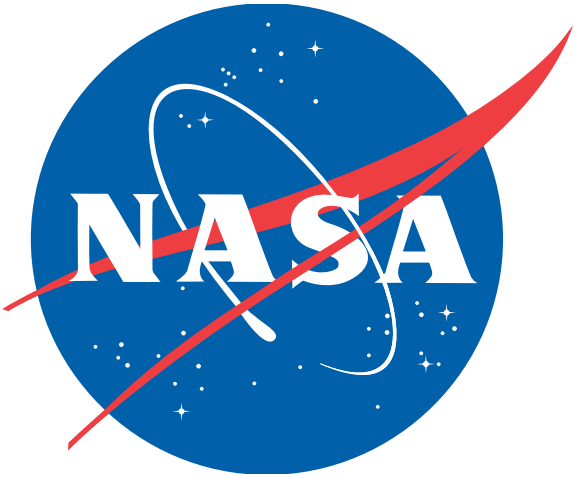

National Aeronautics and
Space Administration

Suborbital Science Missions of the Future

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

OFFICE OF EARTH SCIENCE (OES)
SUBORBITAL SCIENCE MISSIONS OF THE FUTURE

Fill in Science Focus Area here

Statement of Work

Abstract
The Suborbital Science Missions of the Future activity (SSMF) has as its objectives to carry out studies and a workshop that outline future science investigations and which describe the requirements for future integrated airborne systems, such as uninhabited aerial vehicles (UAVs) or other innovative platforms, for collecting Earth observations in support of ESE scientific objectives.

1. Introduction / Background

NASA's Office of Earth Science is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment. Using the unique perspectives available from space, from within the atmosphere, and from the ground, NASA is observing, documenting, and assessing large-scale environmental processes with current emphases in six science focus areas. ESE space-based observations, complemented by suborbital and ground-based observations, are enabling us to better understand Earth system processes, to determine the role of natural and human-related activities on these processes, and to understand the consequences of changes resulting from these processes.

In the integrated global observing system, there are four measurement platform realms: far space, near space, suborbital and surface. Space provides the vantage point for regular global or near-global observation, while suborbital and surface assets can be deployed for in-depth, high-resolution observations. Suborbital platforms bridge the scales between the local, small-scale events that can be studied from surface-based sensors with the much larger-scale regional and global phenomena, thus contributing to the unique integrated perspective that enables Earth system science. To expand the suborbital platforms' capability to make those connections, the Suborbital Science Program is moving to the use of new, state-of-the-art measurement systems, including aeronautical platforms with unique or enhanced capabilities, such as Uninhabited Aerial Vehicles (UAVs). Unique features of such platforms include long duration, higher subsonic altitude flight, and the ability to perform missions that may not be suitable or are too hazardous for on-board piloted aircraft.

The SSMF activity provides the science community with an opportunity to guide the planning and resources of the Suborbital Systems program by describing future science missions and campaigns that address the research objectives of ESE, and specifying the flight and measurement capabilities that would be needed to enable them.

The studies will provide significant guidance to ESE, most notably the suborbital science program, as it seeks to evolve its use of suborbital platforms in the next few years. Historically, the suborbital science program has emphasized the use of NASA-owned aircraft, which have served effectively as platforms for process study and satellite calibration/validation. In spite of their long heritage and successful contributions, they suffer from some common limitations - e.g., limited observing envelope, restrictions associated with crew safety, etc., that place some limitations on their usefulness. The ESE is attempting to evolve to a future suborbital science program that is based on use of leased or shared (rather than exclusively NASA-owned) platforms that can allow different kinds of missions than have been possible until now. Given the potential for very different kinds of missions that may best be served by different types of platforms, ESE is soliciting mission concepts to help it develop an investment strategy for suborbital science over the next several years that will enable an ambitious and flexible future program that can capitalize on advances in platform capability to become available while preserving the synergistic use of optimized platform-sensor combinations that have been the hallmark of NASA's suborbital science program in the past.

2. Study Goals

Following the successful use of UAVs in the ESE-sponsored UAV Science Demonstration Program (UAVSDP: http://geo.arc.nasa.gov/uav-nra/uav_nra.html), ESE is now working to develop plans for the future use of such systems in future science missions and campaigns. Access to new platforms may be through various mechanisms, such as purchase, lease, partnering, or commercial service. It is the goal of the Suborbital Science program to make access available to the science community through the traditional flight request systems, once the needs of the science community are articulated.

To this end, the objectives of this study are to:

- Identify airborne measurement system requirements for future science missions and campaigns that address ESE science focus areas,
- Provide guidance to the future resource and capabilities needs of the Suborbital Science program, including identification of technology gaps to address future requirements.
- Develop a preliminary implementation plan for potential missions which make use of innovative platform capabilities matched to remote sensing and/or in situ observing instruments
- To explore the benefits to Earth-system science by using innovative suborbital systems with enhanced or unique capabilities, such as UAVs.

3. Study Elements

Therefore, the study team is directed to carry out a concept study and deliver a preliminary implementation plan for future science missions or campaigns in the 2010-2015 timeframe. Elements of the study:

- Describe the scientific purpose of the planned observations and how they support the following ESE science focus area: _____
- Address the specific measurements that would be made, and why an enhanced or uniquely capable platform would best address this research objective
- Design a science mission in sufficient detail to determine system requirements, including flight characteristics (location, altitude, endurance, season, frequency), as well as payload characteristics (type, weight, volume, environmental considerations, and access such as sampling or viewing ports), and communication needs such as real-time data or instrument control.
- Develop an implementation plan which contains the following items: mission planning, flight planning, payload development / integration, safety and permitting, deployment, post-flight activities, data analysis and education/outreach.
- Deliver a final report with the following sections: mission concept, technical challenges, success criteria, implementation plan and a costing model.

Considerations:

- The team is not required to specify an airborne platform by name, but is to describe the attributes of the platform that will meet their objectives. The platform need not be currently operational or even existing. However, the team should comment on or discuss the technical readiness, as they understand it, of any platform that might meet their requirements.
- Hardware development is not considered within the scope of this study. However, if instrument development (especially the migration of current or planned instruments to configurations suitable for use on UAVs) will be required to ensure the viability of the selected mission, the nature of such efforts should be spelled out in the study. Additional discussion of payload development needs should be included in the study.
- Engineering resources, such as systems and aeronautical engineers, will be available from the Aeronautics Enterprise.
- The outcome will be requirements that guide Suborbital Systems planning for future capabilities and resources.

4. Period of Performance

The period of performance will be 5 months from award date, estimated as May 1, 2004 through September 30, 2004. An interim review will be held at the midpoint of the study, possibly in conjunction with the companion workshop planned for July 2004.

5. Reporting / Deliverables

Deliverables include an interim review with briefing materials, participation in summer workshop and a final report.