Use of the JPL Electronic Nose to Detect Leaks and Spills in an Enclosed Environment

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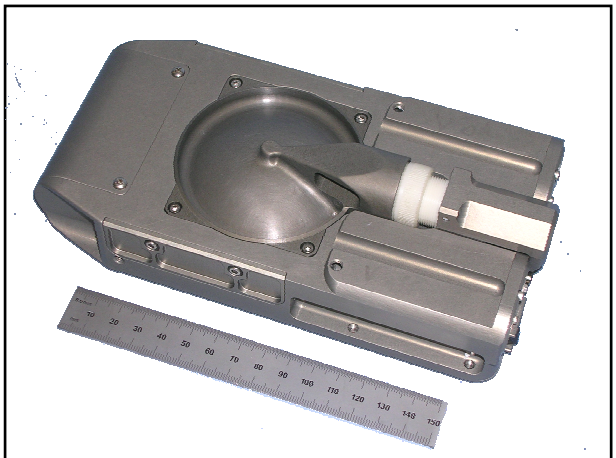
The JPL Electronic Nose (ENose) is an array-based sensing system with 32 polymer/carbon composite conductometric sensors. The Second Generation ENose has been trained to detect, identify and quantify 24 chemical species, the majority of which are organic solvents or commonly used organic compounds, which might be released through a leak or a spill in a spacecraft crew cabin. It has been ground-tested extensively, and includes data analysis software for real-time event detection.

In preparation for an upcoming, long-term (six month) technology demonstration aboard the international space station (ISS), the JPL ENose team is developing a Third Generation ENose. In this work, the capabilities of the JPL ENose are being expanded. Concurrently, the processes, tools and analyses which influence all aspects of development of the device are also being expanded. Until recently, the analyte set has focused on organic compounds such as common solvents and a few selected inorganic compounds, ammonia, water and hydrazine. For the ISS technology demonstration two inorganic species have been added to the analyte set, mercury and sulfur dioxide. To accommodate these inorganic species, the sensor array will incorporate a hybrid sensor approach, including both new sensing materials and new sensing platforms made up of microhotplate sensor substrates. Materials approaches to these analytes have been determined using models of sensor-analyte response developed under this program. Predictive models will also be used to complement array training for additional software analyses including chemical family identification and identification of unknown analytes.



The Second Generation ENose Sensor Unit occupies a volume of 760 cm^3 and has a mass of 800 g. The sensor unit requires 1.5 W average power for operation, and requires a computer (PDA or laptop) for operation and real-time data analysis.

Array analysis will be included on the ENose control computer and event analysis will be available within 15-30 minutes of event onset.

This talk will discuss the use of sensing arrays to detect, identify and quantify specific compounds in a complex background; modes of operation of polymer-based sensors and methods for detecting both inorganic and organic species; approaches to use of temperature as a dimension for analyte identification, and a discussion of data analysis approaches which can be used for near real-time data analysis. The talk will also discuss possible uses of the JPL ENose in environments other than the spacecraft crew cabin and similar enclosed environments.