



# Erasmus Mundus SpaceMaster

at  
Helsinki University of Technology

[www.tkk.fi](http://www.tkk.fi)





# Location

- ‘Otaniemi’ – campus.
- On the coast in the city of Espoo.
- 15 minutes bus ride from Helsinki city centre.





# The Campus

- **Students started building of village in late 1940's.**
- **Building and renovation continues all the time.**
- **Student housing is located on campus.**
- **Student health care is also located on campus.**
- **A post office, bank, pharmacy, sports hall and grocery shops are located on campus.**





# Otaniemi Campus

Student Village

Electrical

Math

Main building

Machine building

Naval engineering

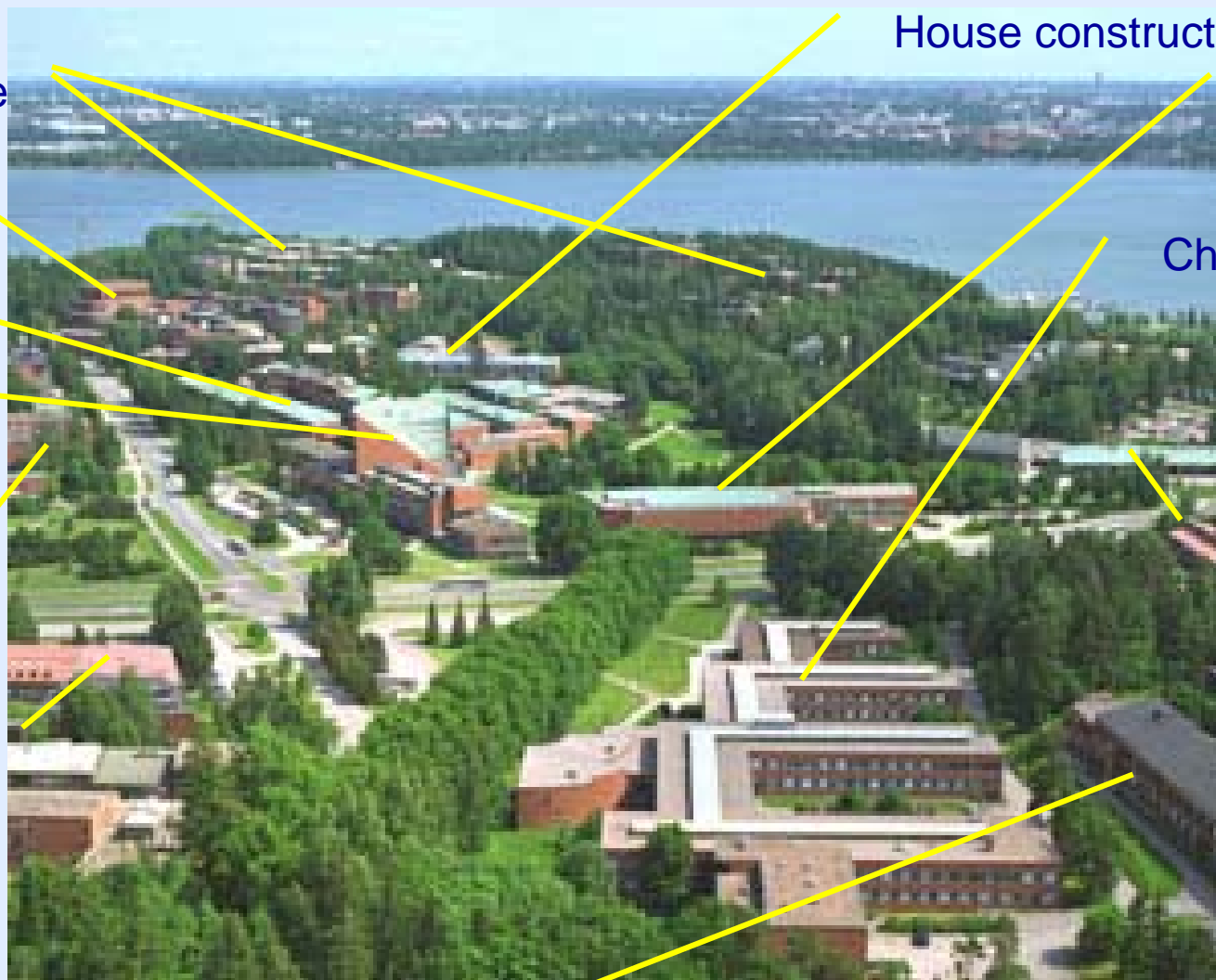
House construction

Library

Chemistry

Mall

Geotechnology





# Statistics 2004

- **15 192 Number of students**
- 12 430 Undergraduates (female 20%, foreigners 4%)
- 2 762 Graduates (female 31%, foreigners 10%)
  
