The Future of Space Tourism and Space Weather

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Space Weather Workshop
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Dawning of a New Space Age

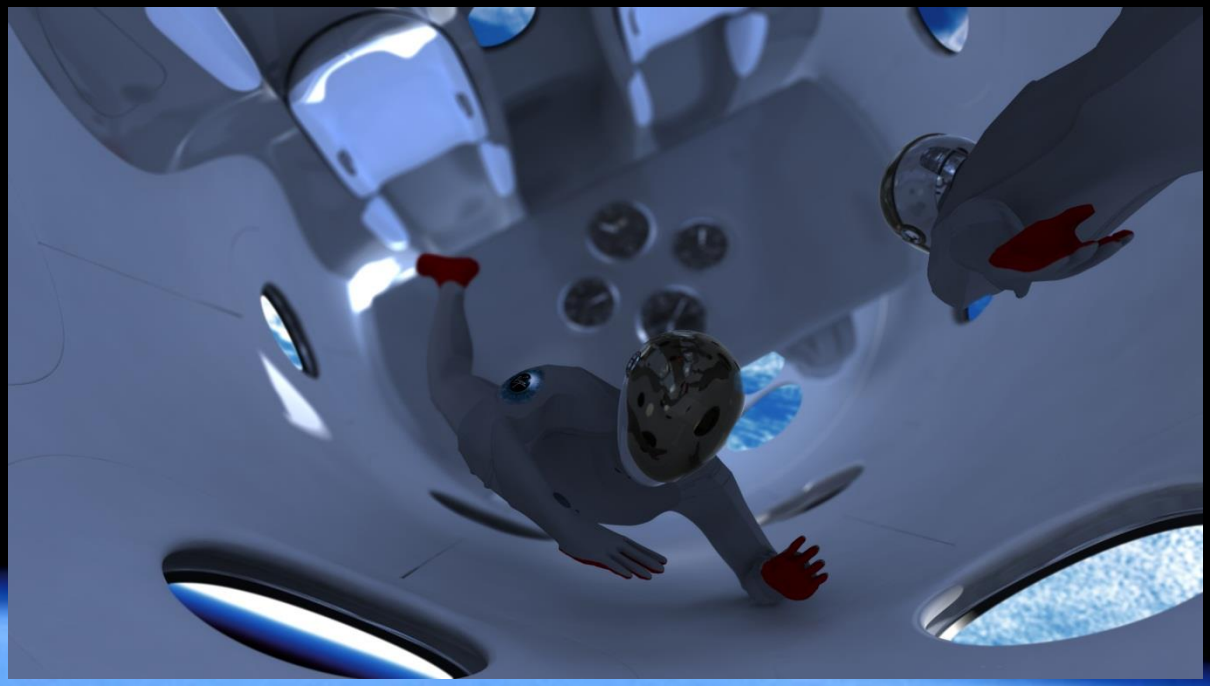
Space Tourism is real

Sub Orbital

Orbital

Point of Reference

- Virgin Galactic has almost as many people on the waiting list to fly to space (510) than the number of people who have already flown in space (approximately 523)



Virgin Galactic LLC

- Mission to create **safe** and commercially viable access to space for people, science and potential for payload
- Space tourism early adopters provided vital proof of first available market and made project possible

Sub-Orbital Space Tourism Experience

- 3-4 days of preparation, medical checks, bonding & training
- Each sub-orbital flight will carry 6 passengers + 2 pilots & lasts about 2.5 hours
- Passengers will be able to leave their seats & float in zero G & enjoy views of the Earth's surface for about 1,000 miles in every direction & get a black sky view of space
- Experience cost is $200K

Virgin Galactic Today

Flight Test Update

- WhiteKnight Two mothership completed most flight testing
- SS2 completed 16 glide flights
- First rocket powered test of SS2 projected for later this year

Rocket Motor Development

Spaceport America

- Major construction completed
- Virgin Galactic starting interior build-out
- Ready for Operations by late 2013

