

# Vacuum Compatible Mass Spectrometer Electronics for the RESOLVE Mission

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The RESOLVE lunar prospecting mission requires gas chromatograph mass spectrometer (GCMS) instrumentation capable of operating in ambient lunar conditions. The driving requirement for the instrument electronics is being capable of operating at lunar ambient pressure, expected to be a vacuum environment. While technology for building vacuum capable electronics for space mass spectrometers already exists, RESOLVE is making use of commercial instrumentation for cost savings and because commercial electronics are congruent with the mission cost and risk profile. The selected instrument, available commercially from Xylem / OI Analytical, is being re-designed for RESOLVE and only select circuit assemblies will be used in the future substantially 'as-is' since they are application specific and the specific functionalities required to run the mass spectrometer are fully tested and meet measurement requirements. To use the commercial boards in a vacuum environment, a development and test program is underway at JPL to 'ruggedize' the boards. For the instrument integrated high voltage (IHV) board, we have designed a mounting and thermal management system which will manage heat flow in the printed wiring board assembly and stiffen the board so that it will survive both vacuum and expected vibration loads. Thermal vacuum testing is complete on the IHV subassembly and the board is verified functional from -10 C to +40 C in vacuum, with no degradation in instrument analytical performance. For the instrument digital (DIG) camera board, we have iterated on a design which was verified during a stratospheric balloon test campaign in September 2012. The DIG board is also verified in thermal vacuum testing within the same temperature range as the IHV board. Both boards will be included in an electronics box assembly to be tested in thermal vac at JPL, with plans to perform a vibration test on the assembly at a future date. After thermal vac, the box will be delivered to Kennedy Space Center (KSC) and integrated by KSC with the rest of the RESOLVE test hardware, to complete a demonstration of the RESOLVE GCMS subsystem in a relevant Lunar environment.