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Author: Mr. Charles Lauer
Rocketplane Global, Inc., United States

A MULTI-PAYLOAD DISPENSER SYSTEM FOR THE ROCKETPLANE XS-1 SUBORBITAL SATELLITE LAUNCH SPACEPLANE

Abstract

The US Defense Advanced Research Projects Agency (DARPA) has begun the Phase I preliminary design competition for a breakthrough in reusable launch vehicle technology intended to lower the cost of launch for small (1-2 ton) LEO payloads by an order of magnitude. The DARPA XS-1 program intends to achieve this disruptive reduction in launch costs by developing a reusable first stage spaceplane with aircraft-like operational characteristics while using a low cost expendable upper stage to reach orbit. The XS-1 spaceplane requirement is to fly at least to a Mach 10 velocity in a suborbital trajectory and be able to fly 10 times in 10 days.

Rocketplane Global, LLC (RGL) has submitted a proposal to DARPA 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.

This paper will describe how the 1-2 ton total payload capacity to LEO can be either a single payload, a primary plus secondary payloads carrier, or be made up entirely of small 50 kg and smaller payloads in a 24 cell dispenser structure with a common payload interface to that found in current ESPA ring class secondary payloads. The upper stage that brings the payload stack to orbit also has cruise capability for spacing out deployment of small satellite constellations in one or more orbit planes. The upper stage dispenser structure can also be equipped with an inflatable heat shield and GPS guided parafoil recovery system for 30 to 90 day multi-payload free flight missions with payload return downmass capacity.