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SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES (D6)
Enabling safe commercial spaceflight: vehicles and spaceports (3)

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THE ROCKETPLANE XS-1 SUBORBITAL SATELLITE LAUNCH SPACEPLANE

Abstract

Rocketplane Global, LLC (RGL) is continuing its preliminary engineering and development 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 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. By taking off "light" with only a fraction of the fuel and oxidizer required and then transferring this propellant load in flight, the vehicle dry mass fraction challenges are greatly reduced. This in turn reduces vehicle development and operations cost, and enables the disruptive reduction in launch price to less than $20 million for a 2 ton LEO satellite. The vehicle is piloted, for several reasons. First, the aerial refueling maneuver is routine to−point transportation into and out of existing major airports. This will require pilots on board for both regulatory and custome 1 vehicle architecture and operations concept, and the engineering legacy of multiple spaceplane design iterations which underl