



NASA SBIR 2008 Phase I Solicitation

S1.11 Lunar Science Instruments and Technology

Lead Center: MSFC

Participating Center(s): ARC, GSFC, JPL, JSC

NASA lunar robotic science missions support the high-priority goals identified in the 2007 National Research Council report, The Scientific Context for Exploration of the Moon: Final Report (http://www.nap.edu/catalog.php?record_id=11954). Future missions will characterize the lunar exosphere and surface environment; field test new equipment, technologies, and approaches for performing lunar science; identify landing sites and emplace infrastructure to support robotic and human exploration; demonstrate and validate heritage systems for exploration missions; and provide operational experience in the harsh lunar environment.

Space-qualified instruments are required to perform remote and in situ lunar science investigations, to include measurements of lunar dust composition, reactivity and transport, searching for water ice, assessing the radiation environment, gathering long period measurements of the lunar exosphere, and conducting surface and subsurface geophysical measurements.

In support of these requirements, this subtopic seeks advancements in the following areas:

Geophysical Measurements

Systems, subsystems, and components for seismometers and heat flow sensors capable of long-term continuous operation over multiple lunar day/night cycles with improved sensitivity at lower mass and reduced power consumption compared to the Apollo Lunar Surface Experiments Package (ALSEP) instruments (<http://www.hq.nasa.gov/alsj/frame.html>). Instrument deployment options include robotic deployment from soft landers, as well as emplacement by hard landers or penetrators. Also of interest are portable surface ground penetrating radars with antenna frequencies of 250-MHz, 500-MHz, and 1000-MHz to characterize the thickness of the lunar regolith.

In Situ Lunar Surface Measurements

Light-weight and power efficient instruments that enable elemental and/or mineralogy analysis using techniques such as high-sensitivity X-ray and UV-fluorescence spectrometers, UV/fluorescence flash lamp/camera systems, scanning electron microscopy with chemical analysis capability; time-of-flight mass spectrometry, gas chromatography and tunable diode laser (TDL) sensors for in situ isotopic and elemental analysis of evolved volatiles, calorimetry, and Laser Induced Breakdown Spectroscopy (LIBS). Instruments shall have the potential to provide isotope ratio measurements and/or hydrogen distributions to $\hat{A}\pm 10$ ppm locally. Instrument deployment options include robotic deployment from soft landers, as well as emplacement by hard landers or penetrators.

Lunar Atmosphere and Dust Environment Measurements

Low-mass and low-power instruments that measure the local lunar surface environment which includes but is not limited to the characterization of: the plasma environment, surface electric field, and dust concentrations and its diurnal dynamics. Instrument deployment options include robotic deployment from soft landers, as well as emplacement by hard landers or penetrators.

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