Spaceport America

- In New Mexico: Lat 107˚W Long 33˚N

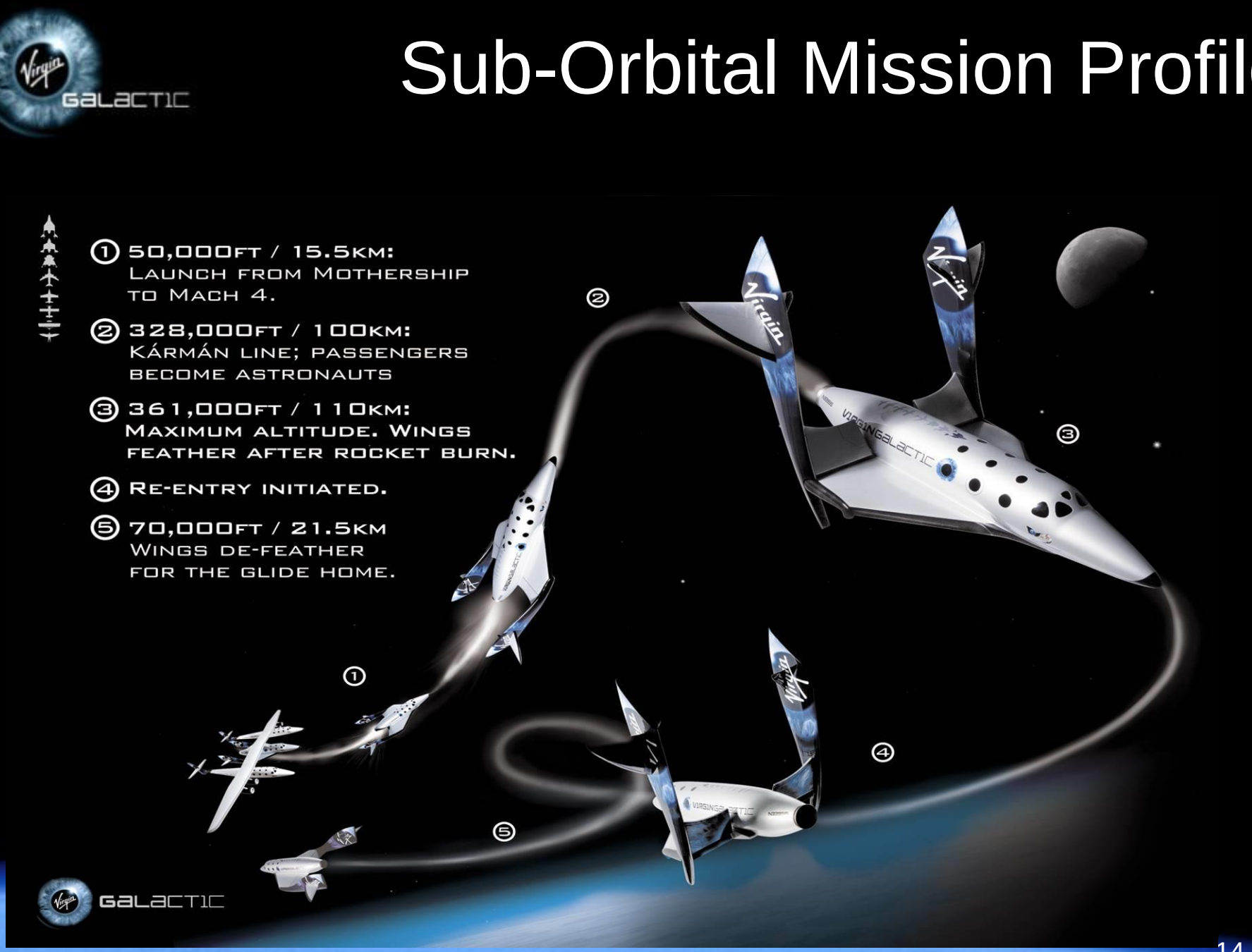
Space Weather implications for Virgin Galactic

Culture of Safety

Virgin transportation companies transported over 50 million people safely each year

Operating the world's first spaceline has new challenges, like Space Weather

Sub-Orbital Mission Profile



Minimal Risks

- Very limited exposure due to limited time and altitude
- Time frames
  - 1 hour take-off to 50,000 feet
  - 5 minutes boost to apogee
  - 25 minutes apogee to landing
- Altitude
  - Nominal flight - 100 KM

Risk Management to date

- Reviewing SS1 flight data
  - Radiation measured
  - Winds in “upper middle atmosphere”
- Enrolled in Space Weather Prediction Center email service
  - Daily forecasts & warnings
  - Gaining familiarity with the system & terminology
  - Observing trends with solar maximum

Risk Management future plans

- Developing Space Weather policies & procedures
- Identifying Go & No-go criteria
  - For each phase of flight profile
  - Evaluating actions for the various warning levels
  - Determining acceptable level of risks for
    - Solar Radiation Storms – people at altitude
    - Geomagnetic Storms – spaceship & ground support
    - Radio Blackouts – spaceship & ground support

Risk Management future plans

- Developing a radiation monitoring program for Virgin Galactic pilots
- Identifying best sources for correlating solar events to New Mexico
- Working with the Space Weather community to handle spaceline daily flights

Risk Management future plans

- Sub-Orbital “Space” Weather interests beyond radiation
- Identifying best sources for pinpointing New Mexico high altitude data
  - Higher altitude wind shears
  - Sprites (extremely high altitude lightning)
  - Notilucent Clouds (extremely high altitude ice clouds)

Pathfinder for the future

Space is Virgin territory