2018 Workshop: Developing small rockets

Long title
Developing small rockets for mesosphere and lower thermosphere research (50-120 km)
Conveners
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Description

Description: The mesosphere and lower thermosphere (MLT) region is strongly and dynamically coupled to the troposphere and stratosphere below and the ionosphere above via a large number of physical and chemical processes. Accordingly, it an absolutely critical region both for earth sciences and heliophysics and is at the heart of CEDAR science.

In order to understand the large number of important processes in the MLT region, such as turbulence, meteor ablation and mesospheric smoke, aerosol and cluster ion chemistry, plasma instabilities, and photochemistry, we require in situ measurements of basic neutral and ionized quantities and their driving forces. Sounding rockets are the only platform capable of gathering these direct measurements. Ideally, these parameters could be observed with multiple flights, including repeated measurements over a mesoscale spatial domain. Such a measurement approach requires cost-effective vehicles and payloads with the appropriate launch infrastructure.

Although NASA continues to carry out a limited number of sounding rocket investigations of the MLT region with large rockets, there is continued interest in developing a small rocket/payload capability that would enable cost effective and multiple launches into this region for a wide variety of instrument techniques. Accordingly, through its Sounding Rocket Working Group, NASA is soliciting input regarding the requirements that might be used to guide and develop such a new capability. Given that CEDAR scientists are at the forefront of this research, and in particular, given that NSF-funded ground-based measurements and theory and

modeling activities are highly germane to the goals of the research that would be addressed with such mesosphere rockets, a CEDAR workshop is organized to discuss and seek community input.

The objectives of the proposed CEDAR workshop on mesospheric rockets include: (1) Present and discuss compelling science questions in mesosphere/lower thermosphere science that can be addressed with small sounding rockets (2) Review past and present system capabilities and new technology developments (3) Solicit experimenter input on necessary volume, mass, apogee, telemetry, launch cadence requirements etc. for existing or future miniaturized instrumentation to study MLT processes (4) Gauge interest of the CEDAR community in developing new cost-effective vehicles, standardized payload modules, and sub-payload deployment systems for MLT ground-based and rocket campaigns

Further information on mesospheric payloads can be found in past findings from the NASA Sounding Rocket Working Group:

Findings 2017 (pdf)

Findings 2010 (pdf)

New Mesospheric Payload (pdf)

Agenda

Short Presentations 10 minutes (+2 for discussion)

List of speakers

- Rob Pfaff: Background
- Nathan Empson (NASA Wallops Flight Facility): Solicitation for mesospheric rocket requirements (pdf)
- Doug Rowland: Past multiple-launch campaigns
- Sven Bilén: Instrumented Loki–Dart Payload for Measuring Mesospheric Plasma Density Fluctuations and Tribute to John "Jack" Mitchell (1944-2018)
- Edgar Bering and Jim Roeder: Rocket Studies of the X-ray Flux in the High Latitude Mesosphere and Stratosphere (pdf)
- Jonathan Snively: Visualizing and interpreting tracer transport by nonlinearly dissipating gravity waves
- Miguel Larsen: Ampule payloads

- Kristina Lynch: From Pucks to Ampules to Bobs: development of instrumented telemetered small payloads for multipoint arrays (pdf)
- Boris Strelnikov: New rocket instrumentation for turbulence studies
- Jim Clemmons: Requirements for small turbulence payloads
- Don Hampton: Sampling E-region winds in the auroral zone

Justification

Justification: Experiments with small rockets for the mesosphere and lower thermosphere (MLT) are highly integral and complementary to CEDAR science goals. The MLT is an absolutely critical region both for earth sciences and heliophysics and is at the heart of CEDAR science. Given that CEDAR scientists are at the forefront of MLT research, and in particular, given that NSF-funded ground-based measurements and theory and modeling activities are highly germane to the goals of the research that would be addressed with such mesosphere rockets, we propose this CEDAR workshop to discuss and seek community input.

The workshop proposal addresses the CEDAR Strategic Thrust #4: Develop Observational and Instrumentation Strategies for Geospace System Studies, in particular, - Coordinate multi-platform observational campaigns; - Develop smart sensors (i.e., autonomous, reconfigurable, robust, low-power, etc.); - Pursue the advancement of innovative, space-based sensing platforms, including suborbital rockets.

The development of new small sounding rockets is currently under the auspices of NASA Heliophysics, the HTIDS element, and the NASA Sounding Rocket Program.

Progress shall be measured by the community interest in this workshop, successful development of small sounding rockets, vehicle and payload technology, and appropriate miniaturized instrumentation

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