- 961 Master's degrees (female 23%, foreigners 5%)
- 72 Licentiate degrees
- 130 Doctor's degrees (female 20%, foreigners 13%)
  
- **11 727 Adult students**
- **3 192 FTE Staff**





## 4 Faculties

**Helsinki University of Technology (TKK) has re-organized its internal structure as of January 1, 2008. TKK's twelve departments consisting of laboratories were re organized into four faculties that consist of departments.**

- **Faculty of Electronics, Communications and Automation**
- **Faculty of Information and Natural Sciences**
- **Faculty of Engineering and Architecture**
- **Faculty of Chemistry and Materials Sciences**

[http://www.tkk.fi/en/about\\_tkk/organisation\\_and\\_administration/faculties\\_and\\_departments/index.html](http://www.tkk.fi/en/about_tkk/organisation_and_administration/faculties_and_departments/index.html)



## Faculty of Electronics, Communications and Automation

The faculty conducts academic research in the fields of electronics, electrical engineering, communications engineering, automation and bioinformatics technology.

### Departments and units

- Automation and Systems Technology
- Electronics
- Micro and Nanosciences
- Radio Science and Engineering
- Signal Processing and Acoustics
- Electrical Engineering
- Communications and Networking
- Metsähovi Radio Observatory
- The Intelligent Machines and Special Robotics Institute
- Institute of Digital Communications
- Micronova
- Institute of Intelligent Power Electronics

<http://sahko.tkk.fi/en/>





# Automation and Systems Technology Department

<http://as.tkk.fi/en/>

## Research groups of the AS Department

- Control Engineering
- Information and Computer Systems in Automation
- Automation Technology
- Generic Intelligent Machines
- Autonomous Systems

**Automation technology laboratory**

<http://automation.tkk.fi/>







## Automation Technology Laboratory

### Research areas:

- **Intelligent Mobile Machines and Robots**
- **HMI- technologies and Telepresence**
- **Bio- and Microsystems**
- **Energy Technology**
- **New generation automation systems**
- **Systems Theory and Algorithms.**





## Classes for SpaceMasters

**Introduction to robot kinematics 4 cr. (Fall, Period I)**

**Behaviour-based Robotics 3 cr. (Fall, Period I)**

**Field and Service Robotics 4 cr. (Fall, Periods I & II, practical work)**

**Seminar in Automation Technology (Spring, Periods I-II)**

**Estimation and Sensor Fusion Methods 3 cr. (Fall, Period I)**

**Machine Perception 3 cr. (Fall, Period II)**

**Real Time Programming 4 cr. (Fall, Period I, practical work)**

**Computer Services at TKK 2 cr. (Fall, Period I)**

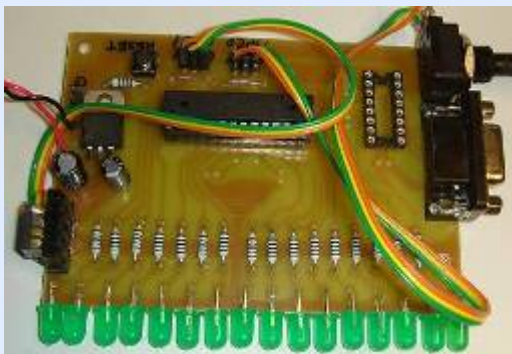
**Finnish IA 2 cr. (Fall, Period I)**

**Finnish IB 2 cr. (Fall, Period II)**

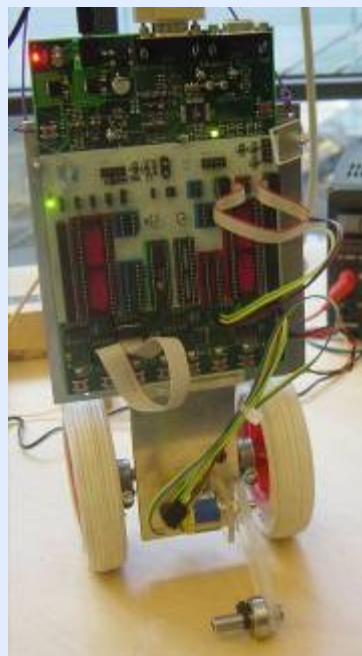
<http://automation.tkk.fi/SpaceMaster/Studies>



