NASA SBIR 2012 Phase I Solicitation

S3.05 Unmanned Aircraft and Sounding Rocket Technologies

Lead Center: GSFC

Participating Center(s): AFRC, ARC, GRC, JPL, KSC, LaRC

All 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.

Unmanned Aircraft Systems

Unmanned Aircraft Systems (UAS) offer significant potential for Suborbital Scientific Earth Exploration Missions over a very large range of payload complexities, mission durations, altitudes, and extreme environmental conditions. To more fully realize the potential improvement in capabilities for atmospheric sampling and remote sensing, new technologies are needed. Scientific observation and documentation of environmental phenomena on both global and localized scales that will advance climate research and monitoring; e.g., U.S. Global Change Research Program as well as Arctic and Antarctic research activities (Ice Bridge, etc.).

NASA is increasing scientific participation to understand impacts associated with worldwide environmental changes. Capability for suborbital unmanned flight operations in either the North or South Polar Regions are limited because of technology gaps for remote telemetry capabilities and precision flight path control requirements. It is also highly desirable to have UAS ability to perform atmospheric and surface sampling.

Telemetry, Tracking and Control

Low cost over-the-horizon global communications and networks are needed. Efficient and cost effective systems that enable unmanned collaborative multi-platform Earth observation missions are desired.

Avionics and Flight Control
Precise/repeatable flight path control capabilities are needed to enable repeat path observations for Earth monitoring on seasonal and multi-year cycles. In addition, long endurance atmospheric sampling in extreme conditions (hurricanes, volcanic plumes) can provide needed observations that are otherwise not possible at this time:

- Precision flight path control solutions in smooth atmospheric conditions.
- Attitude and navigation control in highly turbulent atmospheric conditions.
- Low cost, high precision inertial navigation systems (UA Integrated Vehicle Health Management)

- Fuel Heat/Anti-freezing.
- Unmanned platform icing detection and minimization.

Guided Dropsondes

NASA Earth Science Research activities can benefit from more capable dropsondes than are currently available. Specifically, dropsondes that can effectively be guided through atmospheric regions of interest such as volcanic plumes could enable unprecedented observations of important phenomena. Capabilities of interest include:

- Compatibility with existing dropsonde dispensing systems on NASA/NOAA P-3’s, the NASA Global Hawk, and other unmanned aircraft.
- Guidance schemes, autonomous or active control.
- Cross-range performance and flight path accuracy.
- Operational considerations including airspace utilization and de-confliction.

Novel Platforms and Systems

Innovative fixed wing, rotary wing, or lighter than air platforms and associated systems offering unique capabilities for Earth science research and environmental monitoring are desired. Commercially viable concepts that may have alternative short-term utility for other civil research agencies are in-scope. Systems that are tailored to support new miniaturized instruments for Earth science research, for example those developed under subtopic S1.08 (Airborne Measurement Systems), are encouraged.

Sounding Rockets

The NASA Sounding Rocket Program (NSRP) provides low-cost, sub-orbital access to space in support of space
and Earth sciences research and technology development sponsored by NASA and other users by providing
payload development, launch vehicles, and mission support services. NASA utilizes a variety of vehicle systems
comprised of military surplus and commercially available rocket motors, capable of lofting scientific payloads, up to
1300lbs, to altitudes from 100km to 1500km.

NASA launches sounding rocket vehicles worldwide, from both land-based and water-based ranges, based on the
science needs to study phenomenon in specific locations.

NASA is seeking innovations to enhance capabilities and operations in the following areas:

- Autonomous vehicle environmental diagnostics system capable of monitoring flight loading (thermal,
  acceleration, stress/strain) for solid rocket vehicle systems.
- Location determination systems to provide over-the-horizon position of buoyant payloads to facilitate
  expedient location and retrieval from the ocean.
- Flotation systems, ranging from tethered flotation devices to self-encapsulation systems, for augmenting
  buoyancy of sealed payload systems launched from water-based launch ranges.