MetNet Network Mission to Mars A.-M. Harri[1], S. Alexashkin[2], I. Arrugeo[3], W. Schmidt[1], L. Vazquez[4], M. Genzer[1] and H. Haukka.[1], [1]Finnish Meteorological Institute, Helsinki, Finland (Ari-Matti.Harri@fmi.fi), [2]Lavochkin Association, Moscow, Russia, [3]Institutio Nacional de Tecnica Aerospacial, Madrid, Spain, [4]Universidad Complutense de Madrid, Madrid, Spain.

Introduction: A new kind of planetary exploration mission for Mars is being developed in collaboration between the Finnish Meteorological Institute (FMI), Lavochkin Association (LA), Space Research Institute (IKI) and Institutio Nacional de Tecnica Aerospacial (INTA). The Mars MetNet mission [1] is based on a new semi-hard landing vehicle called MetNet Lander (MNL). The eventual scope of the MetNet Mission is to deploy 16 MNLs on the Martian surface observing the Martian environmental conditions simultaneously around the planet. The MNL would have a versatile science payload focused on the atmospheric science of Mars. Detailed characterisation of the Martian atmospheric circulation patterns, boundary layer phenomena, and climatological cycle require simultaneous in-situ meteorological measurements by a network of stations on the Martian surface. Currently we are defining the MetNet Precursor Mission to send one or two MetNets to Mars to demonstrate the technical robustness and scientific potential of the Mars MetNet mission concept.

MetNet Lander: The MetNet landing vehicles use state-of-the-art inflatable entry and descent systems instead of rigid heat shields and parachutes as earlier semi-hard landing devices have used. This way the ratio of the payload mass to the overall mass is optimized and more mass and volume resources are spared for the science payload.

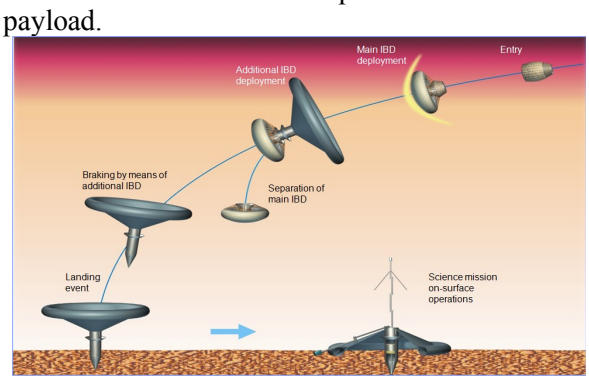

Figure 1: MetNet lander landing scheme.

The vehicle decelerates its entry speed using the inflatable structure and final landing sequence includes a cone headed body penetrating the Martian soil. This way also the scientific payload will benefit from a milder and more stable temperature environment than at the surface.

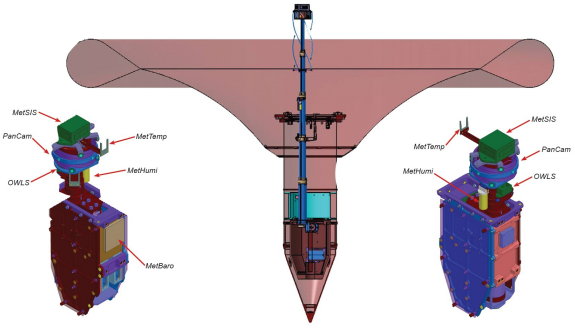

Figure 2: MetNet payload overview.

3. MetNet Mission Status

The MetNet mission concept is building on the results of many years of experience in developing and utilising means to study Mars. By drawing on lessons learned in the course of the Phobos, Mars-96, and the NetLander missions, as well as the earlier ESA Marsnet and InterMarsnet studies, the Metnet development consortium has been working on a mission that is solidly based on demonstrated concepts, technologies and capabilities.

Full Qualification Model (QM) of the MetNet landing unit with the Precursor Mission payload is currently under functional tests. During the next few months the QM unit will be exposed to environmental tests with qualification levels including vibrations, thermal balance, thermal cycling and mechanical impact shock.

