Virgin Orbit's Small Satellite Launch LauncherOne

Briefing for Small Payload RideShare Symposium
14th June 2017
LauncherOne, LLC is now Virgin Orbit, LLC

In March 2017 Virgin Orbit, LLC was announced to lead Virgin’s Small Satellite launch business and develop the LauncherOne system.
AN INTRODUCTION TO VIRGIN ORBIT & LAUNCHERONE
An introduction to Virgin Orbit

• Founded to revolutionize access to Space for Small Satellites
• Virgin Orbit is part of the Virgin Group
• Privately owned by Virgin Group and Aabar investments PJS
• Virgin Orbit R&D and manufacturing facilities based in Long Beach, California.
• Virgin Orbit is the sister company of Virgin Galactic, LLC & TSC, LLC
  o Separate management
  o Separate mission objectives
  o Shared focus on safety
• LauncherOne, a two stage expendable rocket with native LOX/RP engines, air launched from a 747-400
• Designed for high production rate and responsiveness
• Enables rapid response and constellation replenishment
Virgin Orbit & LauncherOne service overview

• Small satellite launch vehicle service developed, manufactured, and operated by a vertically integrated commercial space company

• Two stage expendable rocket with LOX/RP engines, air launched from a 747-400

• Proven technology for cost effective, reliable and regular missions

• Proven technology for high production rate and responsiveness
The Virgin Orbit team - May 2017

Total number of employees 312 and growing
LauncherOne Overview

First Stage
72 in. / 1.8 m Inner Diameter

Second Stage
59 in. / 1.5 m Inner Diameter

Payload Fairing

Interstage

NewtonThree

NewtonFour

Fins
4 fins (1 with a roll tab)

834 in. / 69.4 ft / 21.2 m Total Length
“COSMIC GIRL” 747-400 Carrier Aircraft
"COSMIC GIRL" 747-400 Carrier Aircraft

The LauncherOne Carrier Aircraft
• Major maintenance check and baseline testing
• Undergoing wing modifications to be completed in June
• Pylon integration and flight test to follow
LauncherOne payload dynamic envelope & sample configurations

- Single Large Primary Payload
- Dual Small Primary Payloads
- Small Primary and Multiple CubeSat Payloads
- Multiple, Similar Primary Payloads

Dimensions:
- Diameter: 0.44m, 1.26m, 3.54m, 2.12m
LauncherOne orbital payload delivery performance

![Graph showing performance vs. altitude for different launch scenarios.](Graph.png)
VIRGIN ORBIT FACILITIES
Facilities

Mojave, California

Tank Test Site

Engine Test Site

Stage Test Site

Necker Test Sites

Necker Tank Test Site

Necker Liquid Propulsion Test Site

Mojave Air and Space Port

KMHV Runway 12/30 (12kft / 3800m runway)

FAITH Facility

Fueling operations on concrete pad at end of runway

Command van located near FAITH

~1 mile / 1.6 km

2 hour drive

Los Angeles Area (U.S.)

Long Beach

Long Beach LauncherOne Facility

Payload and Rocket/Aircraft Integration

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Virgin Orbit’s Long Beach Facility for LauncherOne (interior)
Launch Operations Overview

- Running a true mobile launch site (airplane plus mobile ground support equipment)
  - Agile operations: truck and trailer based, not ground based, no tank farms, no cross country fluid lines

Traditional Ground Launch Approach

Virgin Orbit Launch Operations Approach
YOUR VIRGIN ORBIT LAUNCH EXPERIENCE

Standard Services:

• Virgin Orbit Mission Manager: Dedicated to providing a smooth integration and launch
• Interface Control Document: Ensures all your requirements are documented, controlled, and your mission is ready to launch
• Mission Specific Analysis: Ensures your payload gets safely to orbit
• Payload Processing Facilities: Building world class processing facilities to accommodate your spacecraft
LAUNCHER ONE

Your Payload Here