



NOVEL LECTURE “SPACE TOURISM” AT KEIO UNIVERSITY

GENERAL: This document is about a novel lecture called **Space Tourism** at Keio University, Department of System Design Engineering for bachelor, master and doctoral students every Wednesday afternoon in spring semester.

DESCRIPTION: My motivation for this topic is to introduce aerospace and non-aerospace students into new approaches such as space tourism as a driver to overcome the stagnation of the space market. At the moment space tourism is a field where reality, hoaxes and science fiction are mixed up in such a way that it makes difficult for the general public to distinguish between reality and wishes. These circumstances have a negative effect on the realization of space tourism and should be eliminated. Therefore, my vision for the longer term of this lecture is to establish an independent "Advisory Council for Space Tourism Affairs" located at a university environment.

In addition, a student project "Space Tourism Market Simulation" (STMS) in combination with lectures would have a high benefit for educational quality. STMS is an interactive simulation covering many disciplines such as rocket engineering, economics, design, laws, ethics, art, etc. around space tourism to understand and practice coherences about this topic. Participants can choose one out of eight specific groups such as passenger, manufacturer, organization, space travel agency, investor, government, opposition or own created group. They can either cooperate or compete with other groups. The idea of STMS is to improve participant's knowledge and skills of space tourism in the fields of strategic decision-making, engineering, teamwork, marketing and entrepreneurial activities.

GRADING: Grading will be weighed as the following: 60% for presentation of project STMS, 20% for term paper and 20% for exam.

BIBLIOGRAPHY: Robert A. Goehlich was born in Berlin, Germany, in 1975. He studied Aerospace Engineering at the Technical University Berlin from 1996 to 2000 and received his Ph.D. in 2003. His investigations are focused on cost engineering for reusable space transportation systems and strategies to realize space tourism. In 1999, he worked at the Israel Institute of Technology, Haifa, Israel, investigating pollutant emission models for computer-aided preliminary aircraft design. In 2000, he conducted his master's thesis addressing the feasibility of space tourism at the University of Washington, Seattle, USA. At the National Aerospace Laboratory, Tokyo, Japan, he examined the economical performance of a Reusable Launch Vehicle concept, in 2001. He stayed for 3 months in 2002 at Astrium/EADS, Kourou Spaceport, French Guiana to consider a program proposal for a tourist reusable launch fleet operated from Kourou Spaceport. Currently, he is doing post-doctoral research and lecture at Keio University, Yokohama, Japan, in the fields of space tourism, cost engineering and program planning.



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SCHEDULE:

Week	Date	Topic	Short Description
1	14.4.	Introduction	short summary of each lecture, definition of space tourism, requests from audience for lectures
2	21.4.	Aspects on Space Tourism	order of tour events, tourist attractions in space, space advertising, space nutrition, mass space tourism versus individual space tourism
3	28.4.	Space Tourism Market	market demand by passengers, market supply by manufactures, market support by organizations
4	12.5.	History, Present and Future of Space Tourism	Vera Historia book, V-2 rocket, Apollo program, International Space Station, Dennis Tito, Moon/Mars trips, space colonies
5	19.5.	Intermediate Student Presentations	(Grading)
6	26.5.	Basics about Rocket Science	ideal rocket equation, delta velocity, Earth's atmosphere, solar system, Newton's laws, Kepler's laws (easy-to-understand-examples)* *it is advisable to bring a pocket calculator for this class
7	2.6.	Basics about Space Transportation Systems	expendable versus reusable rockets, single-stage versus multi-stage rockets, propulsion technology, typical ascent/descent trajectory, spaceports (easy-to-understand-examples)* *it is advisable to bring a pocket calculator for this class
8	9.6.	Basics about Cost Engineering for Space Transportation Systems	discussion of cost items, simulation tools, profitability (easy-to-understand-examples)* *it is advisable to bring a pocket calculator for this class
9	16.6.	Intermediate Student Presentations	(Grading)
10	23.6.	Case Study for a Typical Suborbital Rocket for Space Tourists	flight profile, vehicle design, mass characteristics
11	30.6.	Case Study for a Typical Orbital Rocket for Space Tourists	flight profile, vehicle design, mass characteristics
12	7.7.	Hurdles and Opposing Forces to Space Tourism	ethics, health, psychology, envy, safety, environmental pollution, licensing, laws, investors
13	14.7.	Conclusion	necessary next steps, feedback
14	21.7. (28.7)	Final Student Presentations and Exam (Additional Class Day)	(Grading)

Note: Schedule is based on 90 minutes lecture/week. Lecture will be given in English, while slides and handouts are bilingual (English/Japanese).