RESEARCH AND TECHNOLOGY
PROGRAM COMMITMENT AGREEMENT
SUBORBITAL RESEARCH PROGRAM

It is the responsibility of each of the signing parties to notify the other in the event that a commitment cannot be met and to initiate the timely renegotiations of the terms of this agreement.

Associate Administrator, Science Mission Directorate — 23 MAY 2013 — Date

Associate Administrator — August 26, 2013 — Date

PROGRAM COMMITMENT AGREEMENT (PCA)

SUBORBITAL RESEARCH PROGRAM

1. PROGRAMS OBJECTIVES

The NASA Science Mission Directorate (SMD) manages the Suborbital Research Program which enables fundamental scientific, technological, and educational investigations. It is characterized by frequent flight opportunities utilizing aircraft, balloons, sounding rockets, cubesats, commercial reusable vehicles, and small International Space Station payloads. These platforms support a wide variety of scientific objectives related to Earth science, heliophysics, planetary science, and astronomy and astrophysics. The goals and objectives of the Suborbital Research Program flow down from the *2011 NASA Strategic Plan,* and they are contained in the *Science Plan for NASA's Science Mission Directorate (SMD) 2010*:

- *Earth Science:* Advance Earth system science to meet the challenges of climate and environmental change.
- *Heliophysics:* Understand the Sun and its interactions with Earth and the solar system.
- *Planetary Science:* Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.
- *Astrophysics:* Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.
- *Technology:* Develop and demonstrate the critical technologies that will make NASA's exploration, science, and discovery missions more affordable and more capable.
- *Workforce and Education:* Improve retention of students in science, technology, engineering and mathematics (STEM) disciplines by providing opportunities and activities along the full length of the education pipeline.

Suborbital platforms often can provide data on much finer spatial and temporal scales than those achievable by on-orbit instruments, and enable in-situ measurements and active experiments that require waiting for appropriate geophysical conditions. Suborbital platforms also provide an in-expensive and low-risk way to develop and test new space flight instrument concepts, as well as to calibrate and validate the on-orbit spacecraft instrument.

2. PROGRAM OVERVIEW

The Suborbital Research Program consists of a set of uncoupled Research and Technology (R&T) projects (which are referred to as programs for historical reasons), each with a separate funding and management structure. Each project conforms to the NASA project management processes detailed in NASA Procedural Requirements (NPR) 7120.8, *NASA Research and Technology Program and Project Management, Section 3.5*. The Suborbital Research Program is organized as Cross-Program Research as shown in Figure 1. The budget lines associated with each project will remain in the SMD research division where they are managed. The Astrophysics

Division (APD) manages the scientific Balloon Program for all of SMD. The Earth Sciences Division (ESD) manages the Airborne Science Program for all of SMD. The Heliophysics Division (HPD) manages the Sounding Rockets Program for all of SMD. SMD-sponsored science, technology, and training investigations utilizing cubesats, small ISS payloads, and commercial reusable suborbital vehicles will be managed on an ad-hoc basis through the sponsoring SMD research division. Each project has a portfolio of R&T investigations with unique science and platform requirements. Science campaigns are conducted at world-wide locations, driven by consideration for the science phenomena of interest. Suborbital research missions must comply with all agency safety policies, including but not limited to NPR 8715.3 and NPR 8715.5. Suborbital Research Projects are typically low cost, level of effort activities, with less than Class D mission assurance requirements.