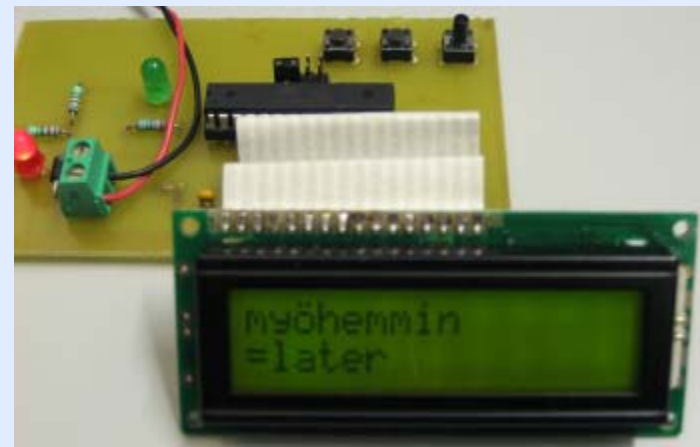
## SpaceMaster Real Time Programming exercises 2007



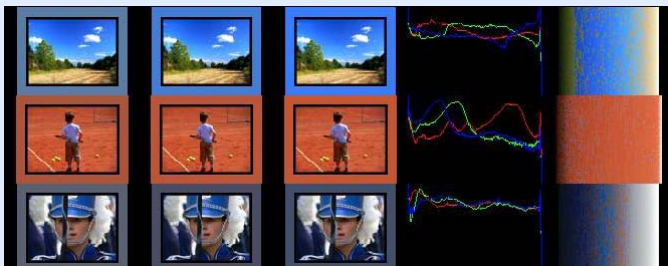
Persistence of Vision with LED-Array



Self-balancing robot



Finnish Vocabulary helper



Ambient light created by a Power-LED

**Students built all hardware themselves. Very clever ideas!**



## Field & Service Robotics exercise: J2B2 robot competition

- **A mobile programmable robot platform J2B2 (in honor of ‘Star Wars’).**
- **Programming and hardware development group work.**
- **Success and performance measured in final robot competition.**





**2007 competition objective was to detect, collect and deliver valuable stones in a maze; autonomously or remote controlled with time delay.**



**SpaceMaster groups won 1st and 3rd position. Well done!**

Pictures: Jari Saarinen



## Hardware available for Space Master-projects: Mars drilling test equipment

- **Realized for ESA-Aurora student contents project.**
- **Has been used for testing and development of drilling tools and procedures for Martian sub-surface exploration.**





## Mars-ball

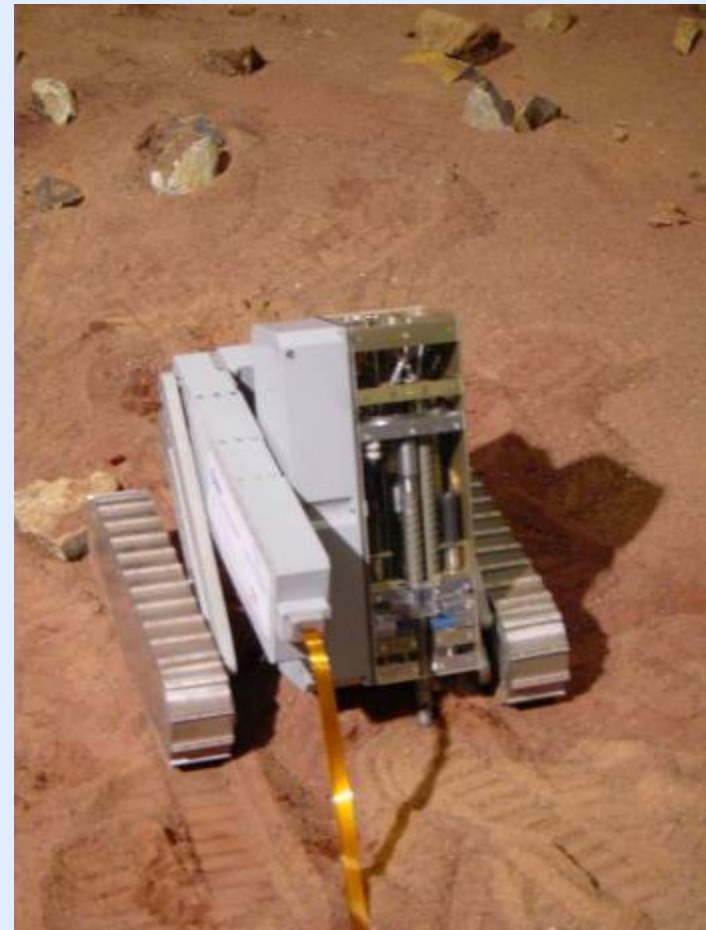
- **Developed under ESA's Ariadna project**
- **Provides an extraordinary platform for study of mobility and steering; powered or wind-driven.**





