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Title

Sub-orbital Taxi Transfer

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Abstract

The idea of fully reusable and rapid orbital launch vehicles has been a topic of interest in the aerospace industry for many years. The challenge is to create a system that can carry substantial payloads into orbit while also being cost-effective and quick to develop. The traditional approach to this problem has been to employ larger and more massive rockets, but this solution has proven to be a never-ending cycle of expense and development time. In this study, we propose a novel approach to orbital launches that involves two systems working together: a suborbital launch vehicle and an orbital propulsion system.

The suborbital launch vehicle will be a single-stage vehicle that carries the payload to a predetermined altitude above the upper atmosphere, where the payload will detach from the booster and continue on to orbit. The orbital propulsion system will then deorbit to rendezvous with the suborbital vehicle and boost the payload to its desired orbit. This system will be able to repeat the process multiple times, with the suborbital vehicle being able to propulsively land back on the surface. The proposed system aims to carry a payload fraction several times greater than current numbers, ensuring complete reusability and low cost.

However, this approach also presents several technical challenges that must be overcome. One of the biggest challenges is the suborbital docking, which will occur at high altitudes where atmospheric density is very low, but the aerodynamic effects on the structure at high speeds will still be significant. Another challenge will be for the in-orbit vehicle to deorbit and match the velocity and trajectory of the booster. To maximize operations, the in-orbit vehicle will require a high-thrust, high-specific impulse propulsion system. Sub-orbital taxi transfer provides an opportunity to use high-thrust, high-efficiency engines for launch-to-orbit applications that cannot be used in the thick atmosphere due to the high energy output from these engines. This paper aims to examine the technical challenges involved in this approach and study the requirements for the propulsive systems needed to make it a reality.

In conclusion, the proposed method of using a suborbital launch vehicle and an orbital propulsion system presents a unique opportunity to revolutionize the way payloads are carried into orbit. While there are significant technical challenges that must be addressed, this approach has the potential to greatly reduce the cost and development time of orbital launches. Further study is needed to fully understand the requirements for the propulsive systems and to determine the feasibility of this approach.