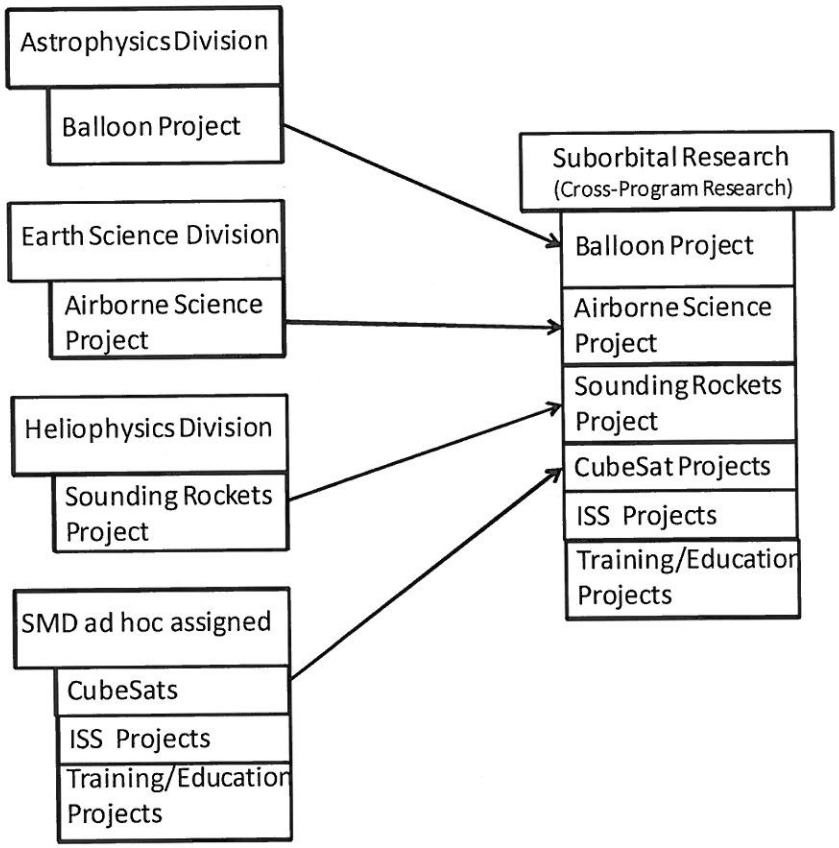

Figure 1- Suborbital Research Program within SMD

The Suborbital Research Program consists of three component projects:

Airborne Science – Conducts Earth science investigations utilizing both NASA and non-NASA aircraft, including both piloted and remotely piloted aircraft, provides payload integration and mission flight operations at altitudes up to 21 km. The Airborne Science Program conducts approximately 1,500 to 2,500 flight hours annually in support of the NASA scientific and technology community.

Balloons – Conducts Earth and space science investigations characterized by payload integration, test, and launch on scientific balloons, with near space access for payloads up to altitudes of 38 km. The Balloon Program Office conducts between 14 to 16 balloon launches per year in support of the NASA scientific and technology community.

Sounding Rockets – Conducts Earth and space science investigations characterized by payload integration, test, field operations support and launch on sounding rockets at altitudes up to 1500 km. The Sounding Rockets Program Office conducts approximately 20 to 25 sounding rockets launches per year in support of the NASA scientific and technology community.

To promote even greater access to space for the science community, the Suborbital Research Program also provides access to commercial reusable suborbital platforms, cubesats, and small International Space Station payloads.

All Suborbital investigations are competitively selected and/or initiated as part of competitively-selected programs, such as the NASA Research Opportunities in Space and Earth Sciences (ROSES) process. The annual manifest for each project is based on peer-reviewed science research and technology development proposals selected by SMD. Occasionally, reimbursable missions, primarily from other NASA mission directorates, branches of the Department of Defense (DoD), other government agencies, and commercial and foreign entities are supported by the Suborbital Research Program.

3. PROGRAM AUTHORITY

NASA Science Mission Directorate (SMD) implements the Suborbital Research Program through its research divisions and assigned field centers to provide a portfolio of highly effective suborbital and special orbital research platforms and mission services. Implementation responsibility is assigned to the following field centers and their respective project offices.

Suborbital Program Element	Field Center	Project Office
Airborne Science	ARC	Earth Science Project Office
	DFRC	Airborne Science Project Office
	GSFC	Aircraft Office
Balloons	GSFC	Balloon Program Office
Sounding Rockets	GSFC	Sounding Rockets Program Office

Table 1: Program Implementation: NASA Field Center and Project Offices

The SMD Program Management Council (PMC) has overall governing responsibility for the Suborbital Research Program. Oversight of the Suborbital Research Program activities is performed by the Center Management Council at the host Center, which evaluates all suborbital project investigations for safety, technical content, and cost and schedule, to ensure compliance with the PCA, Program Plans, Center procedures and processes, and applicable NASA technical standards.

