Capillary Channel Flow (CCF)

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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.

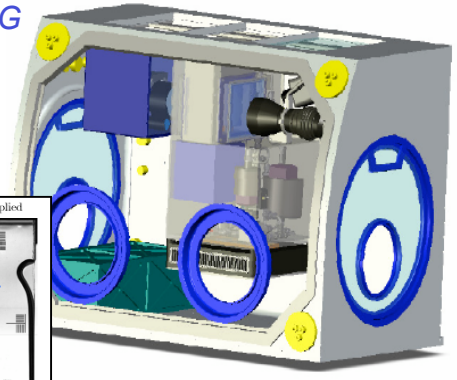
Relevance/Impact:

- 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 overdesign tanks.

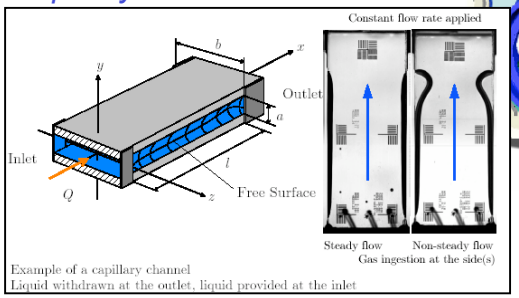
Development Approach:

- Modularly designed system consisting of the Fluid Management System (FMS), the Board Computer (BC), and the Test Units (TU).
- The FMS is equipped with required components to establish the flow (pumps, plunger, valves), the TU contains the test channel, a phase separation chamber, (PSC), a compensation tube (CT), cameras for the video observation and required illumination.
- 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 for the projects application.
- The experiment control, sampling of the housekeeping data, communication with the MSG interfaces and the ground station (PI site) is performed by the BC. For the investigation of the selected channel geometries (parallel channel, groove channel, wedge-shaped channel, and a liquid bridge) and different channel dimensions, the TU is exchangeable. This enables the use of the set-up for other projects with similar technology driven research objectives.

CCF in MSG



Capillary Channel Test Unit



ISS Resource Requirements

Accommodation (carrier)	Microgravity Science Glovebox
Upmass (kg) (w/o packing factor)	35-50
Volume (m^3) (w/o packing factor)	0.133
Power (kw) (peak)	
Crew Time (hrs) (installation/operations)	24
Autonomous Ops (hrs)	TBD
Launch/Increment	STS-130, Increment 18

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline			5/2005	12/2007		6/2007	2008	19A/01/2009	Incr. 19	2009	2010