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DISRUPTIVE LAUNCH AND THE SHIFT FROM A MASS TO A COST PARADIGM IN SATELLITE COMMUNICATIONS

Abstract

Launch has been one of the space industry's fundamental constraints, imposing limitations on the size, mass, cost, and capabilities of spacecraft and the payloads they carry. This has served to restrict satellite communications (satcoms) to a small niche within a significantly larger telecommunications ecosystem. In recent years, however, there has been a surge in launch vehicle development, including a recent focus on a class of "Super Heavy-Lift" launch vehicles (SHLVs) to enable interplanetary missions and human exploration.

These SHLVs, defined as launch systems that can deliver more than 50 metric tonnes to orbit, offer a potentially revolutionary capability to launch customers, possibly within the next decade. Compared to existing state-of-the art systems, SHLVs promise: 1) over five times greater mass capacity to Low Earth Orbit (LEO), 2) four times increase in allowable payload volume 3) greatly increased launch cadence from weeks to days 4) and a potential order of magnitude reduction in launch cost.

By relaxing launch constraints, SHLVs could have a significantly disruptive influence on the satcom market. Historically, satcom engineers have been used to operating in a paradigm where strict performance and mass constraints of the space segment force a high degree of optimisation to maximise payload performance, often at the expense of cost. If SHLVs can offer cheap and easy access to orbit, is this mass-centred approach still valid? Could the introduction of SHLVs disrupt the current paradigm and result in fundamental changes to the way satcom solutions are designed, assembled, tested, and operated? In this way, how can satellite address new market opportunities, likely truly wideband direct-to-device, with requirements currently too challenging to address at scale?

This paper attempts to answer some of these questions by presenting the results of a study on the impact of SHLVs on the satcom industry. The study evaluates how much disruption SHLVs might cause compared to current launch methods, examines how this disruption could affect the design of satellite subsystems, and looks into how SHLVs might impact various use case scenarios. Finally, the paper suggests a roadmap for the satcom industry to capitalise on the improved capabilities offered by SHLVs.