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X-Prize Private Suborbital Flight Competition: 2004



This Photo © Mike Masee

X-Prize Private Suborbital Flight Competition: 2004



This Photo © Mike Masee



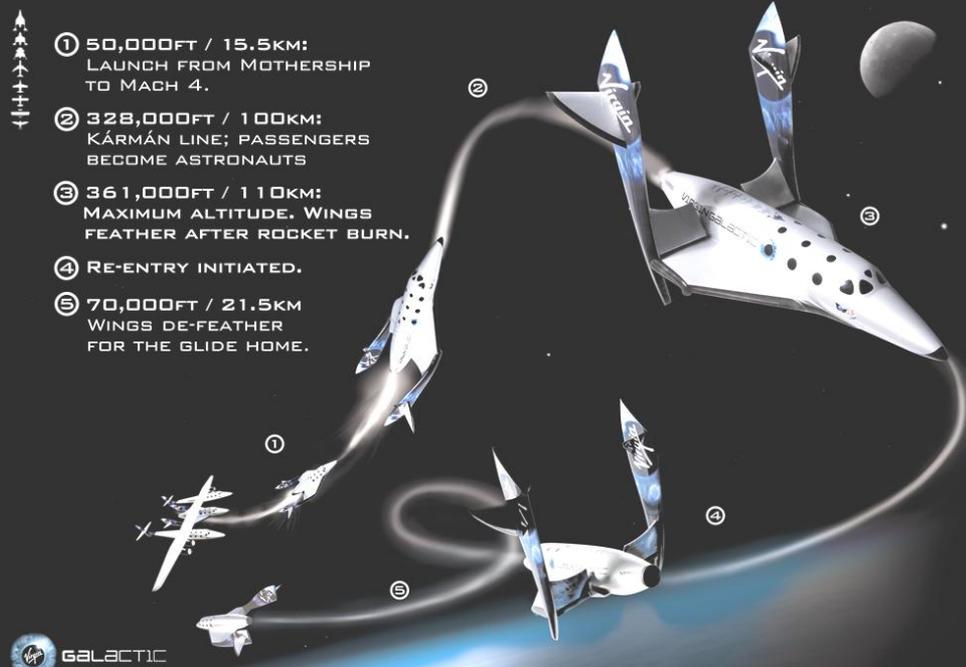
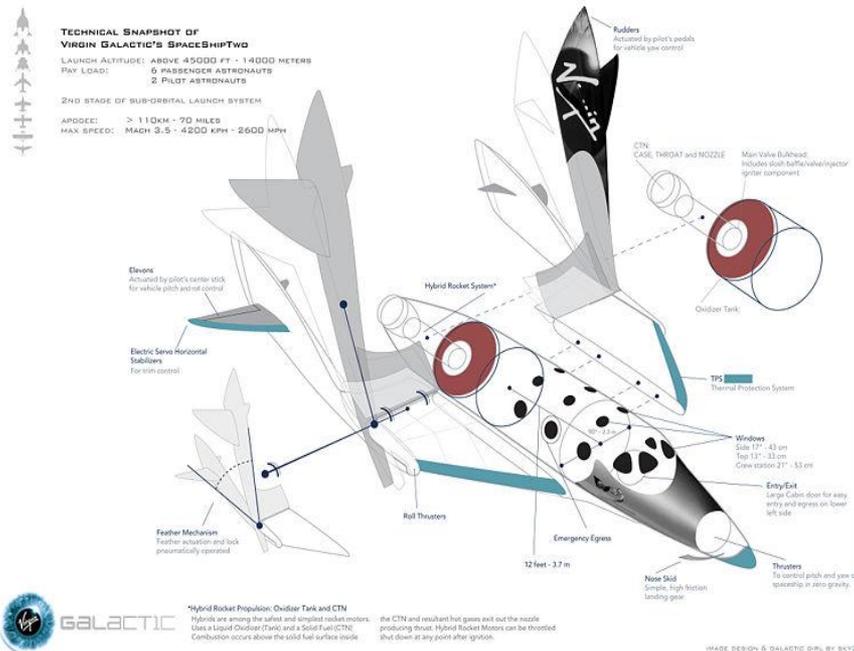


SpaceShipOne team celebrating X Prize win
Photograph by Jim Sugar

SpaceShipOne's Successor: SpaceShipTwo: 2008



Spaceship Two Development: 2009



Spaceship Two Development: 2009



Spaceship Two Begins
Test Flights Early Next
Year and Commercial
Ops the following year.

Seat Prices for Early
Commercial Ops are
\$200K.



