NASA SBIR 2015 Phase I Solicitation

Z3 Entry, Descent, and Landing

Lead Center: LaRC

The Entry, Descent and Landing topic area will focus on technologies that enable EDL for NASAâ€™s challenging future planetary and Earth return missions. Functional areas, or subtopics, of interest include:Â

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- *Engineering Instrumentation* - Sensors and sensor systems are needed, that will gather engineering data during EDL, for validating models, improving future missions, and generally advancing the state of the art. Sensors of interest include heatshield and backshell heating, pressure, radiometric and spectroscopic instruments, cameras for imaging critical events, and minimally-intrusive techniques such as wireless or acoustic systems. Key characteristics that are sought include: modularity; low mass, power, and volume; and minimal cost for the sensor system, which includes data acquisition, transfer, and storage.
- *Guidance and Control Techniques for EDL* - Advancements in hardware and software for autonomously guiding entry vehicles to specific landing sites will enable an increase in productive time on a planetary surface, or allow aggregation of surface assets. Achieving virtually pinpoint landings may require modified vehicle shapes, control methods that operate in extreme environments, or other hardware innovations. Accompanying numerical algorithms need to efficiently and robustly manipulate the vehicle system through the hypersonic, supersonic, and subsonic flight regimes.
- *Advanced Materials* - This subtopic seeks specific materials innovations that are unique to EDL, including thermal protection systems, multifunctional structures, and inflatable and deployable decelerator concepts.
- *Modeling and Simulation* - Innovative M&S tools that will provide insight into system and subsystem performance, design decisions, and trade-offs are sought. Physics-based models that can facilitate a move towards computational validation, or models grounded in flight data, are particularly of interest. The focus is on the reduction of overall development time and cost for advanced future systems needed for space exploration. Â

Subtopics

Z3.01 Wireless Cameras for Entry, Descent, and Landing Reconstruction

Lead Center: JPL

Participating Center(s): LaRC

This subtopic seeks innovative solutions for the collection of high resolution, high frame rate, and low distortion imagery of key events and hardware during entry, descent, and landing. This would enable the capture of valuable

forensic images for spacecraft events such as the deployment and inflation of parachutes, vehicle touchdown dynamics, and plume-ground interactions.Â

Because the intended usage of the camera system is during EDL, a series spacecraft critical events, the camera system must operate on a non-interference basis with the rest of the spacecraft. Additionally, the use of wireless cameras allows the cameras to be optimally placed to capture imagery of key hardware that may be difficult to access with traditional wired cameras.

Camera Sensor Performance Targets:Â

- Format and Frame Rate Minimum: 1080p @ 30 fps (up to 100 fps).
- Array Format Minimum: 1920 x 1080 Pixels.
- Target Wavelength Range: 480nm - 800nm (TBR).
- Windowing: Yes.
- Color: Yes.
- Technology: CMOS or CCD.
- Temperature Range: -30 Â°C to +40 Â°C.

Camera Optical Performance Targets:Â

- Field of View: +/- 45 degrees off center-line.
- Focus: 0.5 m to infinity.Â

Supporting Avionics Functions:Â

- Ability to control the camera sensor.
- Ability to (near) real time, receive and store seconds to a few minutes of data at the above frame rates, then transmit the image data to the main entry vehicle computer.
- Distance from camera to storage device is between 0.5-10 meters.
- Unit volume no greater than 12.7 cm x 12.7 cm x 12.7 cm.Â

Phase I Deliverables- Include a camera system architecture design, and a testing and calibration plan. Constructing a breadboard unit would also be desired.Â

Phase II Deliverables - Include an engineering-level prototype system on which the testing and calibration from Phase I would have been completed, and a test/performance report.Â Â