



ISSUES RELATED TO SPACE TOURISM

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Commercial Summary

Derek Webber Commercial Space Summary





Summary of Content

- Defining the Space Tourism Experience
- Potential Size of the Space Tourism Operations
- Characteristics of Pilots and Space Tourists
- Legal and Policy Issues
- Case Study



Defining the Space Tourism Experience

- Sub-orbital
- Orbital
- Point-to-point
- Spaceports
- Marketing Considerations
- Risk and Insurance

Sub-orbital

(Virgin Galactic SpaceShipTwo, XCOR Lynx, Armadillo)



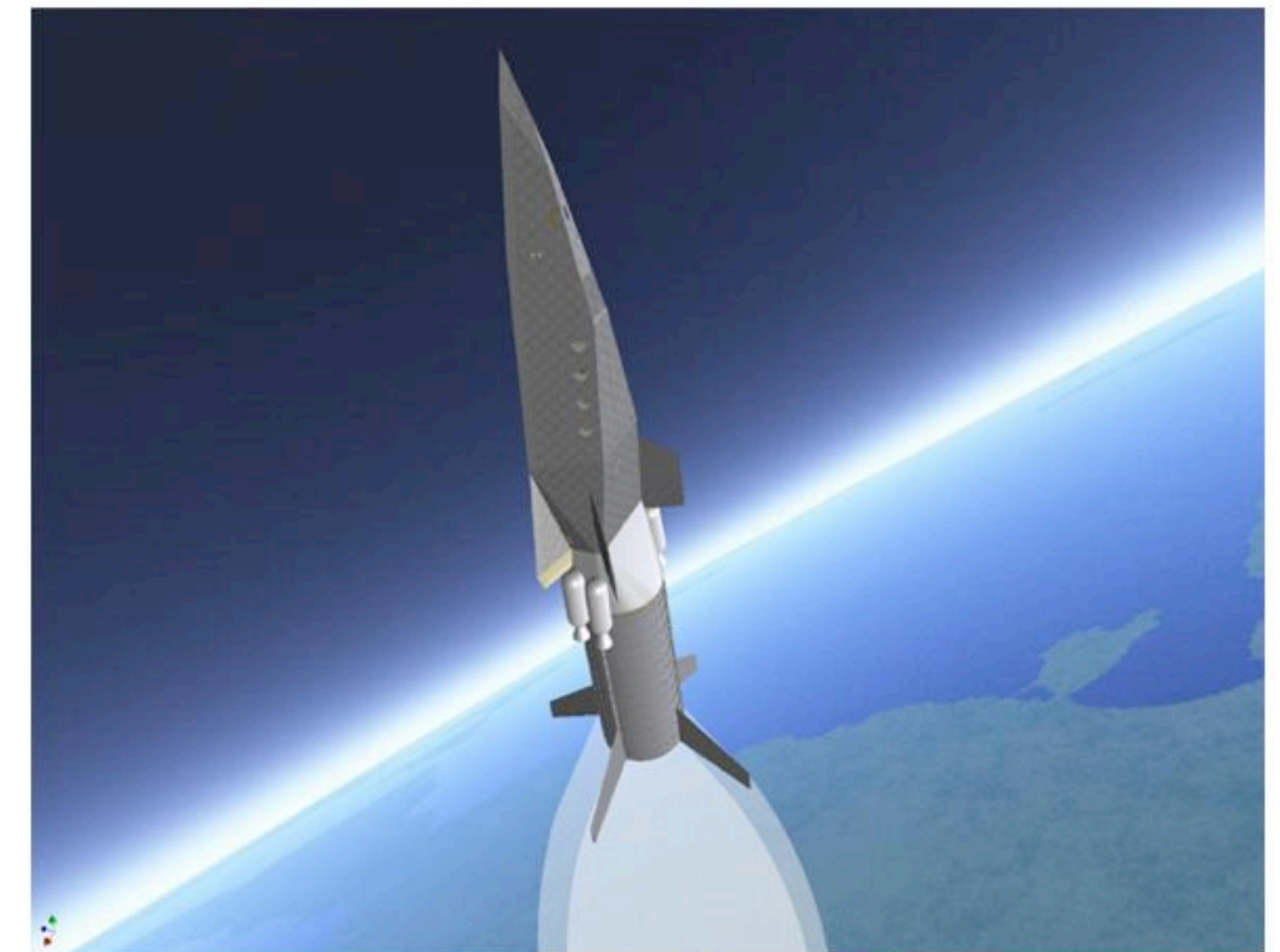
Orbital

(SpaceX Dragon, Orbital Cygnus)



Point-to-Point

(Reaction Engines Alan Bond's Skylon, Planetspace's Silver Dart)



Spaceports

Governmental (Kennedy Space Center)



Spaceports

Commercial (Spaceport America, New Mexico)





Marketing Considerations

- Sub-orb just 5 mins
- “Astronaut” definition
- Pioneer idea
- “Training” as part of experience
- Orbital as quantum difference for future growth
- Space Hotels pricing and other issues
- Branson family goes first



