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Small Launchers: concepts and operations (7)

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PLASMA BUOYANCY AND ITS FUTURE IMPLICATIONS FOR SMALL SATELLITE LAUNCHERS

Abstract

Rockoons, rockets launched from high altitude balloons, have been highlighted as a potentially low cost method for launching small satellites into orbit. The benefits at high altitude from reduced air drag and shorter acceleration profile should, in theory, reduce the size of the required rocket when compared to a ground launched system. However performance and practical issues have arisen with the ignition of a rocket at cold temperatures and the limits of current balloon technology. To date, no rockoon system has been developed that can propel payloads to orbital velocities and this is unlikely to happen without significant developments in rocket or balloon technologies. The key limitation with balloon technology is the required size of a balloon to lift a small orbital rocket (>250kg) to a beneficial altitude (>30Km) is at least 30m in diameter, which is difficult to achieve in a low cost solution and to launch in all but the lowest wind conditions. Plasma Buoyancy (PB), an original and innovative concept, has the potential to overcome all these problems. The concept replaces the traditional thin balloon envelope surrounding a lightweight lifting gas with a magnetically confined plasma, making large gains in altitude, lifting capability, endurance and practicality. These advantages and the potential to keep the rocket engine warm by suspending it inside the plasma could make a PB rockoon a practical and economical small satellite launcher. This paper describes the theory and current work done to develop the PB concept and discusses its use as the first stage of a new small satellite launcher.