2021 Workshop: Commercial suborbital applications

Long title
Exploring mesosphere-lower thermosphere-ionosphere (MLTI) applications for emerging commercial suborbital spacecraft
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Description

We suggest that the continued increase in low-cost access to the MLTI by commercial suborbital payloads provides an opportunity that the CEDAR community can use to advance scientific understanding, develop new instruments and provide revolutionary opportunities for students and early career scientists. These flights provide opportunities for payloads to fly in a ‘shirt sleeves’ environment inside the capsules viewing through a port; externally mounted, or even, potentially, dropped from the vehicle. This opportunity lowers the bar for participation in space missions; typical costs for the ride itself can be as low as $8K. Blue Origin plans to support at least 4 suborbital flights per year when the capability is fully operational.

These vehicles achieve altitudes up to 110 km which make them uniquely suited for providing in situ access to the MLTI and with the addition of external mounting or internal mounts and windows or ports; enabling remote sensing. Multiple companies are currently developing (and flying) various manned and unmanned spacecraft designs that could provide low cost (<$100k per mission), frequent access to this region with payload capacities exceeding 650 kg and a guaranteed safe return of payloads. Additionally, the potential low cost of smaller payloads (<$8K) offer unprecedented educational opportunities. Most of these vehicles have flown from the Mohave Spaceport in California, Spaceport America in New Mexico and the West Texas Launch Site in Texas, however, numerous spaceports are planned at multiple

locations around the world. Thus, not only do these vehicles offer in situ access to the MLTI region but could also be used to perform joint observations with ground-based facilities.

NASA STMD has already flown >40 payloads on these spacecrafts. With several companies conducting operational and/or test flights now is the time for scientists to explore ways to apply this potentially revolutionary advancement in low cost access to near-Earth space. Determination of specific and coordinated research applications that can greatly benefit from low cost frequent access to 60 km -110km is a priority of this workshop. It may well be that commercial suborbital, by providing daytime access to this region, will not only significantly advance NSF-funded ground-based research but it will enhance our understanding of the region not directly accessible by in situ missions such as GDC.

1) Introduction to commercial suborbital 2) NSF Remarks 3) NASA Remarks 4) Blue Origin Overview 5) Virgin Galactic Overview 6) Scene setting Remarks 7) Group discussion 8) Summary/closing/next steps

Justification

CEDAR Thrusts #2 (Explore exchange processes at boundaries and transitions in geospace) and #4 (Develop observational and instrumentation strategies for geospace system studies) are directly addressed in this workshop.

The goal of this workshop is to help define the applications of commercial suborbital spacecraft for in situ observations of the MLTI. Commercial sub-orbital payloads offer unprecedented in situ and remote sensing opportunities with frequent low-cost access to the region of space between ~80 km to ~110 km. This region is difficult to study because it is too high for aircraft and balloons and yet too low for orbital satellites. This means that the ground-based community is confined to RF measurements (e.g. radars) and nighttime remote sensing observations (e.g. FPIs, LIDAR’s, etc.). While some observations of this region exist from sounding rocket missions, low-cost, frequent commercial spacecraft missions can dramatically improve our understanding of this critical and physically complex transition region by enabling repeated access, especially during the day. Because these flights are intended to sustain humans in a comfortable, pressurized environment, the requirements for ‘space qualification’ are significantly lower; the barriers to flying hardware are greatly reduced.

Our approach focuses on community involvement; some of these spacecraft companies are already conducting test flights. The CEDAR community can leverage these new research opportunities to advance CEDAR science. NSF/CEDAR can take advantage of this low-cost opportunity to field innovative new instruments with a significant educational component. CEDAR community feedback to the spacecraft companies will enable better accommodation of future scientific investigations.

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