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LOW COST SUBORBITAL MICROGRAVITY PAYLOAD FLIGHT OPPORTUNITIES IN THE XP SPACEPLANE

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. The coast phase lasts about three to four minutes, and it is during this time that the XP is in the microgravity environment.

While the primary market for this suborbital flight service is space tourism, the same flight profile can also be used to fly microgravity research payloads. The flight profile is slightly modified to orient the vehicle to the proper reentry attitude immediately after main engine cutoff. Thereafter, the entire ballistic coast is free from RCS thruster disturbances and the maximum quality microgravity can be achieved. Life support systems that support passenger loads are more than sufficient to provide cabin air and cooling for research payloads and equipment.

Payloads are expected to be predominantly made up of standard ISS Express Rack locker modules – either single or double locker configuration. The NASA FASTRACK system now in development will provide a standard modular interface that can be installed in place of a passenger seat. This flexible configuration also permits researchers to actually fly with their payloads in a shirtsleeve environment and operate their experiments in real-time conditions. Telemetry and data / video links will also permit tele-operation of payloads from Mission Control.

If demand for this new class of intermediate duration microgravity research proves strong, dedicated full-cabin rack systems can be developed which maximize the number of payloads flown, thereby gaining efficiency and reducing the unit flight cost for each payload. Ultimately, if commercial products such as optical crystals can be developed that can be processed in the 3-4 minutes of microgravity available, then dedicated "factory ships" can be operated to provide commercial quantities of these products without the need to go all the way to orbit.

This paper will describe the development and operation of microgravity racks and support equipment for the XP spaceplane and the business model for suborbital microgravity research flights.