And Virgin's SpaceShip Has Some Competition: from Blue Origin



Jeff Bezos's Blue Origin

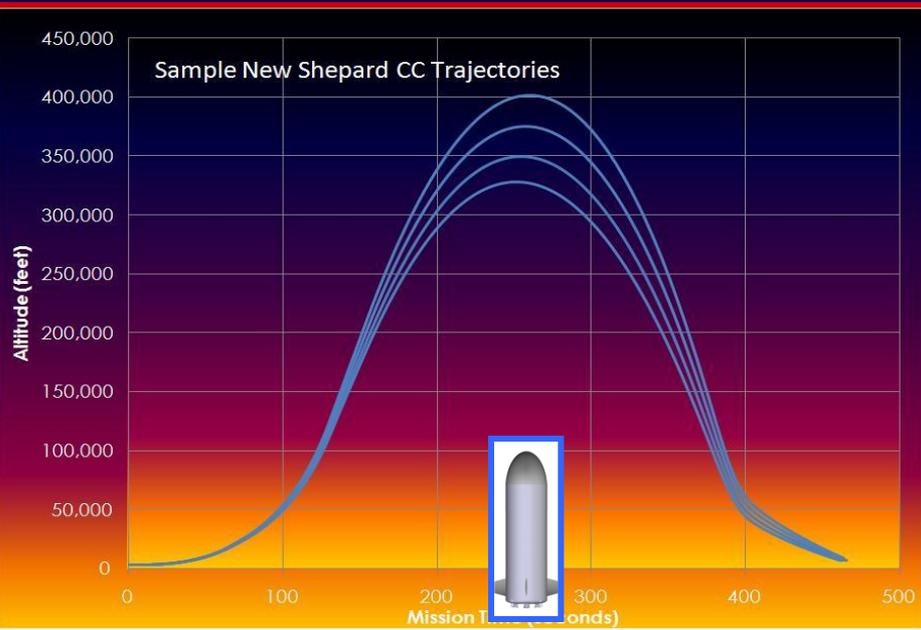
Blue Origin is an aerospace company building a suborbital vehicle for research and space tourism.

Blue Origin is based in Kent, Washington.



Blue Origin's Vehicle is New Shepard

Blue Origin is developing *New Shepard*
to routinely fly multiple astronauts
into suborbital space at competitive prices.





Some New Shepard Capabilities

Attribute	<i>New Shepard</i> Vehicle Capability
Crew/Payload Capacity	3 or more astronauts and/or racks
Experiment Mass	120 kg per position
Windows	One per crew position
Power	28 VDC provided
In-Flight Communications	Recorded voice, & low-data rate link for experiment TM/control
Data Recording	Post-flight download of trajectory measurements
Microgravity Levels	<0.003 Gs in Coast
Pointing Accuracy	$\pm 5^\circ$ per axis during coast
Turning Capability	Yes

And Virgin and Blue Origin Have Competition Too



From Newspace Companies Like:

➤ Armadillo Aerospace

➤ XCOR

➤ Masten Space Systems



Research & Education Missions (REM)



Research & Education Missions (REM)

- All scientific, engineering, and other technical R&D activities applicable to commercial suborbital space flight vehicles.
- And all education and public outreach activities applicable to commercial suborbital space flight vehicles.

■ Frequent Access to Space at Low Cost

- 10x the microgravity time of Zero-G aircraft, and 100x cleaner microgravity environment.
- Direct access to the “ignorosphere.”
- Hundreds to thousands of seats flown each year.

Unique Features of Next-Gen Suborbital Research

■ Fewer constraints on, and Gentler Rides for Payloads

- Fly off the shelf laboratory equipment.
- Fly researchers with their payloads.
- Fly larger payloads than can be flown inside Shuttle or ISS.
- Simple, fast safety/integration processes, Like zero-G aircraft instead of Shuttle/ISS.

Unique Features of Next-Gen Suborbital Research

■ Flexible Operations

- Worldwide launch basing.
- Ability to launch at specific times coincident with phenomenology, in synch with classes, in sync with circadian rhythms, etc.
- Rapid access to samples, test subjects, etc. post-flight



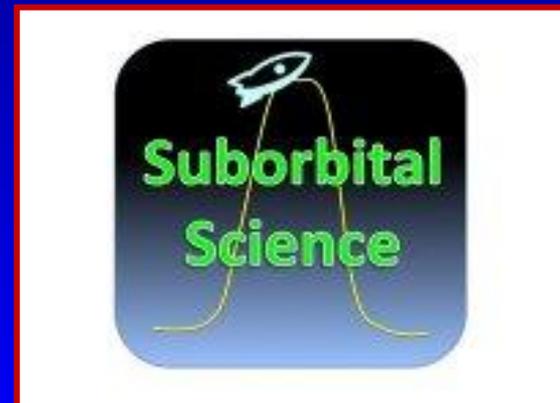
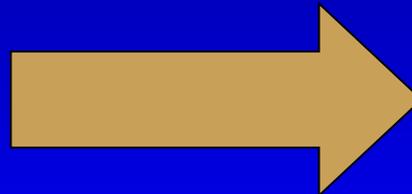
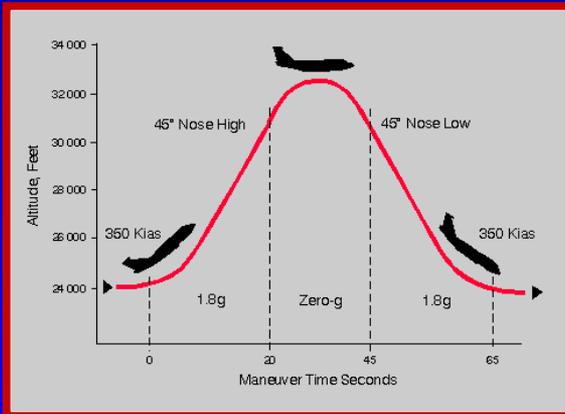
These Attributes Make the REM Market Rich With Applications

