Overview and Testing of the Mars Organic Molecule Analyzer (MOMA), a Gas Chromatograph and Laser Desorption Mass Spectrometer

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The Mars Organic Molecule Analyzer (MOMA), a dual source linear ion trap mass spectrometer investigation on the ExoMars rover mission, will investigate the near-subsurface of Mars at the Oxia Planum landing site. MOMA examines organic molecules in crushed rock samples received from a two-meter drill that could be signs of past or present life. While the MOMA flight model (FM) awaits its launch (now postponed by several years), a testbed (TB) laboratory instrument is installed and maintained in a Mars environmental chamber. The TB will serve as a critical reference instrument for the FM to be used in real time to track, diagnose, and verify data from that instrument during its operation on Mars. The TB is required to duplicate conditions of the FM, including verification of scientific results that may depend on distinguishing trace-concentration martian organics from instrument backgrounds. As such following its commissioning and calibration to establish flight traceability, the TB hardware is to be maintained in a clean (low and reproducible backgrounds) and relatively pristine state.

The previously-developed MOMA engineering test unit (ETU) continues to be used for testing a variety of samples including complex Mars simulants and spiked materials. The ETU is not subject to strict bounds to match the FM, therefore, it can be used as instrument to establish a baseline understanding of expected results obtained with realistic samples on Mars combining pyrolysis and derivatization GCMS and prompt LDMS with MOMA's common linear ion trap. Several GC coupling campaigns and LDI sample campaigns have now been performed on the ETU to verify functionality, to simulate Mars operational scenarios with the rover science team, and to expand the database and knowledge of mineral spectral signatures in LDMS. An overview of the MOMA instrument is presented, and a summary of recent results will be discussed along with details on preparations for supporting operations on Mars in the future.