



NASA SBIR 2009 Phase I Solicitation

S5.05 Extreme Environments Technology

Lead Center: JPL

Participating Center(s): ARC, GRC, GSFC, MSFC

High Temperature, High Pressure, and Chemically Corrosive Environments

NASA is interested in expanding its ability to explore the deep atmosphere and surface of Venus through the use of long-lived (days or weeks) balloons and landers. Survivability in extreme high temperatures and high pressures is also required for deep atmospheric probes to giant planets. Proposals are sought for technologies that enable the in situ exploration of the surface and deep atmosphere of Venus and the deep atmospheres of Jupiter or Saturn for future NASA missions. Venus features a dense, CO₂ atmosphere completely covered by sulfuric acid clouds at about 55 km above the surface, a surface temperature of about 486°C and a surface pressure of about 90 bars. Technologies of interest include high temperature electronics components, high temperature energy storage systems, light mass refrigeration systems, high temperature optical window systems (that are transparent in IR, visible and UV wavelengths) and pressure vessel components compatible with materials such as steel, titanium and beryllium such as low leak rate wide temperature (-50°C to 500°C) seals capable of operating between 0 and 90 bars.

Low Temperature Environments

Low temperature survivability is required for missions to Titan, the surface of Europa and comets. Also Moon equatorial regions experience wide temperature swings from -180°C to +130°C during the lunar day/night cycle, and the sustained temperature at the shadowed regions of lunar poles can be as low as -230°C. Mars diurnal temperature changes from about -120°C to +20°C. Proposals are sought for technologies that enable NASA's long duration missions to low temperature and wide temperature environments. Technologies of interests include low power rad-tolerant RF electronics, mixed signal electronics, power electronics, electronic packaging (including passives, connectors, wiring harness and materials used in advanced electronics assembly), actuators and energy storage sources capable of operating across an ultra-wide temperature range from -230°C to 200°C and computer Aided Design (CAD) tools for modeling and predicting the electrical performance, reliability, and life cycle for low-temperature electronic systems and components.

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 hardware/software demonstration, and when possible, deliver a demonstration unit for functional and environmental testing at the completion of the Phase 2 contract.

