

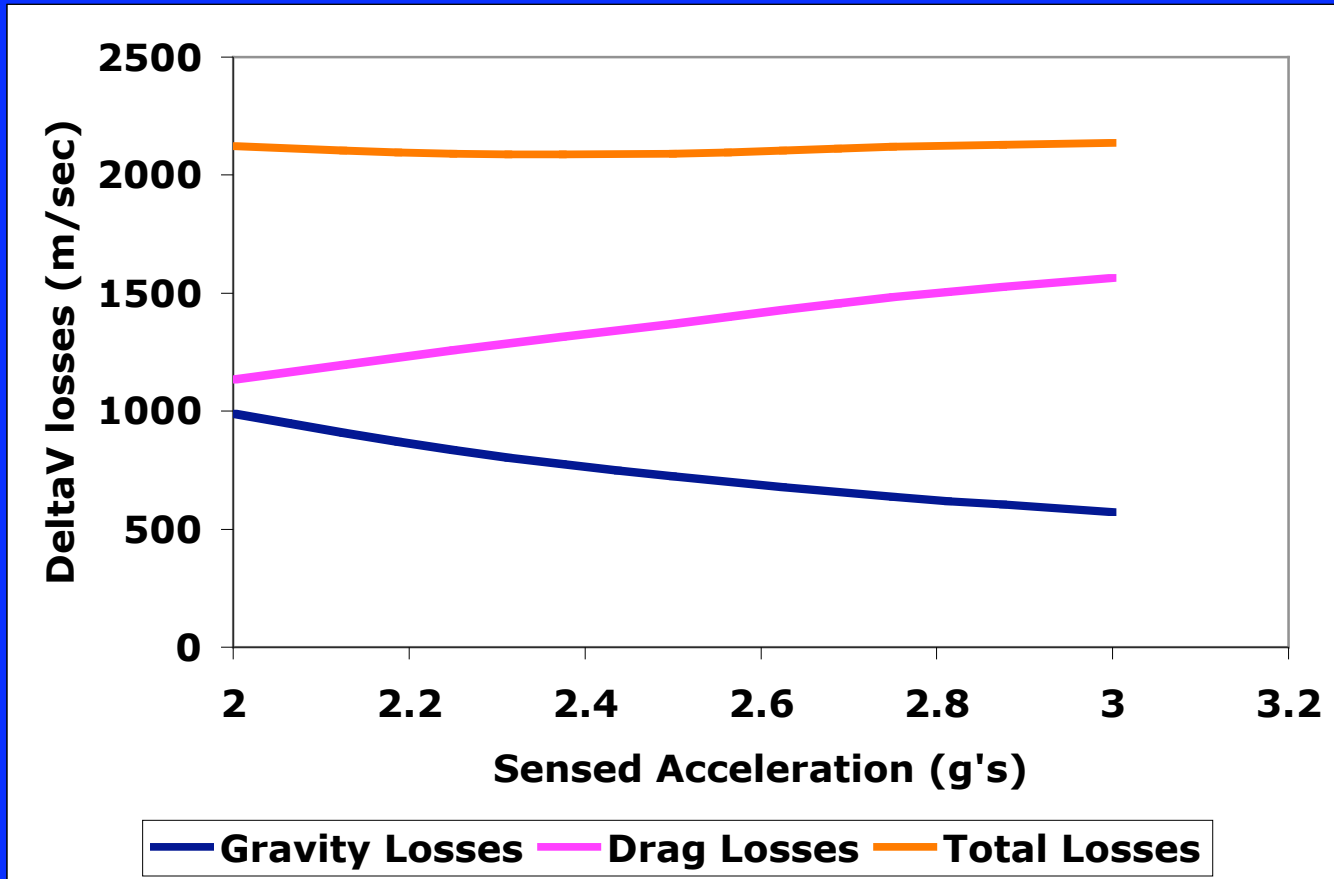
Case Study: The X-Prize

- Overview of requirements
- Underlying physics
- Competitors

X-Prize Rules (synopsis)

