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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 MACH 12 SUBORBITAL SPACEPLANE - A CASE STUDY FOR HIGH SPEED POINT TO POINT TRANSPORTATION SAFETY & OPERATIONAL ISSUES

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. For satellite launch missions, the payload bay doors open to release the payload with an attached upper stage which takes the satellite to orbit. For terrestrial Point to Point missions, a pressurized cargo module would be installed in the payload bay and the trajectory would be depressed to a 45 degree ascent angle to maximize downrange flight distance. A 5,000 km to 6,000 km vehicle range becomes possible with the XS-1 technology, and the hypersonic velocity means that total time from takeoff to landing is less than 90 minutes. This reference design and operations architecture provides a technical framework to look at P2P flight services starting in 2020. 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 paper will examine the flight safety and operational issues associated with hypersonic suborbital spaceplanes flying from existing airports on international routes. Key technical and safety factors include a robust and maintainable high performance thermal protection system that can routinely sustain peak temperatures in excess of 2,000 degrees C; a gas and go liquid fuel engine set; and piloted operational capability for safety and redundancy to autonomous flight operations. Key operational issues include the interface with conventional Air Traffic Control systems; the ability to respond to ATC flight directives; and interfaces with conventional airport operations and infrastructure.