Risk and Insurance

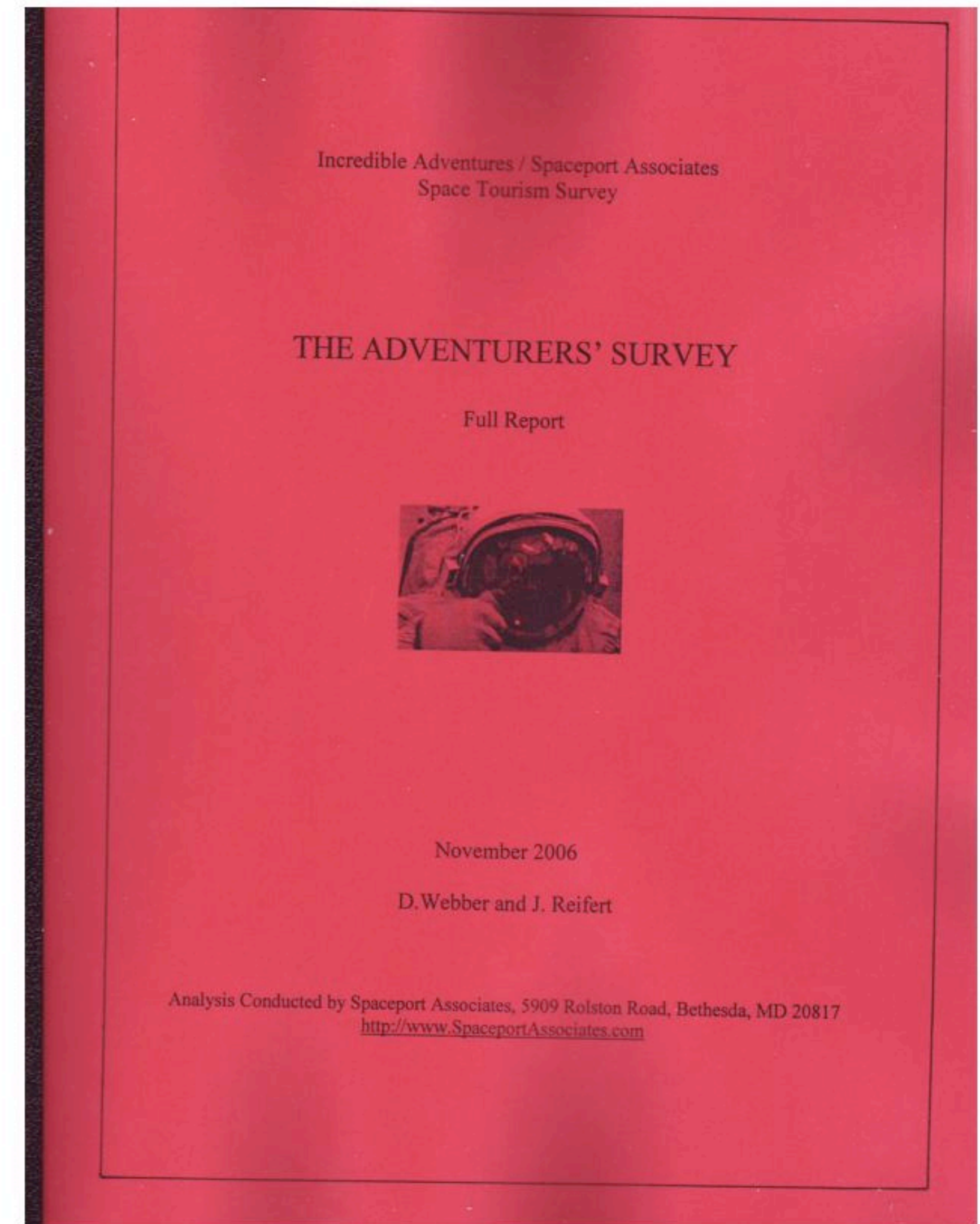
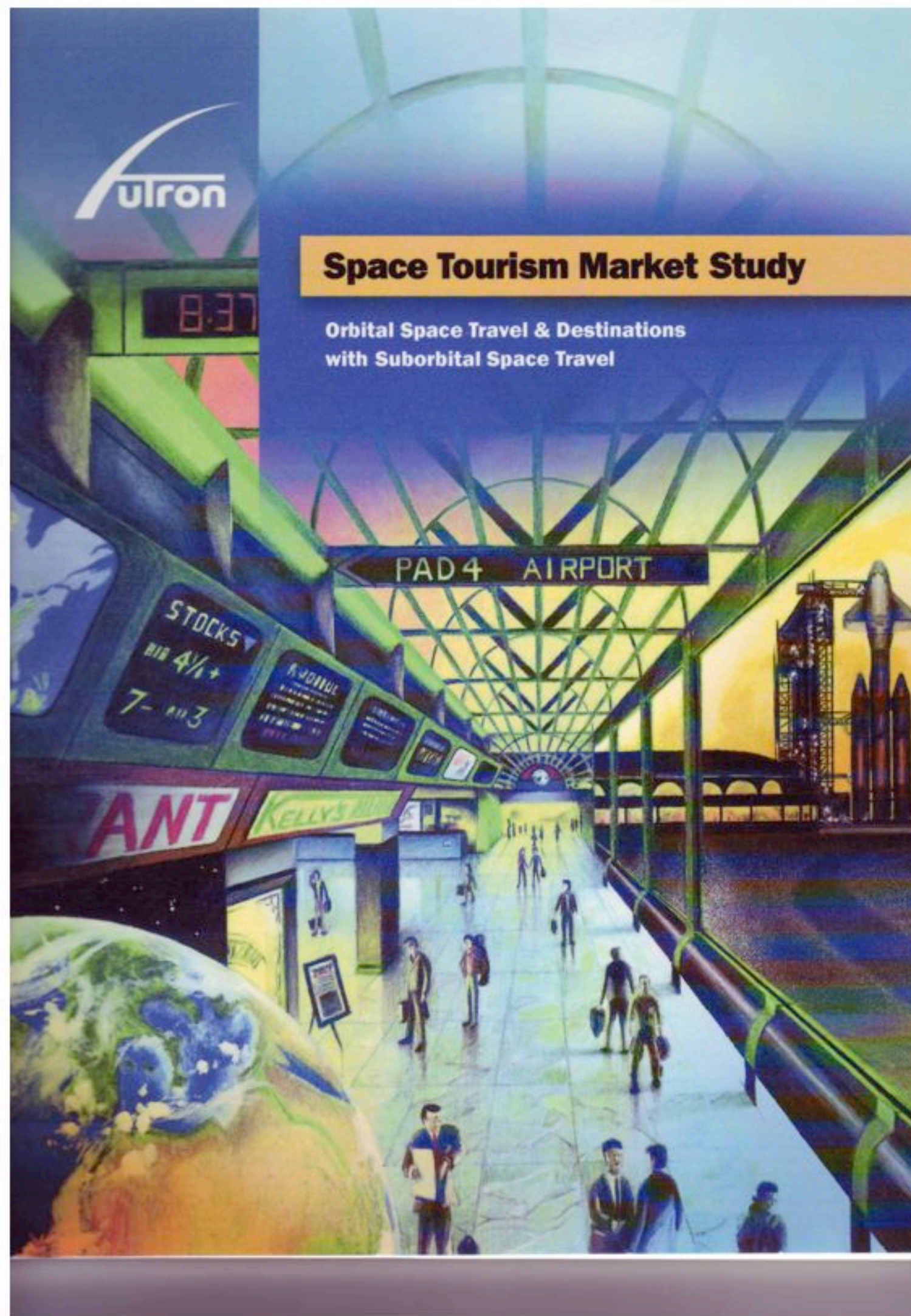
- Risk comparison – skydiving, mountains
- Attitudes – risk is part of deal, disclaimer
- Cultural Aspects – peace or drama?
- Testing Regimen – FAA and marketing
- Preparation – training, screening, exam?