- Must be privately financed
- Have to launch with three people (one crew, two passengers) [For flight test purposes, passengers may be replaced by ballast]
- Must reach altitude of 100 km
- Must return to launch site
- Must make two flights within two weeks
- Must be "substantially reusable" (no more than 10% of non-propellant mass replaced between flights)

Minimum Vertical Trajectory - Losses



Advent Launch Services



- Sea launched, vertical rocket flight
- Recovery?
- Plans to scaling to commercial launch



ARCA (Romania)

- Vertical rocket launch
- Parachute recovery into water



Armadillo Aerospace (Texas)



- Vertical rocket launch (H₂O₂ monopropellant)
- Parachute recovery onto land
- Sponsored by John Carmack ("Doom")



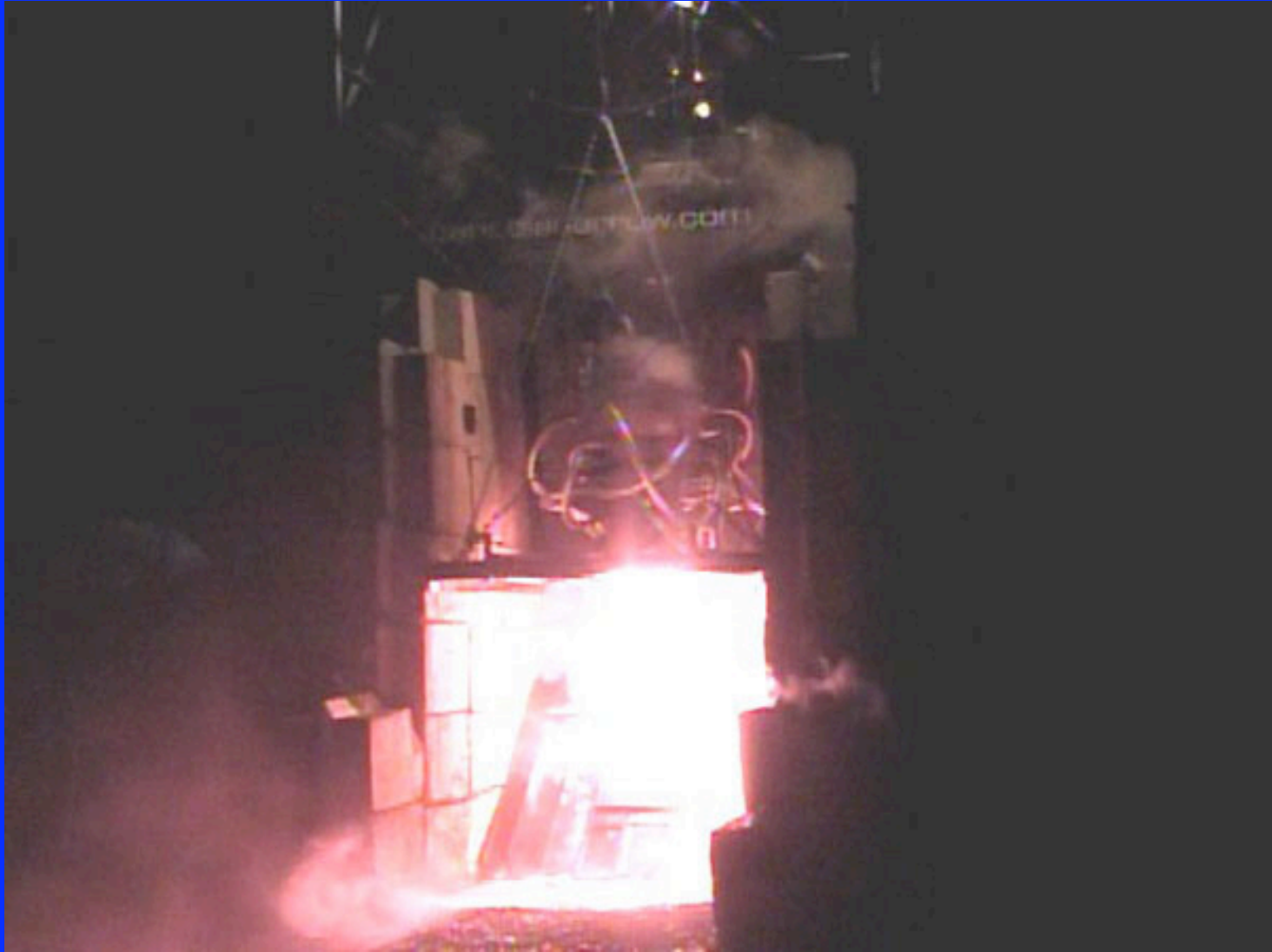
Arrow (Canada)



