NASA SBIR 2018 Phase I Solicitation

S3.05 Terrestrial Balloons and Planetary Aerial Vehicles

Lead Center: GSFC

Participating Center(s): JPL

Technology Area: TA2 In-Space Propulsion Technologies

Satellite Communications

Improved and innovative downlink bitrates using satellite relay communications from balloon payloads are needed.Â Long duration balloon flights currently utilize satellite communication systems to relay science and operations data from the balloon to ground based control centers.Â The current maximum downlink bit rate is 150 kilobits per second operating continuously during the balloon flight.Â Future requirements are for bit rates of 1 megabit per second or more.Â Improvements in bit rate performance, reduction in size and mass of existing systems, or reductions in cost of high bit rate systems are needed. TDRSS and Iridium satellite communications are currently used for balloon payload applications.Â A commercial S-band TDRSS transceiver and mechanically steered 18 dBi gain antenna provide 150 kbps continuous downlink.Â TDRSS K-band transceivers are available but are currently cost prohibitive.Â Open Port Iridium service is also currently being used.

Balloon Sensors and Instrumentation

Improved and innovative devices to make measurements of the balloon and the ambient flight environment are needed.Â Devices or methods to accurately and continuously measure ambient air, helium gas, balloon film temperatures, ambient wind velocity and film strain are desired. These measurements are needed to accurately model the balloon performance during a typical flight at altitudes of approximately 120,000 feet.Â The measurements must compensate for the effects of direct solar radiation through shielding or calculation.Â Minimal mass and volume are highly desired.Â For film measurements, a non-invasive and non-contact approach is highly desired for the thin polyethylene film, with film thickness ranging from 0.8 to 1.5 mil, used as the balloon envelope. Devices for these measurements must be compatible with existing NASA systems and operations.

Planetary Aerial Vehicles

Innovations in materials, structures, and systems concepts have enabled aerial vehicles to play an expanding role in NASA's future Solar System Exploration Program. Aerial vehicles are expected to carry scientific payloads at Venus that will perform in-situ investigations of its atmosphere, surface and interior. Venus features extreme environments that significantly impact the design of aerial vehicles.Â Proposals are sought in the following areas:

- *Aerial Vehicle Platforms for Venus* - NASA is interested in conducting long term monitoring of the Venus atmosphere and planetary surface using aerial vehicles at altitudes around 50 to 60 km. Concepts for Lighter-than-Air (e.g., balloons, airships) and Heavier-than-Air (e.g., fixed wing, rotary wing) vehicles are

encouraged. The aerial platforms should be capable of operation through daylight and/or night time observations on Venus. The proposal should describe how the vehicle concept would be deployed into the atmosphere and operated for its mission. Concepts for any of the following capabilities of aerial vehicle are encouraged:

- Technology demonstration with science payload less than 10 kg.
- Pathfinder mission with science payload less than 50 kg.
- Flagship mission with science payload up to 100 kg.

It is expected that a Phase I effort will consist of a system-level design and a proof-of-concept experiment on one or more key components.