

ExoMars 2016 Schiaparelli at Mars: AMELIA results from the ‘terrific’ six minutes before crashing

Francesca Ferri (1), Ozgur Karatekin (2), Alessio Aboudan (1), Giacomo Colombatti (1), Bart VanHove (2), Carlo Bettanini (1), Stefano Debei (1), Stephen Lewis (3), Fran ois Forget (4)

(1) Universit  degli Studi di Padova, Centro di Ateneo di Studi e Attivit  Spaziali “Giuseppe Colombo” (CISAS) (francesca.ferri@unipd.it / Fax +39-049-8276855),

(2) Royal Observatory of Belgium (ROB), Brussels, Belgium,

(3) School of Physical Sciences, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK,

(4) Laboratoire de M t orologie Dynamique, UPMC BP 99, 4 place Jussieu, 75005, Paris, France

Abstract

On the 19th October 2016, Schiaparelli, the Entry Demonstrator Module (EDM) of the ESA ExoMars Program entered into the martian atmosphere. Although it did not complete a safe landing on Mars, it transmitted data throughout its descent to the surface, until the loss of signal at 1 minute before the expected touch-down on Mars’ surface [1].

The flight data received from Schiaparelli, although more limited than expected, were essential to investigate the anomaly that caused the crash landing and for the achievement of the Atmospheric Mars Entry and Landing Investigations and Analysis (AMELIA) experiment. AMELIA aimed at the assessment of the atmospheric science and landing site by exploiting the Entry Descent and Landing System (EDLS) sensors of Schiaparelli beyond their designed role of monitoring and evaluating the performance of the EDL technology demonstrator [2].

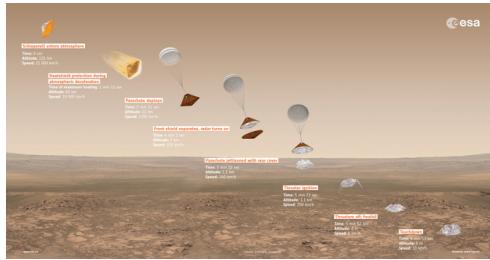


Figure 1: ExoMars 2016 Schiaparelli EDL scenario.

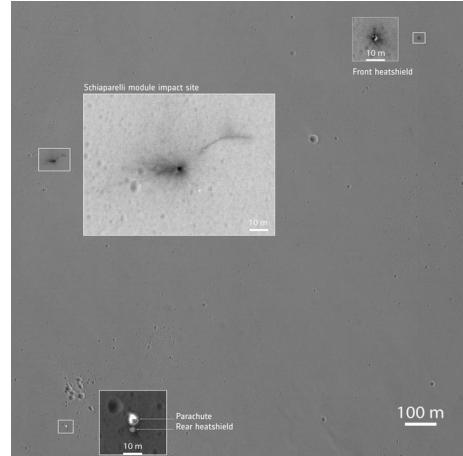


Figure 2: HiRISE image of Schiaparelli crash landing

Despite its ultimate failure to land safely, Schiaparelli allowed for sounding the atmosphere along its trajectory, so as per the seven atmospheric profiles retrieved by previous successful Mars entry probes (Viking 1 & 2 [3], Mars Pathfinder [4,5], MER Spirit & Opportunity [6,7], Phoenix, MSL [8]). Sufficient EDL data were returned in order to reconstruct the trajectory and the attitude of Schiaparelli EDM and to retrieve the atmospheric profiles over the altitude range from 121 km to 4 km above the surface.

We will report on AMELIA results of the atmospheric reconstruction and the analysis of the atmospheric structure observed by Schiaparelli also in the context with other observations, atmospheric modelling and data assimilation.

Acknowledgements

AMELIA is an experiment for scientific investigations of Mars' atmosphere and surface by means of the Schiaparelli measurements during its entry, descent and landing on Mars. The International AMELIA team built under the joint coordination of Principal Investigator: Francesca Ferri (Italy) and 3 Co-Principal Investigators (CoPIs): Özgür Karatekin (Belgium), Stephen R. Lewis (United Kingdom), François Forget (France) (*Interdisciplinary Scientist*). The team included scientists from Italy, France, UK, Belgium, Finland, Germany, Australia and USA. The support of the national funding agencies of Italy (ASI, grant n. 2017-03-17), Belgium (BELSPO and PRODEX), UK (UKSA) and France (CNES) is gratefully acknowledged.

References

- [1] T. Blancquaert et al., (2017) *14th International Planetary Probe Workshop*, The Hague, NL.
- [2] F. Ferri et al. (2017) in press on *Space Science Rev.- ExoMars2016 special issue*
- [3] Seiff, A., D.B. Kirk, (1977) *J. Geophys. Res.* **82**, 4364.
- [4] Schofield, T., et al. (1997) *Science* **278**, 1752-1758.
- [5] Magalhães, J.A., J.T. Schofield, A. Seiff, (1999) *J. Geophys. Res.* **104**, 8943-8945.
- [6] Withers, P. and M. D. Smith (2006) *Icarus* **185**.
- [7] Withers, P., Catling, D.C. (2010) *Geophys. Res. Lett.* **37**.
- [8] Holstein-Rathlou, C., A. Maué, and P. Withers (2016) *Planet. Space Scie.* **120**: 15-23.