SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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BLOOSTAR: A BALLOON-ASSISTED LIGHTWEIGHT LAUNCHER TO ORBIT MICROSATELLITES

Abstract

There is a clear emergence in small satellites (<200 kg), which, in just one year, increased by 400% the four-year forecast of satellite launches.The increase in performances of microsatellites sets the conditions for a disruption in the Space industry. The lower cost of microsatellites (several orders of magnitude lower) will open Space to a wider range of insitutions creating the future Space applications based society. For this to happen, the basic tool that will empower microsatellites to perform at their full potential is a dedicated microsatellite launcher.

The objective of bloostar by zero2infinity is to design and develop a high-altitude balloon assisted launcher; the balloon first stage will increase the available payload of the small rocket. Savings in drag losses and nozzle adaptation reduce by about 8% the deltaV required for reaching orbit. Due to the exponential relation between deltaV and weight, these savings translate into an increase of the payload capacity from 37 kg to 75 kg. The extra payload available justifies the additional costs incurred by the balloon platform. Such a small vehicle, can utilize simple technologies like pressure-fed rockets to further decrease the operating and development costs and to increase the reliability of the launcher.

The benefits of having a high-altitude balloon as a first stage have already been demonstrated. As a summary, the launch of a microlauncher from a high-altitude balloon presents the following benefits when compared with other approaches: (i) It has the potential to decrease by 30 to 50% current launch costs for microsatellites, (ii) it requires minimal capital investment for a launcher and does not need to incur the capital costs of an aircraft first stage and is much simpler than a ground-launched vehicle, (iii) It offers microsatellites the capacity to responsively get into orbit, (iv) The savings in aerodynamic losses and non-adapted nozzles allows doubling the available payload, (v) Simplicity in the design philosophy for the launcher will ensure low development and operation costs: pressure-fed system, differential-throttling control, low thermal loads and virtually neglible aerodynamic loads.

Bloostar presents a novel architecture offering a new value proposition built around proven technologies. Increased balloon payload capabilities together with advanced lightweight materials for the launcher and powerful mission analysis tools make it feasible to step into orbital launches from high-altitude balloons.