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Microgravity Experiments for the ISS

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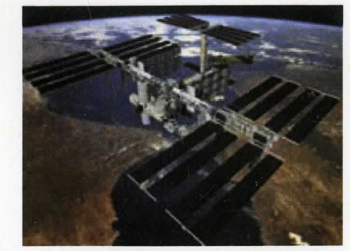


Overview

The Get Away Special (GAS) team is a microgravity research team know for leading Utah State University to impressive distinction of flying more experiments in space than any other university in the world. The following experiments were designed by the GAS team after receiving the opportunity to develop and experiment to be preformed by a Space Flight Participant aboard the International Space Station (ISS).

SASEMI

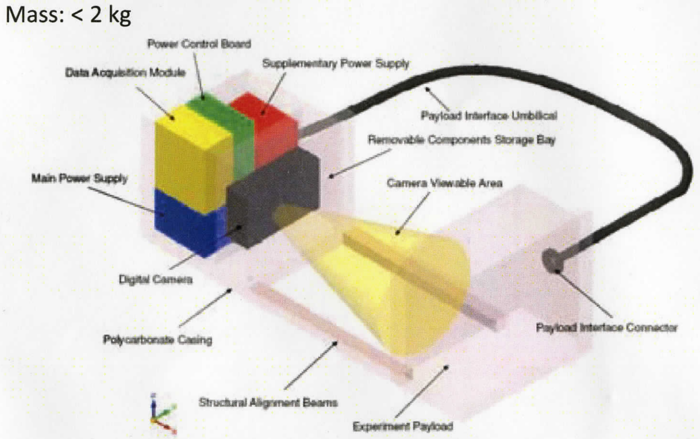
Space Adventures' Scientific Experimentation Module for the ISS

Description

SASEMI was designed with the goal of providing a simple, modular interface for student built scientific experiments to be conducted on the ISS. SASEMI would prevent the complications that come with trying to interface with the ISS by providing power and data acquisition (DAQ).

Features

Power: 50 Whr at 12V from rechargeable Lithium-Ion batteries
DAQ: data recorded to a removable SD card
Visual: 1080p resolution video camera with removable batteries and SD card
Dimensions: 15 cm x 15 cm x 15 cm
Mass: < 2 kg



SASEMI model with experimental payload

Benefits

SASEMI allows for a common interface to ease the integration of university research projects preformed in microgravity aboard the ISS. Since SASEMI will stay aboard the ISS and provide power and data acquisition for a variety of experiments the weight and therefore launch cost of these experiments can be greatly reduced. Research teams simply need to design their experiments to meet the interfacing specifications. SASEMI will increase the accessibility of space research for universities worldwide.

Mission Timeline

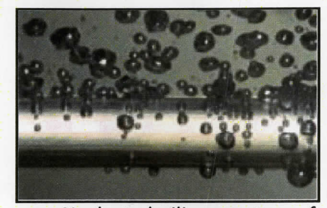
Currently we are in the preliminary design phase and are working to build prototypes of several different experiments. We will deliver the completed experiments to Space Adventures by the end of this summer and hope to launch sometime next Spring.

FUNBOE

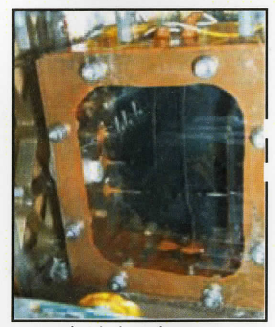
Follow-Up Nucleate Boiling On-orbit Experiment

Description

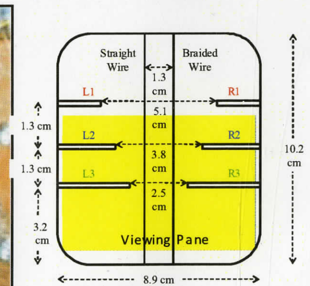
FUNBOE aims to further study the nucleate boiling process in the absence of gravity. Visual and thermal data obtained from this experiment will be analyzed to better understand the forces that influence bubble formation and propagation from various heating surfaces. From this research safe and efficient heat transfer systems utilizing the boiling of water can be developed for microgravity environments.



