

MMX Rover IDEFIX, Looking Forward to Launch and In-Situ Science from Phobos

Stephan Ulamec¹, Patrick Michel², Matthias Grott³, Susanne Schröder³, Heinz-Wilhelm Hübers³, Yuichiro Cho⁴, Olga Prieto-Ballesteros⁵, Naomi Murdoch⁶, Pierre Vernazza⁷, Jens Biele¹, Simon Tardivel⁸, Fabian Buse⁹, Christian Krause¹, Cedric Delmas⁸, Markus Grebenstein^{9,10}, Julien Baroukh⁸, Hirdy Miyamoto¹¹

¹German Aerospace Center, DLR-MUSC, Linder Höhe, Cologne, Germany

²Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Laboratoire Lagrange, Nice, France

³German Aerospace Center, DLR, Institute of Space Research, Berlin, Germany

⁴Department of Earth and Planetary Science, University of Tokyo, Tokyo 113-0033, Japan

⁵Centro de Astrobiología CSIC-INTA, Torrejón de Ardoz, Spain

⁶ISAE-Supaero University of Toulouse, France

⁷Laboratoire d'Astrophysique de Marseille, France

⁸CNES, 18 Avenue E. Belin, Toulouse 31401, France

⁹German Aerospace Center, DLR, Institute of Robotics and Mechatronics, 82234 Weßling, Germany

¹⁰Monash University, Clayton campus, VIC 3800, Australia

¹¹Department of Systems Innovation, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

E-mail: stephan.ulamec@dlr.de

IDEFIX is a rover aboard the JAXA Martian Moons eXploration (MMX) mission to be delivered to the inner moon of Mars, Phobos, to perform in-situ measurements on the surface. MMX is going to explore both martian moons, Phobos and Deimos, and return samples from Phobos back to Earth [1]. IDEFIX will perform complementary measurements to those from the orbiter or the returned samples, characterize the physical properties of the surface material, give information on heterogeneity and provide ground truth [2,3].

The payload of IDEFIX consists of a stereo pair of cameras looking ahead (NavCam) to image the area in front of the rover and characterizing the small-scale geological and spectrophotometric properties of Phobos' regolith in order to understand its origin and evolution, two cameras looking at the wheel-surface interface (WheelCam) to investigate the properties and dynamics of the regolith, a Raman spectrometer (RAX) to measure the mineralogical composition of the surface material and a radiometer (miniRAD) to measure the surface brightness temperature and determine thermal properties of both regolith and rocks. The cameras will serve for both, scientific and technological needs, including rover navigation and surface characterization to prepare the MMX main spacecraft landing and sampling.

The launch of MMX is planned for October 2026, the rover delivery to Phobos is currently foreseen for late 2028 or early 2029.

IDEFIX is attached to the main spacecraft and already at the Tanegashima Space Center, ready for launch.

The rover is a contribution by the Centre National d'Etudes Spatiales (CNES) and the German Aerospace Center (DLR) with additional contributions from INTA (Spain), TU Tokyo and JAXA.

References

- [1] Kuramoto, K., Kawakatsu, Y., Fujimoto, M. *et al.*, *Earth, Planets and Space*, **2022**, 74:12.
- [2] Michel, P., Ulamec, S., Böttger, U., Grott, M., Murdoch, N., Vernazza, P., Sunday, C. Zhang, Y., Valette, R., Castellani, R., Biele, J., Tardivel, S., Groussin, O. and Jorda L., *Earth, Planets and Space*, **2022**, 74:2
- [3] Ulamec, S., Michel, P., Murdoch, M., Vernazza, P., Grott, M., Knollenberg, J., Schröder, S., Hübers, H.-W., Prieto-Ballesteros, O., Cho, Y., Biele, J., Tardivel, S., Buse, F., Miyamoto, H., Krause, C. May, D., Delmas, C., Baroukh J., Mary S., Grebenstein, M., *Progress in Earth and Planetary Science*, **2025**, 12:97