Active Project (2014 - 2015)

µ2 Lab: Microfluidic Microbiology Lab Project

Center Innovation Fund: JSC CIF (Also Includes JSC IRAD) Program | Space Technology Mission Directorate (STMD)

ABSTRACT

Microbial monitoring during spaceflight is crucial to maintain crew health and ensure water purifications systems are functioning properly. Current protocols for in-flight enumeration of bacteria in potable water systems require culture based-methods. In this project, we aim to develop a flight- and microgravity-compatible flow cytometer capable of counting total microbial counts in the water supply and differentiating live from dead bacteria.

ANTICIPATED BENEFITS

To NASA funded missions:

If successful, the microflow cytometer could replace the current cell-culturing based methods for in-flight enumeration of viable bacteria in the potable water supply aboard ISS and spaceflight beyond LEO. In addition, the device offers dual-use potential for monitoring changes in immune system response by white blood cell counts. These measurements could both be made with a single, small, low-power device.

To NASA unfunded & planned missions:

Spaceflight beyond LEO will require small, low power technology to perform critical tasks. The proposed device offers dual-use potential for microbial monitoring and human health studies.

To other government agencies:

The capabilities of the proposed device, counting viable bacteria in potable water and analyzing white blood cells, are important for public health uses (water quality) and medical diagnostics in the field and remote areas. These uses would be of benefit to the CDC, NIH, and DoD.

To the commercial space industry:

As the commercial space industry gears up for manned flights to

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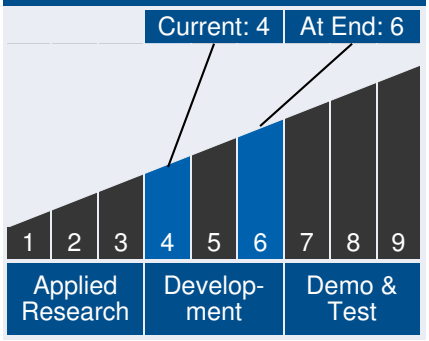
Technology Maturity



Management Team

Project Manager:

- Aaron Burton

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the ISS and beyond, there will be a need for environmental monitoring that the proposed technology addresses.

To the nation:

The drivers for making a device space-flight compatible, namely reducing mass, volume and power requirements, ruggedization of devices, and making devices easy to use, are often the same requirements for equipment to be used in the field and in remote locations. The proposed technology will improve access to flow cytometers for public health and medical use in the U.S.

DETAILED DESCRIPTION

Microbial monitoring during spaceflight is crucial to maintain crew health and ensure water purifications systems are functioning properly. Current protocols for in-flight enumeration of bacteria in potable water systems require culture based-methods. In this project, we aim to develop a flight- and microgravity-compatible flow cytometer capable of counting total microbial counts in the water supply and differentiating live from dead bacteria.

Management Team *(cont.)*

Principal Investigator:

- Aaron Burton

Co-Investigators:

- Douglas Botkin
- Sarah Castro
- Brian Crucian

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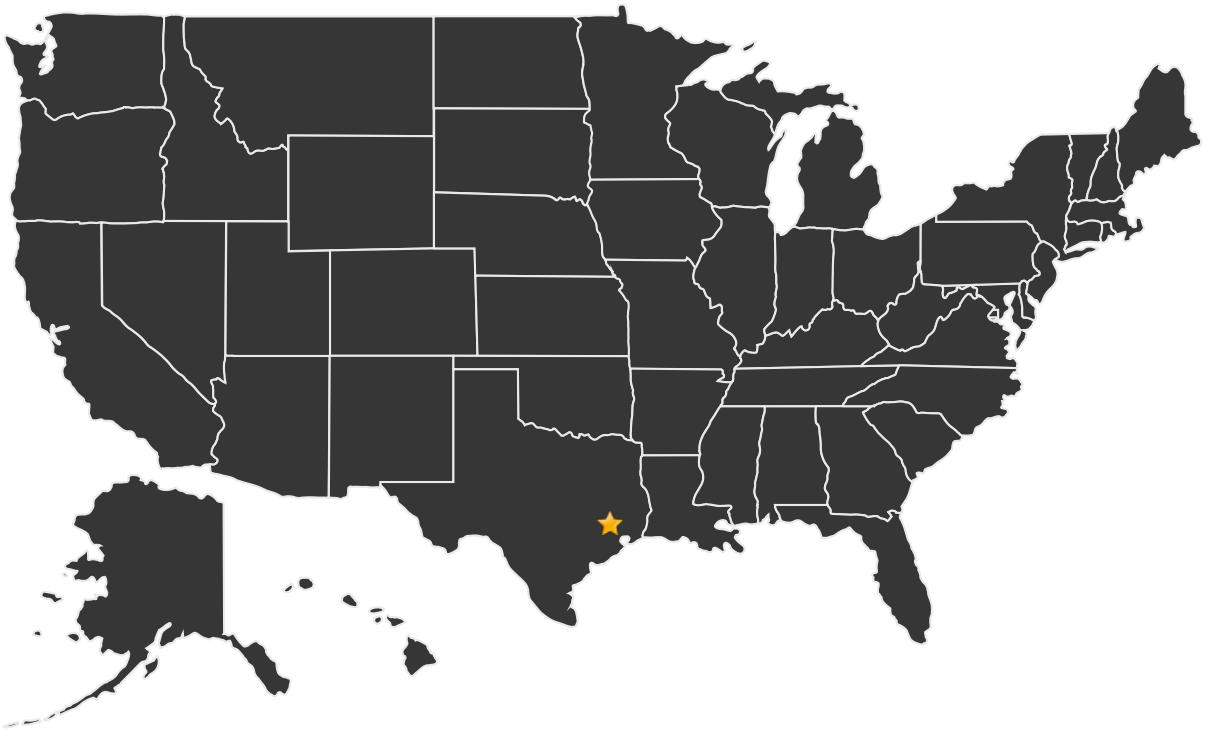
U.S. LOCATIONS WORKING ON THIS PROJECT



U.S. States With Work

Lead Center:
Johnson Space Center

DETAILS FOR TECHNOLOGY 1

Technology Title

microflow cytometer for bacterial detection

Technology Description

This technology is categorized as a hardware system for manned spaceflight

The microflow cytometer analyzes small microliter volumes of sample. It uses laser light to interrogate individual particles passing through a flow chamber, enabling a variety of parameters to be measured for each particle.

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Capabilities Provided

Bacterial cell counting; dead/live differentiation; white blood cell assays

Potential Applications

This technology will be useful for in-flight environmental monitoring, as well as for monitoring spaceflight-induced changes in human immune system response.