The Suborbital Research Program will be managed as cross-program research as defined in NASA Procedural Requirements (NPR) 7120.8, *NASA Research and Technology Program and Project Management*. The Suborbital Research Program and its program management processes are documented in the Suborbital Research Program Plan, a document subordinate to this PCA that is approved by the SMD Associate Administrator, the respective Center Director, and the respective Program Manager. The Suborbital Research Program will identify and document program element-specific SMA roles, responsibilities, and relationships for its platforms in the Suborbital Research Program SMA plan, as well as project unique SMA plans.

Each suborbital project is assigned to an SMD division for management. The assigned Division Director conducts continuous assessment of the program performance through a designated Program Executive and reports to the Associate Administrator for the Science Mission Directorate. The SMD Senior Program Executive for Suborbital Research provides overall monitoring and coordination of the constituent projects of the Suborbital Research Program and reports through the SMD Deputy Associate Administrator for Research to the Associate Administrator for the Science Mission Directorate. The approving official for operations is the designated Center Director.

Airborne Science Program - NASA's Airborne Science Program is administered by the Earth Science Division (ESD) of SMD and operates through NASA's Ames Research Center (ARC), Dryden Flight Research Center (DFRC), Glenn Research Center (GRC), Johnson Space Center (JSC), Langley Research Center (LaRC), and Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF). Program authority and oversight/insight for all airborne science missions are delegated from the SMD Associate Administrator for the Science Mission Directorate through the Earth Science Division Director, Earth Science Associate Director for Research, to the Airborne Science Program Director within SMD. The Airborne Science Program Director reports, programmatically, through the Earth Science Division Director to the SMD Associate Administrator for the Science Mission Directorate. The Principal Investigator (PI), or other project lead for each airborne science investigation is responsible to the sponsoring Division Director for the overall success of the science investigation.

Balloon Program - NASA's Balloon Program is administered by the Astrophysics Division and managed by the Balloon Program Office at Goddard Space Flight Center's Wallops Flight Facility. The Balloon Program Office Chief reports programmatically through the Astrophysics Division Director to the Associate Administrator for the Science Mission Directorate. Program authority and oversight/insight of all Balloon missions are delegated from the Associate Administrator for the Science Mission Directorate through the Astrophysics Division Director to the Balloon Program Office Chief within the Suborbital and Special Orbital Projects Directorate at Wallops Flight Facility. The PI or other project lead for each balloon science investigation is responsible to the sponsoring Division Director for the overall success of the science investigation.

Sounding Rockets Program - NASA's Sounding Rockets Program is administered by the Heliophysics Division and managed by the Sounding Rockets Program Office at Goddard Space Flight Center's Wallops Flight Facility. The Sounding Rockets Program Office Chief reports, programmatically, through the Heliophysics Division Director to the Associate Administrator for

the Science Mission Directorate. Program authority and oversight/insight of all Sounding Rocket missions are delegated from the Associate Administrator for the Science Mission Directorate through the Heliophysics Division Director to the Sounding Rockets Program Office Chief within the Suborbital and Special Orbital Projects Directorate at Wallops Flight Facility. The PI or other project lead for each sounding rocket investigation is responsible to the sponsoring Division Director for the overall success of the science investigation.

Additionally, low-cost orbital projects (typically CubeSats, and small ISS payloads) that are smaller than category 3 flight projects are managed by the sponsoring research division within the Science Mission Directorate.

4. TECHNICAL PERFORMANCE COMMITMENT

The Suborbital Research Program performance commitment shall be as follows:

