



Capillary Channel Flow (CCF)

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NRC Decadal identifier: Capillary Effectiveness (AP1)



PI: Prof. Michael Dreyer, ZARM
Co-I: Prof. Mark Weislogel, Portland State University
PM: Robert Hawersaat, NASA GRC
PS: Robert Green, Lauren Sharp, NASA GRC

Objective:

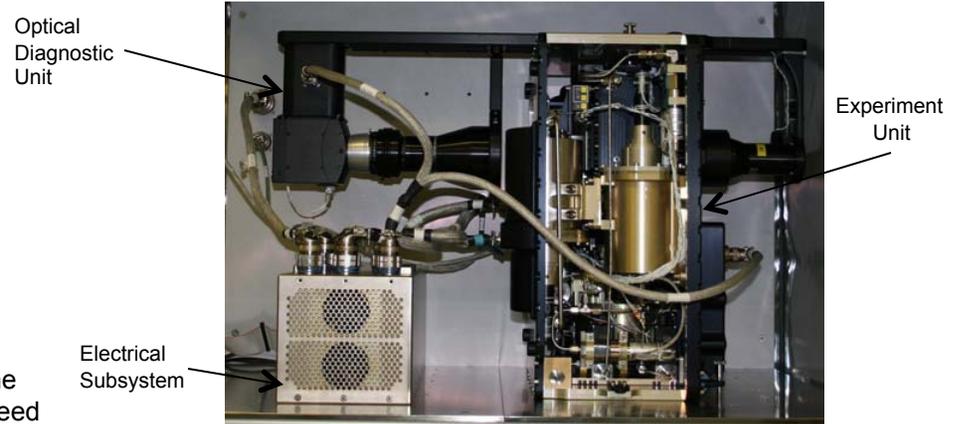
- To enable design of spacecraft tanks that can supply gas-free propellant to spacecraft thrusters, directly through capillary vanes, significantly reducing cost and weight, while improving reliability.

Relevance/Impact:

- The current design of spacecraft fuel tanks rely on additional reservoirs to prevent the ingestion of gas into the engines during firing. This research is required to update these current models, which do not adequately predict the maximum flow rate achievable through the capillary vanes eliminating the need to over design tanks.

Development Approach:

- CCF is designed to operate in the Microgravity Science Glovebox (MSG). CCF consists of three major systems; two Experiment Units (EU), one Optical Diagnostics Unit (ODU), and one Electronics Subsystem (ESS)/Harness.
- Each EU has its own Fluid Management System (FMS) equipped with required components to establish the flow (pumps, plunger, valves); the Test Unit (TU) containing the test channel and Phase Separation Chamber, (PSC).
- The test fluid that will be used is HFE7500, a 3M manufactured thermal engineering fluid, ethoxy perfluoroheptane. A toxicity assessment was performed by JSC, the rating assigned was TOX level 0.
- The investigation of the selected channel geometries (parallel channel, groove channel, and wedge-shaped channel) and different channel dimensions, the EU is exchangeable.
- EU #1 conducted operations during Increment 25-26 (Jan-Mar 2011). EU #2 conducted operations during Increment 28-29 (Sept-Oct 2011).
- EU #1 and EU #2 operations are scheduled during Inc 33-34 to re-run test points not obtained in the first session.



ISS Resource Requirements

Accommodation (carrier)	Microgravity Science Glovebox
Upmass (kg) (w/o packing factor)	90
Volume (m ³) (w/o packing factor)	0.133
Power (kw) (peak)	.170
Crew Time (hrs) (installation/operations)	2hrs install 1.5hrs exchange units 1.5hrs stow
Autonomous Ops (hrs)	1200 hrs
Launch/Increment	STS-131 (19A), Inc 23

Project Life Cycle Schedule

Milestones	SCR	PDR	DeltaPDR	CDR	Ph 0/1 Safety	Ph II Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	03/2002	05/2005	03/2007	02/2008	06/2007	05/2008	2009	19A 4/2010	Inc 25-29+33	Ops+6	2014