The Evolution of Electronics and Detection Systems over Multiple Space Flight Missions

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The Planetary Environments Laboratory (PEL) at NASA Goddard Space Flight Center has a rich history of developing highly efficient quadrupole mass spectrometers for the harsh environment of space. Over the last several years, these instruments have successfully obtained groundbreaking measurements at Mars (MSL/SAM and MAVEN/NGIMS) and the Moon (LADEE/NMS) for the planetary science community. The PEL has most recently developed the Mars Organic Molecule Analyzer (MOMA) for the 2018 ExoMars rover. MOMA has enabled a number of forward-looking instrument concepts such as the Linear Ion Trap Mass Spectrometer (LITMS) and the Advanced Resolution Organic Molecule Analyzer (AROMA), to further advance performance and provide a broader arsenal of instrumentation at minimal cost while maximizing the science return for an array of mission profiles.

Each mission requires specialized hardware designs capable of achieving the stringent measurement requirements while performing reliably in space when exposed to thermal and mechanical extremes as well as extended non-operational (cruise) and operational durations. Careful management of complex development trades, schedule and technical risks, while leveraging design maturity from past systems, have been critical to achieving success within schedule and cost constraints. We will present the evolution of the electrical systems and detection designs from LADEE to LITMS and AROMA, illustrating how new developments exploited previous architectures to maximize performance with reduced cost and risk.