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The Disruptive Potential of Subsonic Air-Launch

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ABSTRACT

This paper first discusses the political and economic factors that limit current space operations and then describes how these factors would have to be changed in order to realise the extremely ambitious operational scenarios envisaged during the first decade of the space age. It highlights the essential role of the launch vehicle in enabling all space operations but also shows the dominant role that 'customer' demand has played in both enabling and constraining the development of those same operations. In addition, it shows how this latter factor has also played a dominant role in controlling all major investments in new technologies. Understanding these factors then helps scope the boundaries for any successful future venture and suggests the type of steps, in terms of both technology developments and business resources, that will be required in order to break out of the current paradigm (i.e. space operations are expensive because of the small amount of activities currently being performed, but the reason for the small amount of activities is because space operations are expensive).

Having identified space launch as a fundamental enabler of future space operations, the paper then discusses the advantages and drawbacks of a subsonic air-launched fully reusable launch vehicle (RLV); comparing and contrasting them against a wide range of other possible launcher concepts. In doing this it highlights the unique evolutionary opportunities that this concept has to offer and provides some insight as to how these may be realised and enhanced via existing technologies. It explains why subsonic air-launch is the only realistic way of enabling space launch from conventional airfields within the foreseeable future and discusses the other major operational advantages of this concept, such as: much enlarged and flexible launch windows; recovery of all flight elements to the same geographic location; increased contingency options for launch abort; the potential to harvest propellant during its cruise to the launch point.

Finally, the paper highlights the radical improvements in operational architecture afforded by such a vehicle. It shows how an RLV with a relatively modest launch performance of less than 6t to low Earth orbit could be capable of supporting almost all current and future launch demand by forming the key element of a fully reusable space transportation network. It identifies the RLV technologies and systems that are common to both orbital transfer vehicles and Lunar landers, as well as the synergistic way their development and production could be coupled in order to both reduce their costs and to increase their reliability, availability and safety. More importantly, it indicates how all these factors can be combined to radically improve the business case for pursuing these ventures as a commercial enterprises, funded almost entirely by private investment.