

## Part 7

No. 1



# C.O.S.T ENGINEERING™

*„Design and Marketing of Rockets“*

Lecture Series given by Dr.-Ing. Robert Alexander Goehlich



Part 7: Basics about Space Tourism –

## Content

No. 2



- **General**
- **Space Tourism**
  - Definition
  - History, Present, Future
  - Demand
  - Ticket Prices
- **Definition**
  - Cost Engineering (Practice VII)
- **Requests from Audience for Lectures**

## General Contact

No. 3



Dr.-Ing. Robert Alexander GOEHLICH  
Mobile: +81-(0)90 1767 1667  
Fax: +81-(0)45-566-1778  
Email: [mail@robert-goehlich.de](mailto:mail@robert-goehlich.de)  
Internet: [www.robert-goehlich.de](http://www.robert-goehlich.de)



Ms. Akiko FUJIMOTO (Teaching Assistant)  
Mobile: +81-(0)80-5039-6222  
Email: [af07302002@yahoo.co.jp](mailto:af07302002@yahoo.co.jp)



Mr. Kenji HASEGAWA (Webmaster)  
Mobile: n.a.  
Email: [malayzaru@hotmail.com](mailto:malayzaru@hotmail.com)



Keio University  
Department of System Design  
Engineering  
Ohkami Laboratory  
(Space System Engineering)  
Office 14-609/14-620  
3-14-1 Hiyoshi  
Kohoku-ku  
Yokohama 223-8522  
JAPAN

## General Goal of Today's Lecture

No. 4



*„You will learn about basics of space tourism and do some exercises with selected examples.“*

## Definition

### Definition of Space Tourism (Version I)

No. 5



*„Space tourism is the term broadly applied to the concept of paying customers traveling beyond Earth's atmosphere.“*

Example:

Dennis Tito can be seen as the first space tourist. His arrival at the International Space Station in April 2001 is shown in the figure.



## Definition

### Definition of Space Tourism (Version II)

No. 6



*“Space tourism can be defined to include not only the vehicles that take public passengers into space, but also from the perspective of the "destination" paradigm. As such, the industry can be envisioned to include not only earth-based attractions that simulate the space experience such as space theme parks, space training camps, virtual reality facilities, multi-media interactive games and telerobotic moon rovers controlled from Earth, but also parabolic flights, vertical suborbital flights, orbital flights lasting up to 3 days, or week-long stays at a floating space hotel, including participatory educational, research and entertainment experiences as well as space sports competitions (i.e. space Olympics).” (Space Policy Institute, 2002)*

Example:

Space camp at the Yuri Gagarin Cosmonaut Training Center at the Russian Star City. Training in a neutral buoyancy hydrolab for \$7000 is shown in the picture.



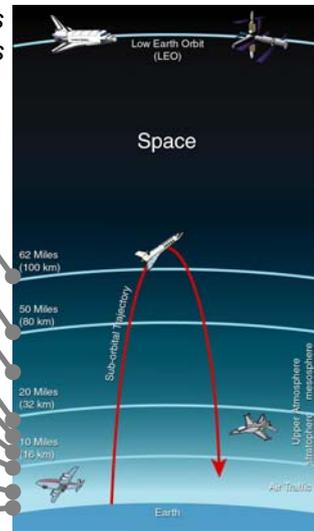
## Definition

### Where does Space begin?

No. 7

Definition varies between nations and organizations concerning different points of view. In this study, it is defined as 100 km above sea level.

- 100 km: no aerodynamic forces
- 81 km: astronaut wings (US DoD)
- 45 km: rocket engine necessary
- 32 km: turbo ramjet necessary
- 24 km: oxygen bottle necessary
- 20 km: pressurized cabin necessary
- 16 km: pressure suit necessary
- 5,3 km: supplemental oxygen necessary
- 3 km: human is not operating efficiently



## History, Present and Future

### History of Space Tourism

No. 8

2 Mio. years ago (Humankind):

Dreams of space travel are assumed to be as old as mankind itself: When humans observed the sky, they wanted to explore the universe in the same way as they wished to fly when they observed birds.



