



Subject: Mars Express Mission Extension request to ESA

The purpose of this letter is to solicit the support of the scientific community worldwide for the extension of the Mars Express (MEx) mission. MEx operations are currently extended until March 2023. However, it has been brought to our attention that a final decision on a new extension will be made at the SPC meeting of 7-8 March 2023.

MEx is the first mission sent by ESA to visit a planet other than Earth. It is a vivid and vibrant example of ESA's accomplishment as a space agency, with nearly 20 years spent orbiting Mars to explore it from deep into the surface all the way up to the outer fringes of its atmosphere, its magnetosphere, and its moon Phobos. It remains today one of the most effective assets to explore the Red Planet comprehensively. Its remarkable versatility, longevity, and dependability have allowed the mission to maintain a high science productivity throughout its existence. As proof, the number of articles per year derived from Mars Express data has remained remarkably high and stable for the last 10 years (see graph in Annex).

Among the main accomplishments of Mars Express, one may retain the following:

- the first detection of hydrated minerals at the surface, which has firmly established that Mars harboured once conditions conducive to the emergence of life;
- the characterisation and mapping of water ice on the surface and deep below it, which has helped decipher the recent evolution of Mars' climate and the internal layering of the polar ice caps;
- a new vision of the Martian atmosphere, with the first annual survey of ozone; the first detection of methane whose presence defies our understanding of chemistry on Mars, as well as the first comprehensive survey of the plasma surrounding the planet.

Since the orbit insertion of Mars Express, several other missions have joined it in its endeavour. Still, MEx leverages on unique capabilities to conduct its investigations:

- MEx has produced a near-global digital elevation model with twice the resolution of previous products, which is becoming the new standard for quantitative geomorphological studies. An extension to the end of 2025 would allow the remaining gaps to be filled and high-quality maps in colour and stereo to be produced for the

entire globe. These maps are needed to determine long-term volcanic rates, past and present global water balance, and to locate all climate-related landforms;

- The high apocentre of Mars Express makes it the only mission capable of measuring the solar wind upstream of Mars; this, combined with the MAVEN mission, provides a unique network to study solar wind interaction and escape. For the same reason, MEx has a unique vantage point to study the moon Phobos, a sample of which will be returned to Earth by the forthcoming JAXA Mars Moon eXplorer (MMX) mission;
- the discovery of potential liquid water by MEx radar at the base of the south polar ice cap is of immense astrobiological and geological interest. The next extension offers optimal conditions to revisit this region and consolidate this finding, something only MEx can do;
- as with the Earth, time series of Mars' climate are only as good as their length and MEx disposes of one of the longest, and still growing climatology of the main climate parameters. Extending this dataset would offer a unique opportunity to contribute to solving a major mystery of Mars' climate embedded in its interannual variability, namely the unpredictable occurrence of global dust storms.

Despite the great accomplishments of the ExoMars Trace Gas Orbiter (TGO) at Mars, MEx remains uniquely equipped to cover a broad spectrum of disciplines and feed Mars' community at large. Over time, MEx has come to serve as a backbone for planetary science in Europe; by fostering, and then retaining the expertise and knowledge for the new generation of scientists and engineers who carry ESA's future in planetary exploration^{1*}. With the early next decade full of promise for ESA with ExoMars, Juice, and EnVision, MEx could play a pivotal role in bridging the relative gap of new planetary missions until then. Of utmost importance would be the role of extending MEx for supporting the European community, which prepares ExoMars and Mars Sample Return.

Within an international context that has seen emerging actors (India, China, UAE, Japan) deploy unprecedented efforts to send missions to Mars, MEx remains a stronghold for Europe that keeps it among the key players of Mars' exploration. As a testimony of MEx' inspiring role for the Mars' exploration community worldwide, science leads of several other missions operating at Mars have written letters supporting the Mars Express extension.

Finally, MEx has always demonstrated its agility to promptly respond to new findings and is now ready to tackle a new round of Mars exploration, as the ESA review has

¹ *As an example of the structuring role of MEx: its data allowed identifying and characterizing Oxia Planum, the landing site of the ExoMars rover.*

established the spacecraft can operate for at least six more years. The next extension period would allow realizing a number of well-defined, achievable yet ambitious science objectives. Stopping MEx in 2023 would not only weaken ESA's role in exploring Mars, it would also weaken the long-term effort of the scientific community to solve the outstanding questions the Red planet still poses to us.

Warm regards,

A handwritten signature in black ink, consisting of several fluid, overlapping strokes that form a stylized representation of the name Franck Montmessin.

Franck Montmessin

On behalf of the Mars Express community

ANNEX: Mars Express (refereed) Publication record