Potential Size of Space Tourism Operations

- Sub-orbital
- Orbital
- Point-to-point
- Spaceports
- Space Hotels

Market Survey Studies (Futron/Zogby, Adventurers')



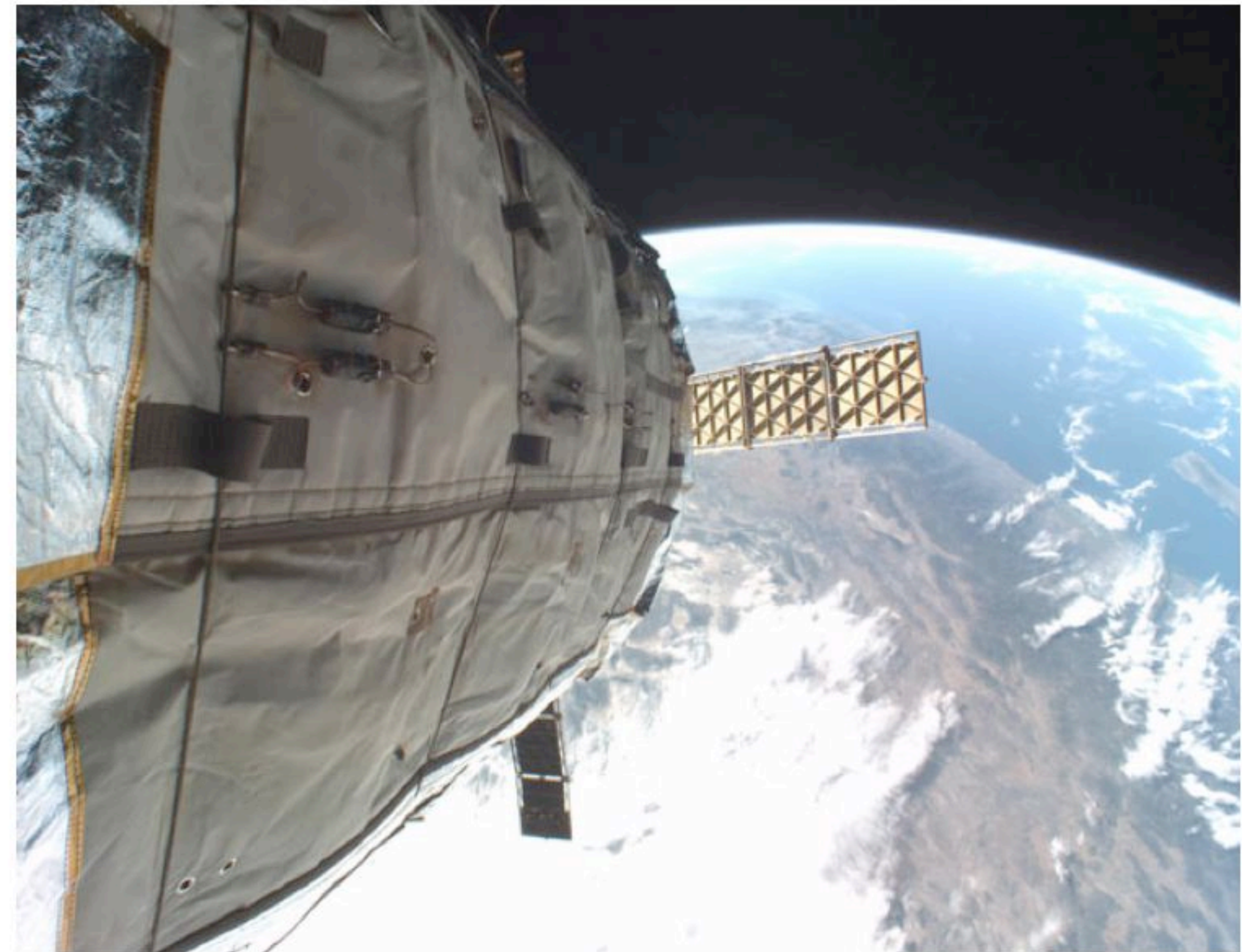


Sub-orbital Markets

- Futron/Zogby Forecasts
- Adventurers' Survey data
- Survey of US Millionaires (there are 1000 global billionaires, 8M millionaires)
- Demand based
- Price \$100,000; 1.5% net worth = \$7M
- 15,000/yr; 40/day globally

Orbital Markets

- Futron/Zogby findings
- 9 tourists to date
- Prices \$30M to \$50M
- \$200M net worth required to give 10% for ticket
- 50/year result
- Puzzle about space hotels premium



Space Hotels

- Bigelow Aerospace
- 2 Prototypes in orbit
- Tourists or governments
- Bigelow's own forecasts 300-500/yr (but includes governments)





Point-to-Point Markets

- **Cargo markets?**- only 30 global flights/day with 460kg at \$800/kg
- **Business Traveler Markets?** – only 100 global passengers/day at ticket price of \$100K to \$300K
- **Space Tourist Markets?** – can only be a tiny subset of the sub-orbital 15,000/yr who would pay a substantial premium



Operators

- Virgin Galactic- Suborbital
