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Results of a Long-Term Demonstration of an Optical Multi-Gas Monitor on ISS

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Previously at SAMAP we reported on the development of tunable diode laser spectroscopy (TDLS) based instruments for measuring small gas molecules in real time. TDLS technology has matured rapidly over the last 5 years as a result of advances in low power diode lasers as well as better detection schemes. In collaboration with two small businesses Vista Photonics, Inc. and Nanoracks LLC, NASA developed a 4 gas TDLS based monitor for an experimental demonstration of the technology on the International Space Station (ISS). Vista invented and constructed the core TDLS sensor. Nanoracks designed and built the enclosure, and certified the integrated monitor as a payload. The device, which measures oxygen, carbon dioxide, ammonia and water vapor, is called the Multi-Gas Monitor (MGM). MGM measures the 4 gases every few seconds and records a 30 second moving average of the concentrations. The relatively small unit draws only 2.5W. MGM was calibrated at NASA-Johnson Space Center in July 2013 and launched to ISS on a Soyuz vehicle in November 2013. Installation and activation of MGM occurred in February 2014, and the unit has been operating nearly continuously ever since in the Japanese Experiment Module. Data is downlinked from ISS about once per week. Oxygen and carbon dioxide data is compared with that from the central Major Constituents Analyzer. Water vapor data is compared with dew point measurements made by sensors in the Columbus module. The ammonia channel was tested by the crew using a commercial ammonia inhalant. MGM is remarkably stable to date. Results of 18 months of operation are presented and future applications including combustion product monitoring are discussed.