Geophysical Research Abstracts
Vol. 17, EGU2015-10511, 2015
EGU General Assembly 2015

The ExoMars Trace Gas Orbiter NOMAD Spectrometer Suite for Nadir and Solar Occultation Observations of Mars' Atmosphere

Ian Thomas (1), Ann Carine Vandaele (1), José Juan López-Moreno (2), Manish Patel (3), Giancarlo Bellucci (4), Rachel Drummond (), Eduard Neefs (1), Cedric Depiesse (1), Frank Daerden (1), Julio Rodriguez-Gómez (1), Lori Neary (1), Séverine Robert (1), Yannick Willame (1), Arnaud Mahieux (1,5), and the NOMAD Team

(1) Belgian Institute for Space Aeronomy (BIRA-IASB), Brussels, Belgium (ian.thomas@aeronomie.be), (2) IAA, Granada, Spain, (3) Open University, Milton Keynes, UK, (4) IAPS, Rome, Italy, (5) Fonds Nationale de la Recherche Scientifique, Brussels, Belgium

NOMAD (Nadir and Occultation for MArs Discovery) is one of four instruments on board the ExoMars Trace Gas Orbiter, scheduled for launch in January 2016 and to begin nominal science mission around Mars in late 2017. It consists of a suite of three high-resolution spectrometers – Solar Occultation (SO), LNO (Limb Nadir and Occultation) and UVIS (Ultraviolet-Visible) – which will generate a huge dataset of Martian atmospheric observations during the mission, across a wide spectral range. Specifically, the SO spectrometer channel will perform occultation measurements, operating between 2.2-4.3μm at a resolution of 0.15cm^{-1}, with 180-1000m vertical spatial resolution and an SNR of 1500-3000. LNO will perform limb scanning, nadir and occultation measurements, operating between 2.2-3.8μm at a resolution of 0.3cm^{-1}. In nadir, global coverage will extend between $\pm 74^{O}$ latitude with an IFOV of 0.5x17km on the surface. This channel can also make occultation measurements should the SO channel fail. UVIS will make limb, nadir and occultation measurements between 200-650nm, at a resolution of 1nm. It will have 300-1000m vertical resolution during occultation and 5x60km ground resolution during 15s nadir observations.

An order-of-magnitude increase in spectral resolution over previous instruments will allow NOMAD to map previously unresolvable gas species, such as important trace gases and isotopes. CO, CO_2, H_2O, C_2H_2, C_2H_4, C_2H_6, H_2CO, CH_4, SO_2, H_2S, HCl, O_3 and several isotopologues of methane and water will be detectable, providing crucial measurements of the Martian D/H and methane isotope ratios. It will also be possible to map the sources and sinks of these gases, such as regions of surface volcanism/outgassing and atmospheric production, over the course of an entire Martian year, to further constrain atmospheric dynamics and climatology. NOMAD will also continue to monitor the Martian water, carbon, ozone and dust cycles, extending existing datasets made by successive space missions in the past decades, and to derive surface UV radiation levels. Using SO and LNO in combination with UVIS, aerosol properties such as optical depth, composition and size distribution can be derived for atmospheric particles and for distinguishing dust from ice aerosols.

The NOMAD science team will interpret instrument observations using simulations of the GEM-Mars global circulation model. This GCM can model complex atmospheric and chemical processes, such as heterogeneous chemistry, phase transitions, and regolith interaction on both a localised and global scale. Model results can then influence the selection of observational modes and measurement parameters, refining future observations to optimise science return.

The instrument, as of January 2015, is currently being assembled and tested. By April, the instrument will have undergone a full range of tests, calibration at Centre Spatial de Liège, and will have been delivered to ESA for mounting onto the Trace Gas Orbiter.