- Vertical rocket launch (LOX/alcohol and solids)
- Parachute landing into water
- Modeled on V-2 rocket
- Have performed full-power (57Klb thrust) static engine firings



Arrow 57Klb Thrust Static Test



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Case Study: The X-Prize
Principles of Space Systems Design

Da Vinci (Canada)



- Launch from hot-air balloon
- Parachute landing



Da Vinci Prototype



Da Vinci Prototype



HARC (Alabama)

- Vertical launch from ocean-going barge
- Parachute landing



Interorbital Systems (California)



- Sea launch, vertical rocket
- Parachute landing



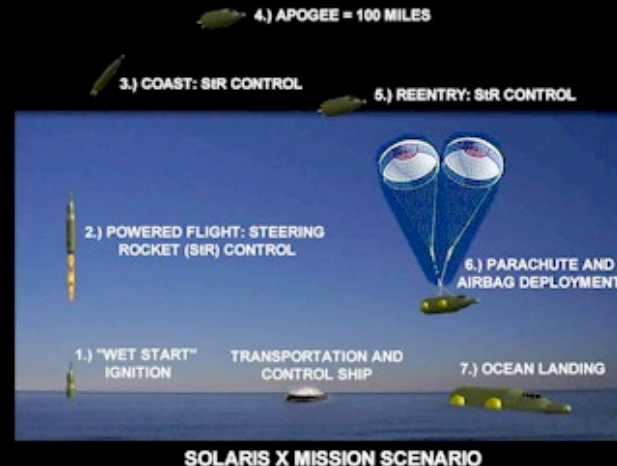
Interorbital Systems



INTERORBITAL SYSTEMS



Interorbital Systems entered the X Prize competition in January 2003. The IOS X Prize entry, the Solaris X is presently in the development and testing stage. X Prize launches will take place from the Pacific Ocean west of Los Angeles or from the Kingdom of Tonga in the South Pacific. The pilot will be former Mercury 13 female astronaut candidate, Wally Funk. She is currently a flight instructor with 16,800 hours of flight time and has trained at the cosmonaut-training center in Russia.



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Case Study: The X-Prize
Principles of Space Systems Design

Starchaser (England)

- LOX-kerosine vertical launch
- Parachute landing



Starchaser Thunderbird Vehicle Concept



Gauchito (Argentina)

- Hybrid rocket, vertical launch
- Parachute recovery



Pioneer Rocketplane (California)



- Horizontal takeoff (turbojet engines)
- Rocket zoom
- Horizontal landing
- (Out of money)



Space Transport (Washington)



- Vertical rocket launch
- Parachute landing into water
- Static-tested 12Klb solid engine



Scaled Composites (Burt Rutan)



- Two-staged
 - Subsonic air-launched
 - Rocket-powered winged
- Supported by Paul Allen (Microsoft)
- Flown to 106Kft, Mach 1.6

SpaceShip One with Thermal Protection



"White Knight" Launch Aircraft



SpaceShip One



White Knight with SpaceShip One

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Feathered Entry Configuration