Nucleate boiling courtesy of Incropera



Fluid chamber



Chamber Schematic

Past Experiment

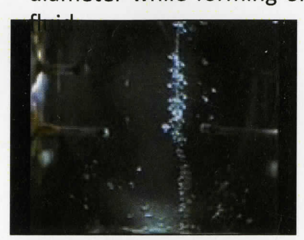
- Designed and built by the GAS team in 1999
- Flew on Space Shuttle Endeavor (STS-108) in 2001
- Boiled water with a braid of Nichrome wires and a single straight wire
- Produced small individual bubbles that grow on and then departed from the wire

Improvements

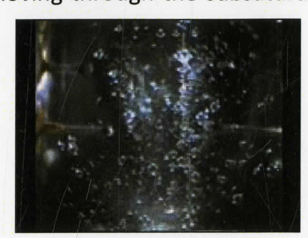
There where several aspects of the previous experiment that can be improved in order to obtain more information on the boiling process.

Issue	**Solution**
Wall boundary effects on bubble motion	**Larger fluid chamber**
Unknown temperatures close to heating element	**More thermistors closer to heating element**
Pixilation at vapor fluid interface	**Higher resolution camera**
Unknown movement in third dimension	**Multiple camera or mirrors**
Bubble interference and coalescence	**Less power to wire to produce fewer bubbles**

These improvements should provide more accurate data on bubble position and diameter while forming on the heating elements and moving through the subsaturated fluid.



Boiling after 10 minutes of power to braided wire



Boiling after 35 minutes of power to braided wire

Acknowledgements

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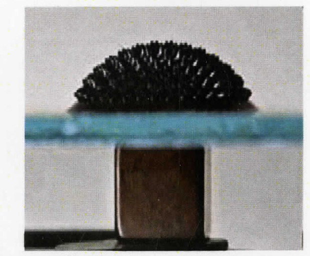
FANDI

Ferrofluids with Agglomerated Nanoparticles as DIelectrics

Description

FANDI will experimentally quantify the electrical resistance of ferrous nanoparticles suspended in a carrier fluid as the particles agglomerate in a magnetic field over time.

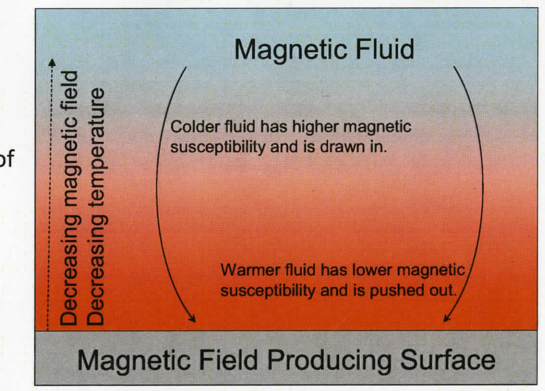


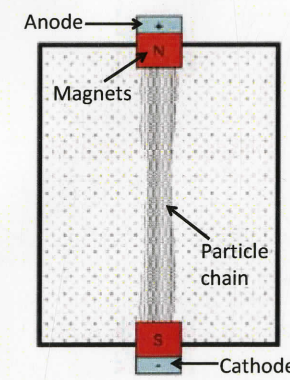
Ferrofluid on a magnet courtesy of G. Maxwell

Applications

Wide spread industrial applications including:
- resonance imaging
- digital data storage
- ink cartridges
- Coolants

The figure to the right shows how the magnetic properties of ferrofluids can be used for thermal management.

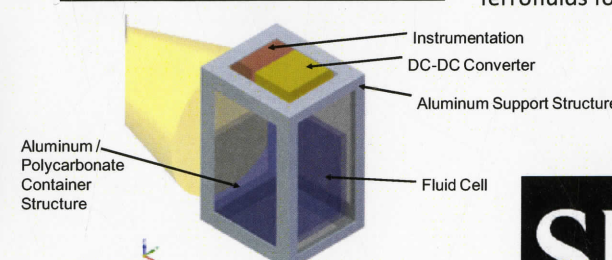




Objective

The objective of this experiment is to create a chain of agglomerated nanoparticles using a magnetic field. A ohmmeter will measure the resistance of this chain as the number density of particles in the magnetic field increases. The results form this experiment can be used to optimize the characteristic of ferrofluids for electrical devises.

Schematic of FUNBOE and FANDI



Mass: < 1.5 kg
Dimensions: 10 cm x 8.5 cm x 15 cm