The MOMA Mass Spectrometer: Flight Model Integration, Testing and Operation Schemes

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The Mars Organic Molecule Analyzer (MOMA) is based around a linear ion trap mass spectrometer configured with two complementary ion sources - electron ionization and laser desorption ionization. The complete instrument is a joint development between NASA and teams in Germany and France and is a key component of the 2020 ExoMars rover. MOMA's mass analysis of volatile and non-volatile species will play a key role in achieving the mission's main goal of searching for molecular "signs of life". In the past year significant progress has been made in integrating and testing the MOMA flight model instrument along its way to full qualification and delivery to the European Space Agency in 2018. At the beginning of 2017 the Mass Spectrometer portion of MOMA went through a partial thermal vacuum campaign in order to verify its operation and specifications under the conditions it will experience while on the surface of Mars. All tested requirements were successfully verified and the results have identified key components that need to be further characterized in order to accurately interpret the data that is sent back from Mars. Several details of both modes of operation will be discussed to outline some of these factors. Additionally, while the flight model has been undergoing requirements verification, the other breadboard and engineering instrument models have been used for refining the operational sequences and scripts such that optimal data can be obtained. This work has focused on novel methods for performing ion charge control during both modes of operation as well as further developing the selective accumulation and ion isolation schemes within the limitations of the electronics available for instrument operation. The performance of these portions of the ion trap experiment has recently been demonstrated on Mars analog samples and the results of these experiments will also be presented.