NASA SBIR 2008 Phase I Solicitation

X7.03 Cryogenic Instrumentation for Ground and Flight Systems

Lead Center: GRC

Participating Center(s): JSC, KSC, MSFC

This subtopic includes technologies for reliable, accurate cryogenic propellant instrumentation needs in-space, on the lunar surface, and on the Earth. These technologies will impact cryogenic systems for space transportation orbit transfer vehicles, space power systems, spaceports, lunar habitation systems, in situ propellant systems, and launch site ground operations. Innovative concepts are requested to enable accurate measurement of cryogenic liquid mass in low-gravity storage tanks with and without propellant settling, to enable the ability to detect in-space and on-pad leaks from the storage system, and address other cryogenic instrumentation needs. Cryogenic propellants such as hydrogen, methane, and oxygen are required for many current and future space missions. Operating efficiency and reliability of these cryogenic systems must be improved considering the launch environment, operations in a space environment, and system life, cost, and safety. Proposed technologies should offer enhanced safety, reliability, or economic efficiency over current state-of-the-art, or should feature enabling technologies to allow NASA to meet future space exploration goals.

Mass Gauging technologies will principally impact cryogenic systems for space transportation orbit transfer vehicles. Mass gauging provides accurate measurement of cryogenic liquid mass (LH_2, LO_2, and LCH_4) in low gravity storage tanks, and is critical to allowance of smaller propellant tank residuals in assuring mission success. Both low-gravity mass-gauging (measurement uncertainty

Leak detection technologies impact cryogenic systems for space transportation orbit transfer vehicles, lunar surface, and launch site ground operations. These systems will be operational both in atmospheric conditions and in vacuum with multiple sensor systems distributed across the vehicle or a region of interest to isolate leak location. Methane and hydrogen leak detection sensors with milli-second response times and 1 ppm detection sensitivity in air are desired for ground and launch operations.

Other cryogenic instrumentation needs include minimally invasive cryogenic liquid flow measurement sensors for rocket engine feed lines, and sensors to detect and quantify two-phase flow (bubbles) within the feed lines.