NASA SBIR 2007 Phase I Solicitation

X2.02  Autonomous Precision Landing and Hazard Detection and Avoidance

Lead Center: JSC

Participating Center(s): JPL, LaRC

NASA seeks innovative sensor system technologies to support autonomous precision landing with hazard detection and avoidance for landing spacecraft on the lunar surface with extensibility to Mars. Sensor systems that can characterize and identify spacecraft landing surface hazards for purposes of avoidance and surface relative navigation with high precision and accuracy are of interest. The emphasis of this solicitation is for sensor systems or sensor components that can be utilized in current sensor systems to go beyond current technology capability. These systems or components must be compatible with the environmental conditions of spaceflight and the rigors of landing on the planetary surface. Proposals for development of certain aspects of these technology systems including sensor components that include partnering with other vendors developing this kind of technology are encouraged.

Candidate items include but are not limited to the following:

- Innovative lidar sensor systems and component technologies that directly address autonomous precision landing and hazard avoidance needs

  - 3D imaging lidar systems capable of generating elevation maps covering terrain areas 10k to 100k square meters from 1-2 km altitude with a resolution of the order of 20 cm
  - High efficiency focal plane arrays with over 16k pixels capable of detecting laser pulses shorter than a few nanoseconds (wavelengths of interest are 1 to 1.5 microns)
  - Reliable Readout Integrated Circuit (ROIC) with high frame rate capability greater than 20 hertz and capable of resolving target depth to a few centimeters
  - Novel real-time lidar image reconstruction and processing technologies;

- Passive or active detector systems which operate in certain ranges between 100 km to 2 km for utilization in terrain relative navigation systems;
- Sensor systems which provide very high accuracy and precision for determining velocities and altitudes relative to the surface with 0.1% accuracy;

- Robust and reliable sensor system or sensor system components which significantly reduce the impact of incorporating such sensors or components on the spacecraft in terms of volume, mass, power, thermal dissipation, placement or cost;

- Semiconductor or solid-state-controlled mirror systems capable of rapidly moving a lidar FOV over a defined areas;

- Innovative systems that significantly improve current precision landing and hazard detection capability for lunar descent and landing.

Proposals should describe the expected improvements and advantages of proposed deliverables over existing technologies and should estimate the effects of these improvements on the state-of-the-art navigation and hazard detection capabilities. Attributes of interest include reliability, precision, lighting requirements, accuracy, thermal sensitivity, heat dissipation capability and performance degradation due to rocket plumes and lunar dust.