliation, address, e-mail address and the SST to which the proposal is intended (max. 1 page);
- A description of the proposer's scientific expertise and experience that is relevant to the SST to which the proposal is intended, and of the proposer's experience in scientific collaborations (max. 2 pages);
- A description of the proposed contributions to the MMX SST specified, and a statement concerning the time availability of the proposer (max. 4 pages);
- Letters of Endorsement (in addition to the 7 A4 pages of the proposal), signed by the proposer's Head of Institute and/or relevant funding agency/institution, with the endorsement to the proposer's application and the explicit support with respect to the proposed activities and the availability of funding, facilities and infrastructure, as needed to the proposer for the accomplishment of the proposed tasks.

Proposals must be submitted as indicated in see Section 6.

5. EVALUATION CRITERIA

The following criteria will be used (in no particular order) in assessing and evaluating individual proposals:

- The proposer's competence and experience in fields related to the science objectives of the MMX mission and of the SST to which the proposer is applying;
- The importance and relevance of the proposed contributions to the MMX science objectives and to those of the SST to which the proposer is applying;
- The proposer's ability to work collaboratively within a team of scientific experts;
- Adequacy of the time that the proposer intends to devote to activities related to the MMX SST member role, and;
- Adequacy of any resources required by the proposer to carry out activities related to the MMX SST role.

6. PROPOSAL SUBMISSION

Proposals must be submitted electronically in PDF format (file size cannot exceed 5 MB) according to the instructions on the following webpage:

<https://www.cosmos.esa.int/web/mmx-ao-sst-2023>

and according to the deadlines listed in Table 1.

Proposers will receive confirmation upon successful receipt of their Proposals.

Enquiries regarding this AO should be addressed to:

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7. ACRONYMS

AO	Announcement of Opportunity
CMDM	Circum-Martian Dust Monitor
D/SCI	Director of the Science Programme of ESA
ESA	European Space Agency
ISAS	Institute of Space and Astronautical Science
JAXA	Japan Aerospace Exploration Agency
LIDAR	Light Detection And Ranging
MEGANE	Mars-moon Exploration with GAMMA rays and Neutrons instrument
miniRAD	(MMX rover) infrared radiometer
MIRS	MMX Infra-Red Spectrometer
MMX	Martian Moons eXploration
MoO	Mission of Opportunity
OROCHI	Optical RadiOmeter composed of CHromatic Imagers
PDF	Portable Document Format
RAX	Raman spectrometer
SPC	Science Programme Committee of ESA
SST	Science Strategy Team
SWT	Science Working Team
TENGOO	TElescopic Nadir imager for GeOmOrphology