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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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NUMERICAL STUDY OF OPTIMAL SKIPPING TRAJECTORIES FOR SUBORBITAL INTERCONTINENTAL TRAVEL

Abstract

Increasing attention is being paid to the idea of how to move to a faster mode of intercontinental travel for passengers and cargo, through the use suborbital spacecraft. Such travel is desirable, as it presents an opportunity to get people and packages nearly anywhere in the world in a matter of a few hours. One of the key challenges facing this endeavor is to determine what trajectories are possible for intercontinental flight, both in terms of the survivability and reusability of any future suborbital spacecraft, as well as the comfort and safety of passengers and crew. At present, there is some literature available on this subject, but there has been no clear indication of what trajectory, or trajectories, would be appropriate for this civilian application.

A 2-D numerical study of transcontinental "skipping" trajectory has been undertaken in order to find an optimal flight path that maintains acceleration and heat loading on the spacecraft to within acceptable limits. These limits are either set out by regulatory bodies, or are a function of material limitations. The resulting transcontinental trajectories are presented, considering the entire flight path of a Horizontal Takeoff Horizontal Landing (HTHL) suborbital spacecraft from takeoff through to final landing approach. Also presented are key design parameter envelopes that a suborbital HTHL spacecraft must fall inside in order to take full advantage of the trajectories presented, assuming combined rocket and turbine powered flight, and potential staging options.