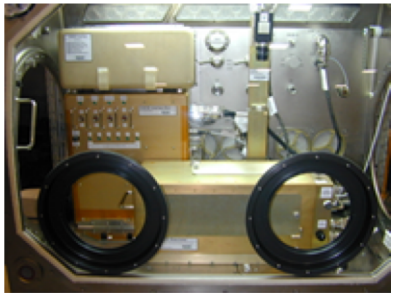
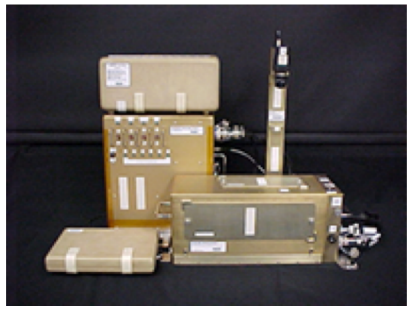
# Shear History Extensional Rheology Experiment II (SHERE II)

**Glenn Research Center**


***PI:*** Prof. Gareth McKinley, MIT
***PS/PM:*** Nancy R. Hall, NASA GRC
***Engineering Team:*** ZIN Technologies, Inc.

*SHERE hardware in GBX*



*SHERE flight hardware*

## Objective:

- To investigate of the effect of preshearing on the stress/strain response of a model filled viscoelastic suspension (consisting of inert rigid non-Brownian microspheres dispersed in a dilute polymer solution) being stretched in microgravity.
  - Will investigate a controlled preshear history (from no preshear to very strong preshear) for a specified period. Then shear flow is halted and followed by exponentially increasing elongation profile axially to the polymeric liquid.

## Relevance/Impact:

- Allows optimization of polymer processing operations that involved *complex flows*, i.e., both *shearing* ("rotation") and *elongation* ("stretching").
- Understanding the rheological properties of highly viscoelastic suspensions may be of paramount importance for lunar in-situ resource utilization and for the future construction of a permanent lunar base.

## Development Approach:

- SHERE flight experiment and design leverages off of the Extensional Rheology Experiment (ERE) sounding rocket experiment which studied the uniaxial stretching flow of a polymeric liquid.
- Protoflight approach used for flight hardware development.
- Fluid modules returned from ISS, cleaned and refilled with new flud samples.
- A high fidelity operational trainer is available.
- Experiment is set up and run by an astronaut. Some telemetry is viewed on the ground.

## ISS Resource Requirements

| | |
|---|---|
| **Accommodation (carrier)** | Microgravity Science Glovebox |
| **Upmass (kg)** (w/o packing factor) | 29.1 - Main Hardware (on orbit)<br>7.3 - Fluid Module Stowage Tray |
| **Volume ($m^3$)** (w/o packing factor) | 0.100 - Main Hardware (on orbit)<br>0.012 - Fluid Module stowage Tray |
| **Power (kw)** (peak) | 0.085 |
| **Crew Time (hrs)** (installation/operations | 33 crew time |
| **Autonomous Ops (hrs)** | 24 |
| **Launch/Increment** | ULF-5 (Middeck) - Fluid Module stowage Tray |

## Project Life Cycle Schedule

| Milestones | SCR | RDR | PDR | Design Rvw | VRR | Ph III FSR | FHA | Launch | Ops | Return | Final Report |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fluid Modules (25)** | **N/A** | **N/A** | **N/A** | **2Q10** | **N/A** | **2Q10** | **3/10** | **6/10** | **Inc 22-24** | **TBD** | |
| **Documentation** | Website:<br>http://spaceflightsystems.grc.nasa.gov/Advanced/ISSResearch/MSG/SHERE/<br>eRoom: SHERE | | | | SRD: signed, in eroom<br>EDMP: | | | Project Plan: in eroom<br>SEMP: N/A | | | |