NASA SBIR 2010 Phase I Solicitation

S5.01 Planetary Entry, Descent and Landing Technology

Lead Center: JPL

Participating Center(s): ARC, JSC, LaRC

NASA seeks innovative sensor technologies to enhance success for entry, descent and landing (EDL) operations on missions to Mars. Sensing technologies are desired which determine the entry point of the spacecraft in the Mars atmosphere; provide inputs to systems that control spacecraft trajectory, speed, and orientation to the surface; locate the spacecraft relative to the Martian surface; evaluate potential hazards at the landing site; and determine when the spacecraft has touched down. Appropriate sensing technologies for this topic should provide measurements of physical forces or properties that support some aspect of EDL operations. NASA also seeks to use measurements made during EDL to better characterize the Martian atmosphere, providing data for improving atmospheric modeling for future landers. Proposals are invited for innovative sensor technologies that improve the reliability of EDL operations.

Products or technologies are sought that can be made compatible with the environmental conditions of spaceflight and the rigors of landing on the Martian surface. Successful candidate sensor technologies can address this call by:

- Providing critical measurements during the entry phase (e.g., pressure and/or temperature sensors embedded into the aeroshell);
- Improving the accuracy on measurements needed for guidance decisions (e.g., surface relative velocities
- Extending the range over which such measurements are collected (e.g., providing a method of imaging through the aeroshell, or terrain-relative navigation that does not require imaging through the aeroshell);
- Enhancing the situational awareness during landing by identifying hazards (rocks > 20cm height, slopes > 0.05 radians, craters > 1m diameter) and distinguishing between favorable and unfavorable landing materials (e.g., differentiate bowls of dust from solid rock)
- Substantially reducing the amount of external processing needed to calculate the measurements or provide high performance flight qualified processing with low mass and power (e.g., 1 GFLOPS processing in
- Decoupling spacecraft attitude from instrument pointing through the development of fast gimbals that are low mass and power (2rad/s² accelerations, 2 rad/s rates with mass
• Improving landing site map accuracy and resolution while also providing a means for validating the generated map (10cm resolution elevation with 5cm height errors and map tie errors)

• Providing modular and low mass spacecraft to spacecraft navigation systems that work through all of EDL (e.g. orbiter to lander during entry or lander to surface rover).

• Monitoring local environmental (weather) conditions on the surface to facilitate forecasting of wind velocities up to ~10km altitude above the surface in preparation for landing (for missions targeted to land near previously landed assets)

• Significantly reducing the impact of incorporating such sensors on the spacecraft in terms of volume, mass, placement, or cost.

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.

Other subtopics that could be soliciting entry, descent, and landing related technology developments include S1.01 Laser and Lidar System Components, S3.10 Earth Entry Vehicle Systems, X9.01 Ablative Thermal Protection Systems, and X9.02 Advanced Integrated Hypersonic Entry Systems. Proposals more aligned with exploration mission requirements should be proposed in X9.