- XCOR – suborbital
- Armadillo – suborbital
- Blue Origin – both suborbital and orbital?
- Spacedev – both suborbital and orbital?
- EADS/Astrium?
- SpaceX - orbital
- Orbital - orbital

Ancillary Industries

(Spacesuits, Training, Medical, Insurance, etc)





Characteristics of Space Pilots and Space Tourists

Tourists, Pilots or Astronauts?



Pilots/Astronauts

- Rick Searfoss of XCOR (with Greason)
- Often ex-NASA or airline pilots
- Need to be glider pilots
- Defining Roles (eg Crew Chief)
- FAA is studying training requirements





First 9 Space Tourists

LAUNCH DATE	TRAVELER	NATIONALITY	VEH/SPACECRAFT DESTINATION	SELF-FUNDED?
2nd Dec 1990	Toyohiro Akiyama	Japan	Soyuz/Mir	No
18th May 1991	Helen Sharman	UK	Soyuz/Mir	No
28th April 2001	Dennis Tito	US	Soyuz/ISS	Yes
25th April 2002	Mark Shuttleworth	South Africa	Soyuz/ISS	Yes
1st Oct 2005	Greg Olsen	US	Soyuz/ISS	Yes
18th Sept 2006	Anousheh Ansari	US/Iran	Soyuz/ISS	Yes
7th April 2007	Charles Simonyi (A Flight)	US/Hungary	Soyuz/ISS	Yes
12th Oct 2008	Richard Garriott	US/UK	Soyuz/ISS	Yes
26th March 2009	Charles Simonyi (B Flight)	US/Hungary	Soyuz/ISS	Yes
30th Sept 2009	Guy Laliberté	Canada	Soyuz/ISS	Yes



