

Investigating the Structures of Paramagnetic Aggregates from Colloidal Emulsions-3, (InSPACE-3)



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Objectives:

- ◆ Visually study the gelation transition in magneto-rheological (MR) fluids under steady and pulsed magnetic fields.
- ◆ InSPACE-3 study the effect of particle shape on the kinetics of aggregation and structures formed by DC and pulsed magnetic fields in suspensions of super paramagnetic particles.

Relevance/Impact:

- ◆ Directly aligns with high priorities from the NRC Decadal survey on Biological and Physical Sciences.
 - ◆ FP1: Research on complex fluids. Study the structures and forces important to the properties of the materials in microgravity.
 - ◆ AP5: Understand complex fluid physics in microgravity including fluid behavior of granular materials, colloids, etc.
- ◆ MR fluids are a class of smart materials capable of changing visco-elastic properties. Microgravity data of the internal particle structure and dynamics will provide an assessment of the viscous-elastic properties. These objectives improve limb and dextrous motion in robotic components and human-robotic interfaces for EVA suits. Earth applications include improved active damping systems for bridges (to counter act wind gusts) and buildings (to protect from earthquake damage).

Development Approach:

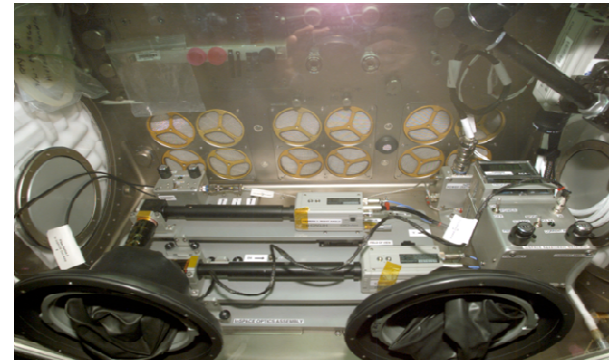
- ◆ InSPACE-3 will utilize the InSPACE-1 experiment hardware presently on ISS, and InSPACE-2 Helmholtz coil assembly and light guide tool.
- ◆ An improved vial assembly design was used to allow orthogonal views of the resulting aggregate structures.
- ◆ InSPACE-3 hardware will consist of 3 vial assemblies each with different ellipsoid-shaped particles MR fluid and 3 backup vial assemblies.

Project Life Cycle Schedule

Milestones	RDR	PDR	CDR	Ph III FSR	SAR	FHA	Launch	Ops	Return	Final Report
InSPACE-3	NA	NA	5/2009	12/2010	2/2011	3/2011	5/2011	Aug2012- Nov 2012	TBD	Return + 1yr

3/2012

Glenn Research Center



InSPACE in MSG



Vial Assembly

ISS Resource Requirements

Accommodation (carrier)	Microgravity Science Glovebox
Upmass (kg) (w/o packing factor)	3.57
Volume (m³) (w/o packing factor)	0.011
Power (kw) (peak)	0.030
Crew Time (hrs)	51
Autonomous Ops (hrs)	2-3 hours of unattended operations per test run
Launch/Increment	STS 134 Endeavour (Flight ULF-6).