

NASA SBIR/STTR Technologies

X1.01-9003 – Miniature Gas Chromatograph Mass Spectrometer for In-Situ Resource Utilization

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Identification and Significance of Innovation

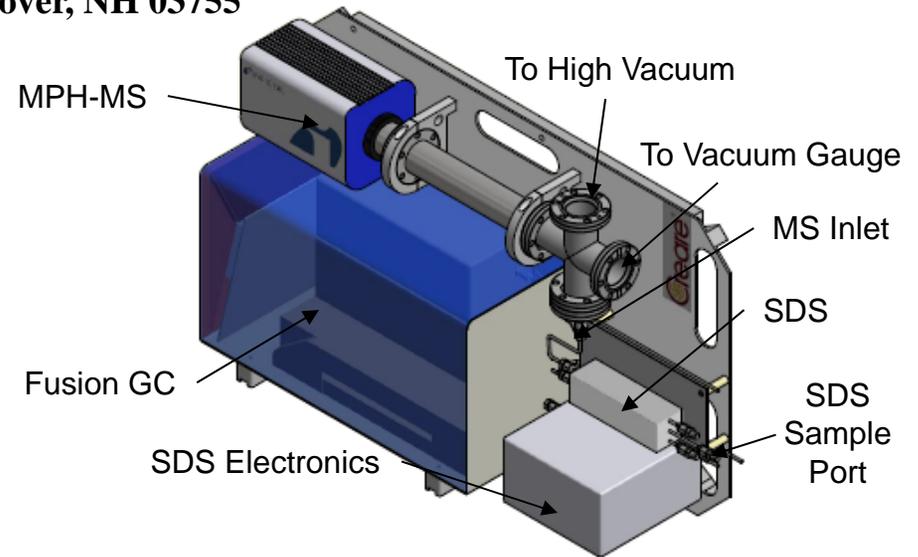
NASA's Regolith & Environmental Science and Oxygen & Lunar Volatile Extraction (RESOLVE) mission's objectives are to analyze the distribution of volatile compounds on the lunar surface and to demonstrate in situ resource utilization (ISRU). The RESOLVE mission includes a volatile detection instrument designed to accurately and quickly quantify hydrogen, water, and other relatively low molecular weight volatile compounds such as CO, CO₂, He, N₂, Ar, NH₃, CH₄, H₂S, and SO₂. During the mission, a drill will be used to obtain samples of the lunar regolith, the samples will be heated, and the resulting outgassing volatiles will be analyzed. What is needed is a space-qualified gas chromatograph/mass spectrometer (GC/MS) that can be used in the Lunar Advanced Volatile Analysis (LAVA) subsystem to analyze the volatile compounds that are released from the heated lunar regolith.

Expected TRL Range at the end of Contract (1–9): Begin: 4 End: 6

Technical Objectives and Work Plan

Technical Objectives: The objective of the Phase II research project is to develop, build, test, and deliver a brassboard GC/MS system tailored for the RESOLVE mission to analyze the volatiles evolving from a regolith sample. The GC/MS will be designed to analyze and quantify all the required gasses, including saturated water at 150°C. The system will use commercial off-the-shelf electronics that will NOT make use of space-qualified components or be able to be conductively cooled, both of which will be required for operation in vacuum or extended operation in a high-radiation environment.

Work Plan: During the project, we will optimize and finalize the GC/MS design, perform thermal and structural analysis of the design as needed, fabricate and test a brassboard GC/MS in the laboratory, deliver it to NASA, and support testing at NASA.



NASA Applications

The main initial application for the proposed system will be in NASA's RESOLVE mission to the surface of the moon. Also, future missions to Mars and the moon will benefit from this development. Long-duration missions to the moon will require substantial amounts of resources for life support and energy. Martian sample return missions and manned missions to Mars may be prohibitively expensive, technically exigent, and unacceptably risky unless resources can be produced on Mars.

Non-NASA Applications

The primary private sector application for the proposed GC/MS system is for use in performing portable chemical analysis, particularly when looking for harmful gasses in harsh environments. For example, inexpensive portable mass spectrometers could revolutionize pollution monitoring, process control, and the response to incidents by emergency personnel.

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NONPROPRIETARY DATA