Mesospheric Sub-orbital Ballooning System (MSBS) for Low-cost, Instant, and Long-Duration Mesospheric Access for Research, Testing, and Technology Demonstrations

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Abstract

Space technology testing services available in the market can be categorized in three major types: ground-based laboratory testing, atmospheric testing, and ISS testing. Ground based laboratory testing provides simulated test environment by controlling the temperature and pressure conditions of the test chamber that are generally equivalent to an altitude of 30 km (100K ft). However, ground-based laboratories lack ability to provide real time environment that constitutes the dynamically varying incoming solar radiation, existence of space dust, reduced gravity effects, effects of ionization in the absence of atmosphere, and their combined effects along with the much higher vacuum, temperature, and pressure conditions.

Atmospheric testing is a much better option that is currently provided by drones, UAVs, airplanes, HABs (High Altitude Balloons), LTA (Lighter Than Air) technologies, and sub-orbital rockets. Other than sub-orbital rockets, all other types of testing are heavily impacted by the Stratospheric and Tropospheric layers that does not offer relevant space environment and are much denser compared to the Mesospheric environment. Airplane and rocket-based testing are expensive and provide access only for a short duration. Sub-orbital rocket does enable access to Mesospheric altitude for technology testing, but they require long wait time, and provides less than 10 mins of access at a cost that can exceed a million dollars per launch. ISS is the ultimate option that provides relevant environment required for LEO technology testing, but the testing on ISS also suffers from long wait times and high costs. HAB platforms on the other hand can provide long duration atmospheric testing but are limited to Stratospheric altitude, generally below 35 km, and occasionally at 49 km with NASA Scientific balloon. Conventional HAB platforms are not widely used because of their lack of ability to control direction, lack of ability to recover the payload successfully, lack of ability to reuse, and limited ability to control the balloon altitude.

SpaceLoon's novel technology, Mesospheric Sub-orbital Ballooning System (MSBS), under development with the support from National Science Foundation through a Phase I SBIR, enables long duration (>30-days) access to the Mesospheric sub-orbital region up to 80 km beyond the reach of the conventional HAB technologies and at a cost an order of magnitude less than the cost of the rocket launches. As a result, MSBS can increase the success rate of the technologies that are developed using MSBS as a test platform. This paper will introduce potential users to SpaceLoon as the company works to build a new research platform.

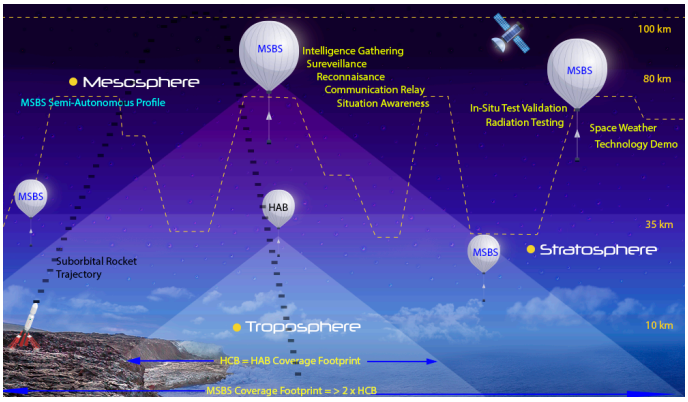

Figure Insert: SpaceLoon's MSBS in Comparison with Conventional HAB Systems