# History, Present and Future

## Present of Space Tourism

No. 9



21th century (SpaceShipOne):

SpaceShipOne, a full privately financed rocket, broke sound barrier and reached an altitude of 65 km.



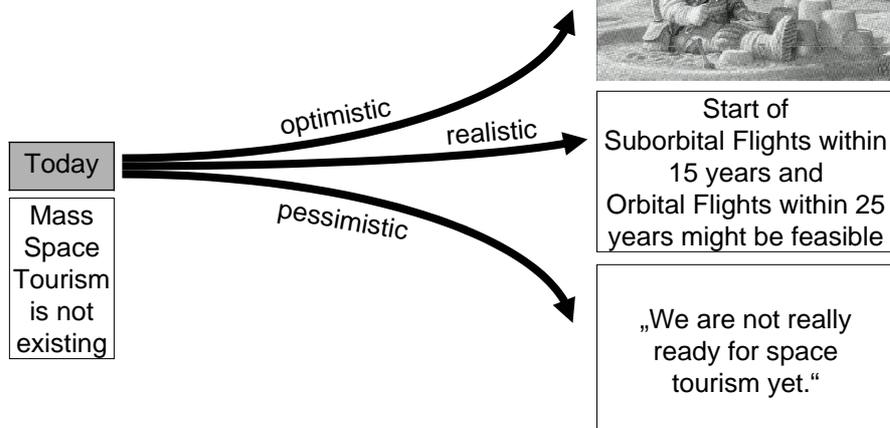
# History, Present and Future

## Future of Mass Space Tourism

No. 10



(= regular flights / air passenger type)



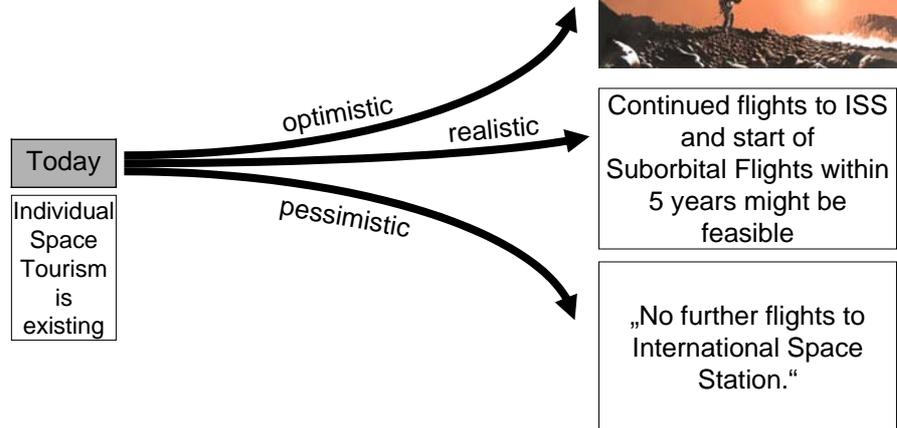
# History, Present and Future

## Future of Individual Space Tourism

No. 11



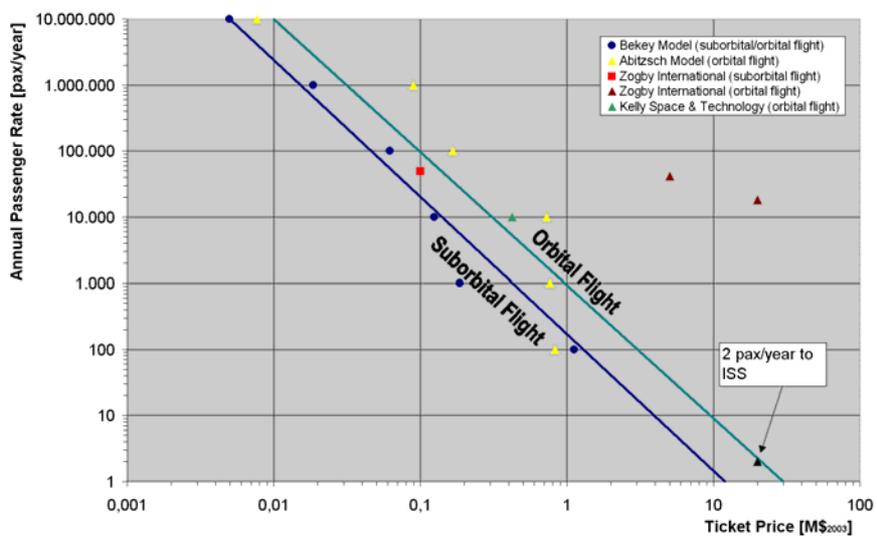
(= non-regular flights / explorer type)



