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SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES (D6)
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DEVELOPMENT OF A FLIGHT TEST PROGRAM FOR HIGH MACH SPACEPLANES WITH DAILY OPERATING CAPABILITY

Abstract

Rocketplane Global, LLC (RGL) is continuing its preliminary engineering and development effort for its Mach 12 spaceplane design, based on a 20 year legacy of systems engineering for a variety of high Mach suborbital spaceplanes. The Rocketplane XS-1 spaceplane is a winged horizontal takeoff and landing configuration using military turbofans for takeoff and landing and a LOX / kerosene rocket engine for the main propulsion on the zoom climb to a Mach 12 140km apogee. Once the rocket engine shuts down and the vehicle is on a ballistic coast the payload bay doors are opened and the satellite payload and upper stage stack are released in a gentle exo-atmospheric mechanical separation. The upper stage is then ignited, taking the payload on its insertion trajectory. The spaceplane closes the payload bay doors and orients for reentry. Once the vehicle has completed the reentry deceleration maneuver and is in a subsonic glide the jet engines are restarted for a powered landing – either at the original spaceport or at a downrange recovery runway. A key enabling technology for this system is the use of a KDC-10 tanker aircraft to transfer the majority of the propellant load to the spaceplane once the vehicle is in the air and flying at normal subsonic jet speed. The tanker carries the 64,000 kg of LOX plus additional kerosene to replace the fuel used by the turbofans during takeoff and the tanking maneuver.

The spaceplane is designed for a routine 24 hour turnaround as a fundamental operating requirement. This requirement was partially derived from a government requirement, specifically the DARPA XS-1 program which calls for demonstration of 10 flights in 10 days. However, designing the spaceplane for routine 24 hour turnaround also reduces to recurring operations costs and increases system throughput for high volume customers such as OneWeb. A robust flight test program is required to assure system safety and operability. The test data from this program as well as the routine operational data also becomes the core IP for expansion of high Mach suborbital flights into new markets such as fast cargo and hypersonic business jets for executive transport with 90 minute transoceanic routes possible.

This paper will describe the planned flight test program for the RGL SatLaunch1 spaceplane and the incremental envelope expansion and performance validation that will be completed by the end of 2020 to allow the start of commercial launch services in 2021.