

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)
Small Launchers: Concepts and Operations (7)

Author: Mr. Charles Lauer
Rocketplane Global, Inc., United States, clauer@rocketplane.com

Mr. David Faulkner
Rocketplane Global, Inc., United States, dfaulkner@rocketplane.com

Ms. Misuzu Onuki
Space Frontier Foundation, Japan, mszmail@aol.com

Mr. Tsuneyoshi Matsuoka
Hokkaido University, Japan, tm.tsunekichi@gmail.com

A MICROSATELLITE LAUNCH SYSTEM USING THE XP SPACEPLANE AS A REUSABLE FIRST
STAGE FOR A NEW GENERATION HYBRID ROCKET UPPER STAGE

Abstract

The XP spaceplane now being developed by Rocketplane Global (RGI) is a fully reusable suborbital vehicle about the size of a mid-sized business jet. It takes off and lands from conventional runways using J-85 afterburning turbojets and ascends to a 13 km altitude under airbreathing thrust before igniting its LOX / kerosene rocket engine for the ascent to space. After a 70 second main engine burn the XP has accelerated to Mach 3.5 and climbed to about 50 km altitude at rocket engine cut-off. Thereafter a ballistic coast carries the vehicle to its 104 km apogee and back to atmospheric re-encounter at 50 km again.

While the primary market for the XP is space tourism, the same flight profile can also be used to carry an expendable upper stage to a high altitude and velocity for a soft exo-atmospheric separation staging. Moreover, early testing of this launch system and actual launch services for microsatellite payloads can be achieved through the use of existing supersonic fighter aircraft equipped with the same external payload mounting system. RGI has teamed with Starfighters, Inc. as the only US operator of privately owned supersonic aircraft to develop a robust, affordable and responsive microsatellite launch system. A new generation of safe, high-performance LOX / polyethelene plastic hybrid upper stage rocket motors is being developed in Japan for these launch missions.

While the F-104 staging is at a lower velocity and altitude – about Mach 1.6 at about 18 km – the same 900 kg upper stage package that will fly from the XP can deliver 5 to 10 kg of payload to low Earth orbit. The increase in altitude and velocity provided by the suborbital spaceplane serves to improve payload performance by more than a factor of two to about 25 kg total payload. Payloads can be a cluster of small 1 kg Cubesats in a dispenser or a single payload.

This paper will describe the technical and operational aspects of this new microsatellite launch system and the cost and performance of the system using both the existing F-104 Starfighter as the initial carrier aircraft for the air-launch system and the upgraded performance achieved with the XP spaceplane. Ultimately both systems can provide routine and affordable launch services to a variety of commercial, government and new market customers at locations in the US and also overseas.