



NASA SBIR 2009 Phase I Solicitation

S5.06 Planetary Balloon Technology

Lead Center: JPL

Innovations in materials, structures, and systems concepts have enabled buoyant vehicles to play an expanding role in planning NASA's future Solar System Exploration Program. Balloons and airships are expected to carry scientific payloads on Venus and Titan in order to investigate their atmospheres in situ and their surfaces from close proximity. Their envelopes will be subject to extreme environments and must support missions with a range of durations. Proposals are sought in the following areas:

Metal Balloons for High Temperature Venus Exploration

Balloons made of metals are a potential solution to the problem of enabling long duration flight in the hot lower atmosphere of Venus. Proposals are sought for metal balloon concepts and prototypes that provide 1-5 m³ of fully inflated volume, areal densities of 1 kg/m² or less, sulfuric acid compatibility at 85% concentration, and operation at 460°C for a period of up to 1 year.

Rapid Buoyancy Modulation System for a Titan Montgolfiere Balloon

Montgolfiere, or hot air, balloons are under development for use on a future mission to Titan. While systems are feasible based on the waste heat from a radioisotope power system (RPS), the large thermal inertias make it dangerous for such balloons to fly near the surface because of their inability to quickly respond to atmospheric turbulence or approach topographic hazards. Proposals are therefore sought for a rapid buoyancy modulation system that can be integrated into a 10 m diameter Titan Montgolfiere balloon operating at 90 K and using a steady-state RPS heat source in the range of 2 - 4 kW. This system needs to be lightweight (less than 10 kg) and consume a small amount of electrical power (less than 5 W average).

Gas Management Systems for Titan Aerobots

Hydrogen-filled aerobots at Titan must contend with the problem of gas leakage over long duration (1 year or more) flights. Proposals are sought for the development and testing of two kinds of prototype devices that can be carried on the aerobot to compensate for these gas leakage problems: one device is to produce make-up hydrogen gas from atmospheric methane; the other device is to remove atmospheric gas (mostly nitrogen) that leaks from the ballonets into the hydrogen-filled blimp. Both kinds of devices will need to operate on no more than 15 W of electrical power each while compensating for a leakage rate of at least 40 g/week of hydrogen or 500 g/week of nitrogen.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.