- In Life Sciences
- In Instrument Test & Demonstration
- In Atmospheric Science
- In Earth Science & Oceanography
- In Space Physics
- In Astronomy & Solar Physics
- In Microgravity R&D
- In Education, Training, & Public Outreach

Why REM Is Next-Gen Suborbital's Killer App

- Only relatively small numbers of tourists (hundreds) have paid \$200K to fly.
- But \$200K is cheap for governments and industry space research programs.
- There are over 190 nations on Earth, And virtually all can afford a rem program that spurs national pride, research, & education at \$200K per flight. (Even aruba can now have a human space flight program!)
- unlike tourists who buy 1 or 2 tickets, research programs buy dozens to hundreds, and then come back for more, year after year.
- The estimated REM market over 5 years is many, many thousands of seats.

- What traditional SLS research can be supplemented in a useful way with short observations?
- What might suborbital vehicle owners and operators want to know about the effects of their vehicles?
- Who else might be interested in this data?



➤ What applications exist, given the 10x Longer Time constants over parabolic flights,

E.g., for:

- Vestibular and sensori-motor responses
- Lung deposition of particulates
- Acute cellular responses
- Fertilization and early development
-

What applications Exist to Study Initial responses to micro-g exposure, for:

- Fluid shifts
- Motion sickness
- Pharmacokinetics
-

What research can be uniquely enabled by

- Multiple flights of the same individual
- Multiple flights of the same hardware
- Very high Population Ns
- Higher g exposure
- Upper atmospheric radiation exposure
- Large Cabin Volumes
- Ability to Fly Diverse Animal Models
-

What research can be uniquely enabled by?

- Young subjects
- Elderly subjects
- Subjects with a variety of health ailments
- Blind subjects
- Labrynthine-deficient subjects
- Quadriplegics
- Non-human primates
- Various Frequent Flyer Populations
-

What Apps Exist For:

- Operations training
- Procedures Development
 - Airway management
 - Diagnostic ultrasound
 - Emergency & invasive procedures
 - Disorientation recovery

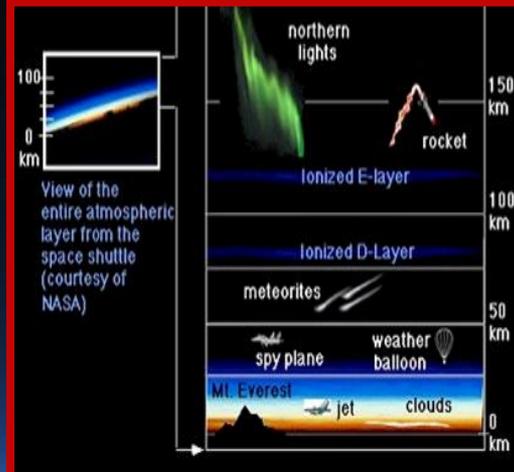
What Apps Exist For:

- Access to g-transitions
- Ability to launch in sync with circadian rhythms, other time points
- Rapid access in- and post-flight
- Possible ability to manipulate cabin Temp, pressure, composition, etc.



Next-Generation Suborbital Researchers Conference

Boulder, Colorado; 18-20 February 2010



Objectives:

- ✓ Educate 250+ researchers across 9 relevant REM fields;
- ✓ Demonstrate interest in REM to Government agencies, suborbital providers, press, & policy makers.

Organizing Institutions: SwRI,

USRA, CSF

Venue: Boulder, CO; 18-20 Feb 2010

Format: 2.5 days, plenary overview

& parallel technical sessions

Sponsors: SwRI, USRA, ULA, NASTAR,...

Day/Segment	Session (Proposed Chair)
1/Morning	Opening Plenary (Stern & Colwell)
1/Afternoon	Space Life Sciences (Wagner & Shelhamer)
1/Afternoon	Space Grant REM Competition
1/Afternoon	Planetary and Astrophysical Science (Durda)
1/Evening	Evening Public Lecture (Durda)
2/Morning	Atmospheric Science (Summers)
2/Morning	Microgravity Physics (Collicott)
2/Morning	Technology Applications & Payloads (Miles)
2/Afternoon	EPO (Grinspoon)
2/Afternoon	Miscellaneous/Other (Pojman)
2/Afternoon	Ionosphere/Aurora (Englert)
3/Morning	Closing Plenary (Sirangelo)

<http://www.lpi.usra.edu/meetings/nsrc2010/>

- First announcement posted Sep 2009
- Abstract deadline Nov 2009
- Abstracts to program committee Nov 2009
- Final text & session assignments due Dec 2009
- Final announcement posted Dec 2009
- Pre-registration deadline Jan 2010

Suborbital Researchers Conference



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