Space Tourists

- Nomenclature – tourist, participant, traveler, adventurer, explorer, astronaut.....
- Wealth - millionaires
- Age – 50's
- Gender - male
- Health – unhealthy (big and heavy)
- Nationality - varied



Legal and Policy Issues

- UN Treaties and Conventions
- Principles, control and Jurisdiction
- Liability
- Other legal issues



Applicable Space Law

- 1967 The Outer Space Treaty
- 1968 Rescue of Astronauts Agreement
- 1972 Liability Convention
- 1975 Registration Convention
- 1979 Moon Treaty (later!)
- ITAR
- 1984 Commercial Space Launch Act
- 2004 Commercial Space Launch Amendments Act
- Other countries have national space laws



Treaties and Conventions

- Public International Law and National Laws
- Main International Instruments:
 - i. Outer Space Treaty 1967
 - ii. Rescue Agreement 1968
 - iii. Liability Convention 1972
 - iv. Registration Convention 1975
 - v. Moon Agreement 1979



Outer Space Treaty

- Heritage of Mankind and Sovereignty
- OST provides: A State Party to the Treaty on whose registry [a space object] is carried shall retain jurisdiction and control over such object. [Article 8]



Liability Convention

- Absolute and Fault Liability
- Exclusion of Participants
- Waivers and CSLAA
- CSLAA



Liability Waiver

- Informed Consent:
 - i. CLAA Requirement
 - ii. Liability Limitation
 - iii. ITAR Impact
- State Laws:
 - i. Virginia, Florida, New Mexico
 - ii. Effectiveness



... Liability Waiver

- European Dimension - Directive 93/13/EEC
- National Laws and NY Limitation
- Application of Warsaw and Montréal Conventions



Other Legal and Policy Issues

- Nature of the Craft and Passengers
- Nature of the Activity
- US Solution in CLAA
- Other Regulatory Issues
 - i. Export
 - ii. Rescue and Return
 - iii. Communication



Liability Issues

- Sub-orbital – are they aircraft or space objects?
- Safety
- Standard of care
- Space Tourism Insurance market
- Third Party Insurance –ground, air, space
- Statutory Waivers
- State laws
- Space debris



Role of Regulator

- US Gvt appoints FAA-AST
- COMSTAC
- Working Groups
- Guidelines
- NASA role? “human rating?”
- European Aviation Safety Agency?



Permits, Licences

- 2004 Launch Site Operators' Licenses
- 2007 RLV Experimental Permits
- Integration with Air Traffic Control regime?



Informed Consent

- Consequence of CSLAA
- How to be “fully informed”
- Lack of risk data
- Family Members?
- Written Exam?
- ITAR conflict?



Training Requirements

- Limited Time Available
- Regulatory Requirements – FAA still assessing needs
- Operator Proposals – some see training as an experience “plus” and are already giving future tourists centrifuge training.



Medical Requirements

- 2006 FAA-AST “Guidance for Medical Screening of Commercial Aerospace Passengers”
- Screening regimes for different kinds of space tourism
- Sub-orbital med history questionnaire
- Orbital needs examinations
- Pilots radiation questions
- Wyle Labs



Reconciliation of laws

- International/Fed Government/State
- Spacecraft built in one state, launched in another, owned by a foreign entity, etc.
- Clarify ITAR vs informed consent



CASE STUDY



Thank You

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Thank You

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