NASA SBIR 2016 Phase I Solicitation

H2.04 Cryogenic Fluid Management for In-Space Transportation

Lead Center: GRC

Participating Center(s): JSC, MSFC

This subtopic solicits technologies related to cryogenic propellant (such as hydrogen, oxygen, and methane) storage, and transfer to support NASA's exploration goals. This includes a wide range of applications, scales, and environments consistent with future NASA missions. Such missions include but are not limited to the Exploration Upper Stage (EUS), In-situ Resource Utilization in cooperation with Mars Landers, and the evolvable Mars Campaign.

Specifically, listed in order of importance:

- High Power/High Efficiency cryocoolers and cryocooler components (specifically compressors, turbines/expanders, or recuperative heat exchangers) for systems designed to reject >150 W at 90 K with a specific power of less than 15 W (input power)/W (heat rejection) and specific mass of less than 12 kg/W (of heat rejection) at the design point. The cryocooler components should be suitable for space flight.
- Novel structural solutions that can be partially disconnected post launch which the upper stage has successfully reached orbit. Full scale structural solutions (5 – 10 m diameter tanks) should be able to support > 20 mT at up to 5 g's sustained compressive loads and have no structural modes below 50 Hz. Post disconnection, the supports should still be able to support 20 mT, but at 0.2 g's sustained compressive loads. Solutions (which do not have to be full scale at this point) should also attempt to minimize the residual heat load to the propellant tank after disconnection.
- Liquid acquisition devices (or propellant management devices) capable of preventing gas ingestion into engine feedlines in low gravity. The liquid acquisition devices should maintain bubble-free flows of 37 liters per minute while having an expulsion efficiency of 97%.
- Lightweight fluid coupling for low (< 50 psi, Cv > 5) pressure cryogenic liquids with low internal (~ 1 sccm) and external (~ 3 sccm) leakage on both halves. Coupling should be designed either for ease of use by Astronauts (i.e., bulky gloves and minimal force) or easy automation.