## Rosa-2 platform

- **A mobile drilling device delivered to ESA.**
- **A copy of the roving vehicle exists at the lab**
- **The vehicle is to be used to study mobility, steering and navigation with a tracked vehicle.**







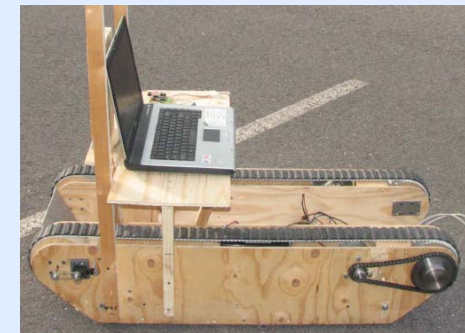
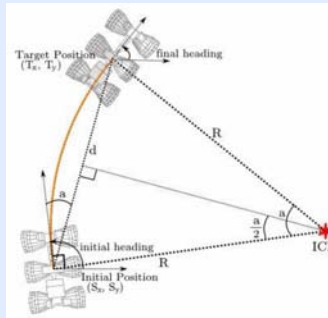
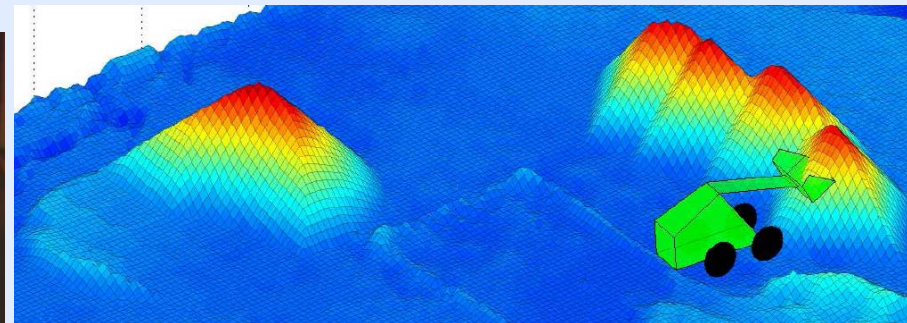
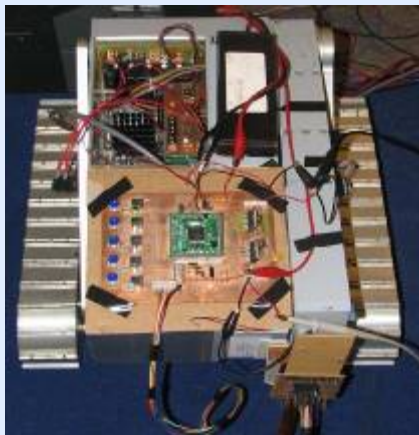
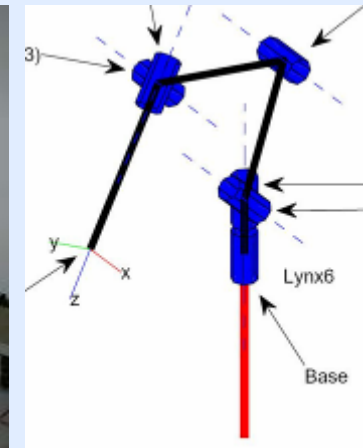
## Marsokhod

- **6-wheeled multi-freedom all-terrain vehicle intended for Mars-exploration**
- **Procured in co-operation with RCL-company.**
- **Available for the lab for instrumentation, mobility, steering and navigation studies.**





## SpaceMasterThesis research 2006-2007



- Wireless Teleoperation of Robotic Arms
- Tether Tracking and Control of ROSA Robotic Rover
- The Design of an Energy Management System
- State Estimation Technique for a Planetary Rover
- Development of Mobility System for Marsokhod Rover
- Study and Implementation of Wheel Walking for a Mars Rover
- Design and Implementation of a Stereo Vision Based Navigation System for the Micro-RoSA-2 Mars Rover
- Development of a Simulator for Modeling Robotic Earth-Moving Tasks



**2006-2007 SpaceMaster graduates &  
some academic staff at TKK.**

**(2 graduates are absent from the photo.)**



## Other services from TKK: International Student Services

- International Student Services office helps to arrange accommodation.
- Department's study advisers and tutors assists in all concerns
- Orientation Days in September clarify
  - activities by the Student Union
  - library and computer facilities
  - the Finnish way of life, what kind of health care etc.





# Language Centre

- Finnish
- Swedish
- German
- English
- French
- Russian
- Norwegian
- Japanese
- Chinese
- Portuguese
- Spanish





# WELCOME TO FINLAND!