a. The Suborbital Research Program will safely operate, collect, and distribute scientific data to the PI or other project lead.
b. The Suborbital Research Program will conduct science campaigns from locations world-wide, commensurate with the availability of funding and scientific interest. The Suborbital Research Program schedule is highly fluid and dependent on a variety of factors, including mission requirements, maintenance, improvement, and modernization needs. The utilization of extended capability vehicles is dependent on a selected mission's requirements and available funding.
c. The Suborbital Research Program will utilize a wide variety of suborbital and special orbital platforms for access to space. Airborne science platforms (piloted aircraft, UAS), sounding rockets, scientific balloons, commercial suborbital reusable launch vehicles, CubeSats, and International Space Station (ISS) payloads are all encouraged as ways to increase program flexibility and maximize flight opportunities for Earth and space science.
d. Research is conducted in the altitude region from ~1 to 1600 kilometers. Flight durations range from less than 20 minutes to several weeks. Extended flight durations of up to 100 days and altitude requirements of up to 3000 kilometers are under development to meet enhanced science requirements.
e. Suborbital Research Program science investigations shall be complete missions, where the project office provides the platform, launch vehicle integration, mission operations, tracking support, and payload recovery. The PI or other project lead provides the instrument to be integrated and flown on the platform. The project office is responsible for providing the required mission assurance for the required platform. The aggregate mission success (launch vehicle and experiment success) is expected to be on the order of 85 percent in a given year. The PI or other project lead is responsible for data analysis, publication, and training of students.
f. The requirements of NASA Procedural Requirements NPR 7120.8, *NASA Research and Technology Program and Project Management*, apply to the Program as tailored by this document and the Suborbital Research Program Plan.
g. The risk management requirements defined in NPR 7120.8 apply to the Suborbital Research Program at a level of rigor commensurate with the cost and complexity and risk

documented in project Risk Management Plans and implemented at a level commensurate with the cost, complexity, and risk of the suborbital mission.

h. Per NPD 8700.1E (NASA Policy for Safety and Mission Success), the Suborbital Research Program will establish safety and mission success requirements per the Suborbital SMA Plan within their projects and elements, in conjunction with the designated Center Technical Authority at a level of rigor commensurate with the cost and complexity of the project. Suborbital Projects will work with the host Center SMA organization to coordinate/execute SMA efforts within the project/element.

i. The Suborbital Research Program is excluded from NPR 8705.4, *Risk Classification for NASA Payloads*. However, accepted risks associated with the project or science investigations are documented in the projects' project plan to ensure that the risk is understood and agreed to by the PI and the project, such that no further specific mitigating action is required.

5. SCHEDULE COMMITMENT

The Suborbital Research Program schedules are customer driven and within the bounds of level-of-effort funding. Funding and science demands drive the flight rate and the launch/flight schedule. In a typical year, the airborne science program will fly between 1500 and 2500 hrs in support of science operations. A total of 30 to 40 sounding rocket and balloon launches are conducted each year. Each fiscal year, the suborbital flight manifest is authorized by SMD. Reviews are conducted with the PI team to assess mission requirements and readiness. Launch locations are driven by science requirements, within the limits of available funding and demand for flight opportunities. Launch and reflight schedule flexibility is a feature of the program designed to accommodate the experimental nature of the technology used in many of the payloads. In addition, the timing of scientific targets of opportunity, such as forest fires, hurricanes, new supernova or comet, cannot be planned in advance.

Project	**Airborne Science Program**	**Sounding Rocket Program**	**Balloon Program**
Annual Flights	1500 - 2000 hours flown annually	20+ missions conducted annually	15+ missions conducted annually
Acquisition	Selected via NRA(ROSES)	Selected via NRA(ROSES)	Selected via NRA(ROSES)
Divisions Supported	Earth	Astrophysics, Heliophysics, and Planetary	Astrophysics, Earth, Heliophysics, & Planetary
Mission Life Cycle	Mission life cycle <36 months	Mission life cycle <48 months	Mission life cycle <36 months
Locations	World-wide launch locations	Polar, Mid-latitude, Southern Hemisphere launch locations	Polar, Mid-latitude, Southern Hemisphere launch locations

Table 1: Suborbital Project Scope

6. COST COMMITMENT

The Suborbital Research Program activities are levels of effort funded by the SMD because of the constant stream of missions being processed. The following table represents the expected budget for the next 5 years, based on the FY2013 President's Budget Request:

Element - NOA	FY2013 ($M)	FY2014 ($M)	FY2015 ($M)	FY2016 ($M)	FY2017 ($M)
Airborne	48.2	49.2	50.2	51.7	52.2
Sounding Rockets	56.1	51.6	53.7	53.0	53.0
Balloons	33.0	32.9	32.8	34.2	34.3

These full-cost budgets are necessary to sustain the program, including, but not limited to, standard program activities, facility costs, launch vehicles, aircraft, science campaigns, launch and mission operations, maintenance, and technology development activities. These budgets do not include the development of payloads, and other activities of the science teams, including training of students, data analysis and archiving. Science team funding for the investigation is provided separately from the platform funding by SMD. NASA competitively selects and separately funds the science investigation from the suborbital platform.

