Science, Sensors, and Students: Pillars of Suborbital Research for Planetary Science

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Abstract

Suborbital research with sounding rockets and high-altitude balloons is considered a key element of the base of the NASA science and development portfolio of all the Science Divisions with the exception of Planetary Science. The lack of suborbital opportunities for solar system study represents an ongoing cost in terms of reduced scientific breadth, barriers limiting new technology development, and a diminishing overall technical literacy of the research community. In this presentation I describe how a Suborbital Research Program would increase the effectiveness of the wider aims of the Planetary Science Division (PSD).

Suborbital Science

Research from low-cost suborbital platforms can fill multiple roles in the planetary science portfolio. Four areas of particular significance include 1) niche science employing techniques (e.g. polarimetry, wide field, interferometry, high-resolving power) that are not typically included as instruments on robotic probes or orbital observatories, 2) science of opportunity (e.g. comets) where rapid response is important, 3) synoptic monitoring (e.g. long-term infrared auroral study from high altitude), and 4) mission under flight support (e.g. Doppler structure measurement of emission lines).

Technology Development

The Planetary Science Division invests heavily in the development of new instrumentation through programs including *Planetary Instrument Concepts for the Advancement of Solar System Observations* (PICASSO) and *Maturation of Instruments for Solar System Exploration* (MatISSE). Beyond these programs, there is a Technology Readiness Level (TRL) gap that limits the elevation of new instruments to the mission portfolio. Suborbital testing is an effective way to qualify instruments using low-cost, recoverable platforms, without the volume and power limitations of SmallSats.

Training of Engineers and Investigators

The opportunities for students in planetary science to design, test, and deploy spaceflight experiments is limited, and this has led to a steady decrease in the number of experienced instrumentalists entering the field to lead mission and sensor teams. Similar concerns about the rate at which engineers with spaceflight training have been raised repeatedly. SmallSats and CubeSats are a new path forward in both areas, but the platforms are highly specialized and the number of mission opportunities is small. Suborbital research is a proven way for scientists and engineers (Fig. 1) to learn in a low-stakes, flexible environment where pedagogy is a focus.

Conclusion

Suborbital platforms are an underutilized resource with tremendous potential for contributing to planetary science research and development. Using the existing model of the other NASA Science Divisions, the PSD can develop new lines of investigation, accelerate TRL advancement of next generation spacecraft instruments, and maintain a sustainable influx of scientists and engineers.

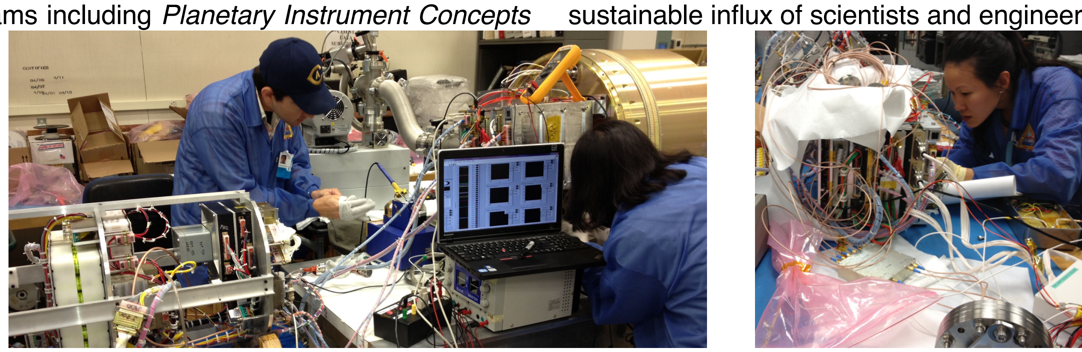

Figure 1: Student, Post-doctoral, and engineering training is a key element of suborbital research.