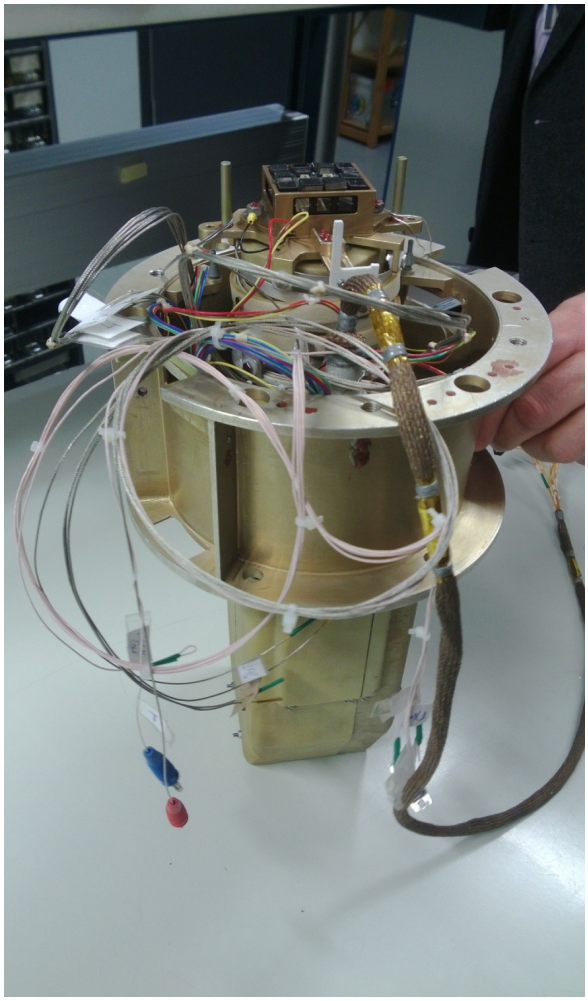

Figure 3: MetNet Payload under tests.

One complete flight unit of the entry, descent and landing systems (EDLS) has been manufactured and tested with acceptance levels. Another flight-like EDLS has been exposed to most of the qualification tests, and hence it may be used for flight after refurbishments. Accordingly two flight-capable EDLS systems exist.

The baseline program development funding exists for the next seven years. Flight unit manufacture of the payload bay takes about 18 months, and it will be commenced after the Precursor Mission has been defined.

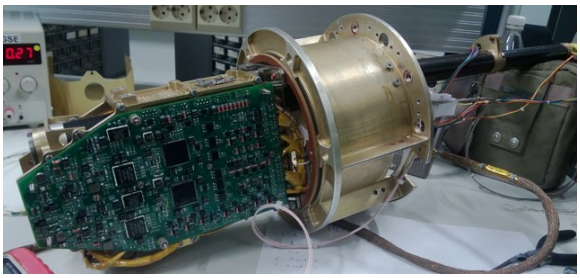

Figure 3: MetNet payload bay QM.

References:

[1] http://metnet.fmi.fi. [2] Blumsack, S. L., Gierasch, P. J., and Wessel, W. R. An analytical and numerical study of the Martian planetary boundary layer over slopes. J. Atmos. Sci., 30:66–82, 1973. [3] Haberle, R. M. and Catling, D. C. A Micro-Meteorological mission for global network science on Mars: rationale and measurement requirements. Planet. Space Sci., 44:1361–1383, 1996. [4] Harri, A.-M., et al. Network science landers for Mars. Adv. in Space Res., 23(11):1915–1924, 1999. [5] Harri, A.-M., et al. METNET — the next generation lander for Martian atmospheric science. Proceedings of the IAC, 2003. [6] Tillman, J. E. Mars global atmospheric oscillations: annually synchronized, transient normal mode oscillations and the triggering of global dust storms. J. Geophys. Res., 93:9433–9451, 1988. [7] Zurek, R. W., et al. Dynamics of the atmosphere of Mars. Mars book, pages 835–934, 1992.