In-flight Water Quality Monitoring

Name of Technology:
In-flight Water Quality Monitor for Quantification and Identification

Participating NASA Centers:
JSC (Lead); ARC, GRC, JPL, KSC, MSFC

Technological Area:
T6.06 Enabling Spacecraft Water Monitoring through Nanotechnology

Vision for the Technology:
Long term space missions will require clean water for crews for consumption. Water quality monitoring systems are needed for crews to know if the water is clean and safe to drink. The system needs to not only monitor but also identify and quantify organic, inorganic, and mineral content.

Challenges:
Currently, on the International Space Station (ISS) the bulk of water quality testing is conducted on Earth after samples have been returned (down-mass). Water quality monitoring and identification is critical for missions where down-mass is not feasible and is needed for both nominal crewed operations and post-dormancy operations prior to allowing the crew to consume the water.

There is no current in-flight capability to identify or quantify specific organic and inorganic content. All water samples must be brought back to Earth for any analysis at a down-mass of 8.5kg/yr.

Without in-flight water monitors/sensors, crew will be at health risk due to contaminated water.

NASA Seeks to Meet the Following Specs:

In-flight monitors/sensors are needed to:

1. Measure 1-10 mg C/L water +/- 25% of reading
2. Identify and quantify 10 specific organic compounds
3. Identify and limited inorganic compounds, 0 kg/month down-mass (e.g. ammonium, antimony, barium, cadmium, manganese, nickel, silver, and zinc. But there is also interest in measurement of other cations and anions including iron, copper, aluminum, chromium, calcium, magnesium, sodium, potassium, arsenic, lead, molybdenum, fluoride, bromide, boron, silicon, lithium, phosphates, sulfates, chloride, iodine, nitrate, and nitrite.)

Overview of Student Project:
NASA seeks innovative in-flight monitors/sensors to evaluate water quality in water systems used for crew consumption. The sensors are needed to identify and quantify a variety of chemical species including total organic carbon, mineral, organic, and inorganic content.

Innovative Areas Student Projects Can Address:

- Develop sensors that can identify non-clean water.
- Develop sensors that can identify and quantify organic, inorganic, and mineral content.

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Project Phases

I. Conceptual and feasibility study with characteristics

II. Proof of Concept/Prototype in lab environment

Research Funded by NASA on this Topic:

Proposal Number: 15-1 H3.01-9673
Spacecraft Potable Water Monitor

Proposal Number: 09-2 X2.03-9435
A Miniaturized Sensor for Microbial Monitoring of Spacecraft Water Environment

Proposal Number: 171 H3.02-9639
Compact Chemical Monitor for Silver Ions in Spacecraft Water Systems

Proposal Number: 20-1- H3.02-5370
Real-time Non-destructive Microbial Water Monitoring for Spacecraft Cabins

Proposal Number: 21-1- T6.06-2093
Monitoring Systems for Inorganic and Organic Analytes in Spacecraft Water Streams

Proposal Number: 21-1- T6.06-1195
New-generation spacecraft water monitoring with flight ready solid state nanopores

References:

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H3.02 Microbial Monitoring for Spacecraft Cabins

H3.01 Environmental Monitoring for Spacecraft Cabins

H3.03 Microbial Monitoring and Control for Spacecraft Cabins

X3.03 Monitoring and Control for Spacecraft Environmental Quality and Fire Protection