

# **Progress on the Organic and Inorganic Modules of the Spacecraft Water Impurity Monitor, a Next Generation Complete Water Analysis System for Crewed Vehicles**

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The Spacecraft Water Impurity Monitor (SWIM) is a joint collaboration to develop an instrument platform that will perform in-flight measurements and deliver a more complete picture of water quality to decision makers. For exploration missions, returned water samples will not be an option, so spacecraft and habitats will need to be equipped with advanced water monitoring capabilities. Eventually, missions to the moon, Mars, and beyond should be equipped with analytical capabilities roughly analogous to those found in terrestrial labs. Based on what we know about current and future spacecraft environments, SWIM will seek to provide enhanced analytical capability that enables NASA to confidently send astronauts on distant missions without the possibility of returned water samples.

The SWIM architecture can be broken down in an Organic Water Module (OWM) and an Inorganic Water Module (IWM), independent of each other but can be flown together if desired; an integrated system may share some commonality, e.g., single sample injection, sampling consumables, waste, etc. Each of these main modules can be broken down further into separation (if required) and detection modules. And, each separation module can be paired with one or more detection module depending on mission, spacecraft, customer needs, and size/mass/power constraints.

This paper discusses the research and development progress toward the goal of a total water analysis system. For OWM, one of the analysis technologies that the SWIM team have been developing is a liquid-injection gas chromatograph mass spectrometer system; these systems are the workhorses of analytical chemistry laboratories world-wide. For IWM, the team is exploring a number of technologies ranging from traditional liquid chromatography technologies (e.g. ion chromatography, capillary electrophoresis) to flight-heritage technology such as ion-specific electrodes.