7. ACQUISITION STRATEGY

In the acquisition of scientific investigations using suborbital research platforms, NASA will use full and open competitions, primarily through the NASA Research Opportunities in Space and Earth Sciences (ROSES) process, where science investigations are peer reviewed, competitively selected, and separately funded from the suborbital platform. In some cases, science investigations that require a suborbital platform will be selected and funded separately by an Explorer or Earth System Science Pathfinder (ESSP) Announcement of Opportunity (AO) process, where multiple investigations are selected for concept studies with a competitive down select to proceed toward the formulation and implementation phase. In these cases, the suborbital science investigation will be acquired through competitively selected contracts managed by the selecting program, and is not a part of the Suborbital Research Program. In some cases, selected SMD science investigations will utilize non-SMD acquired, commercial suborbital reusable launch vehicles and flight support services to conduct the investigation.

8. HIGH RISK AREAS

Risks in the Suborbital Research Program associated with the suborbital platform will be managed via the risk management plan associated with the suborbital platform. Project specific risks are documented in the suborbital platform's Risk Management Plan, in accordance with the requirements of NASA Procedural Requirements NPR 7120.8.

13. Waivers

No waivers are being sought for the Suborbital Research Program.

14. PCA ACTIVITIES LOG

Date	Event	Change	Addendum	Termination Review Req'd	MDAA Signature	Associate Administrator Signature
4/21/1999	New PCA	None	N/A	No	Signed by MDAA	
6/11/2003	Updated to Reflect 7120.5B	Entire Document	N/A	No	Signed by MDAA	Signed by DA
4/30/2013	Updated to Reflect 7120.8	Entire Document	N/A	No		

9. INTERNAL AGREEMENTS

The Suborbital Research Program is supported by services provided by the Space Network Communications and Data Services and by the WFF Research Range Program.

10. EXTERNAL AGREEMENTS

External agreements are managed by each project in accordance with its project plan. Foreign campaigns and expeditions are conducted as required and diplomatic clearances and international agreements with foreign countries for launch, overflight, and recovery operations are coordinated by the project office with the NASA Office of International and Interagency Relations (OIIR). Project specific agreements are documented in the suborbital platform's Project Plan.

11. INDEPENDENT ASSESSMENTS AND OPTIONAL KDP'S

Program reviews will be conducted in accordance with the terms of reference and consistent with NPR 7120.8. Independent reviews of Suborbital Research Program elements and activities by SMD, Office of the Chief Engineer (OCE), Office of Education, and the Office of Safety and Mission Assurance (OSMA) are conducted as required to evaluate the project's performance against science, technical, education and programmatic performance requirements. Review of the Suborbital Program's anomalies will be conducted annually by SMD, Office of the Chief Engineer, the appropriate Center's Safety and Mission Assurance organization, and the NASA Office of Safety and Mission Assurance (OSMA).

12. OUTCOMES

The Suborbital Research Program's outcomes directly support the goals of the Agency's Vision and Strategic Plan. They have played an important role in developing and validating space technologies. Many suborbital instruments and instrument concepts proven initially on Aircraft, Sounding Rockets, or Balloons have been developed for spacecraft missions. Suborbital sensors have also been flown to calibrate on-orbit sensors.

Suborbital Research missions are expected to contribute to the following outcomes:

- Advance Earth system science to meet the challenges of climate and environmental change.
- Understand the Sun and its interactions with Earth and the solar system.
- Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.
- Infuse game changing and crosscutting technologies throughout the Nation's space enterprise to transform the Nation's space mission capabilities.
- Identify, cultivate, and sustain a diverse workforce and inclusive work environment that is needed to conduct NASA missions.
- Improve retention of students in STEM disciplines by providing opportunities and activities along the full length of the education pipeline.