



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 m diameter tanks) should be able to support > 20 mT at up to 5 g 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 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, $C_v > 5$) 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.