# Market Demand by Passenger

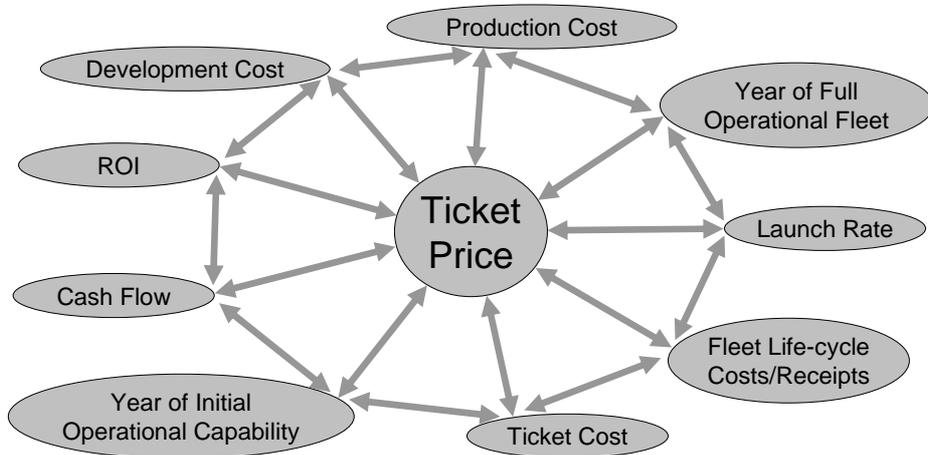
## Passenger-Ticket Price-Model

No. 12



# Simulation

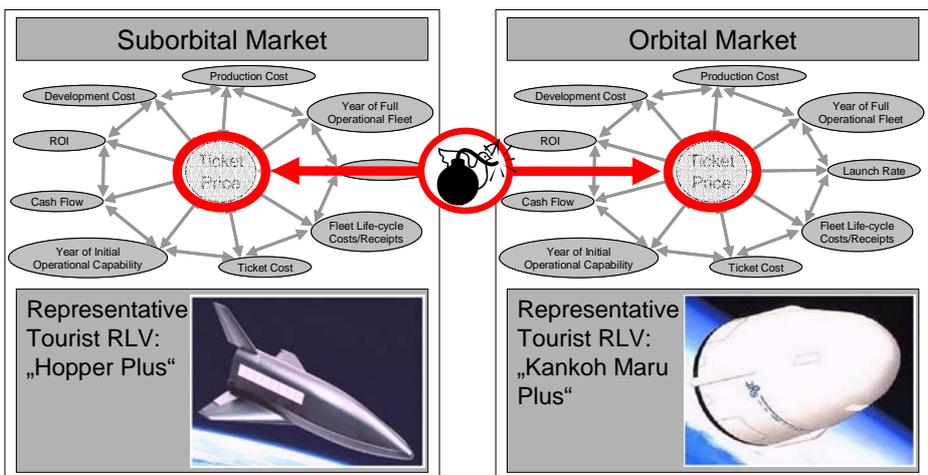
Price Strategy - Correlation to Ticket Price No. 13



# Simulation

Price Strategy - Markets

No. 14



## Definition

### Definition of Cost Engineering (Practice VII) p. 15



#### Case C

- *Step 7: Describe the differences between today's spaceport (for satellites) and future spaceports (for tourists).*

