



Pavel Pačes  
and the ESMO Czech Team

**ESMO CZECH**

CTU Lions go to the Moon

Pavel Pačes

# Introduction

European  
Student  
Moon  
Orbiter



## ⦿ ESMO =

- **European Space Agency** project (AO6031) to support engineering education in space sciences – increase number of experts
  - First student mission to the Moon (expected launch early 2014)
- ## ⦿ Assigned by **ESA** to
- Surrey Space Technologies Limited (**SSTL** England) – part of EADS Astrium and to
    - **the universities**

# ESMO Mission

- Main aim: support space related education and knowledge
- Moon observation
- Radiation monitoring
- Details available on request

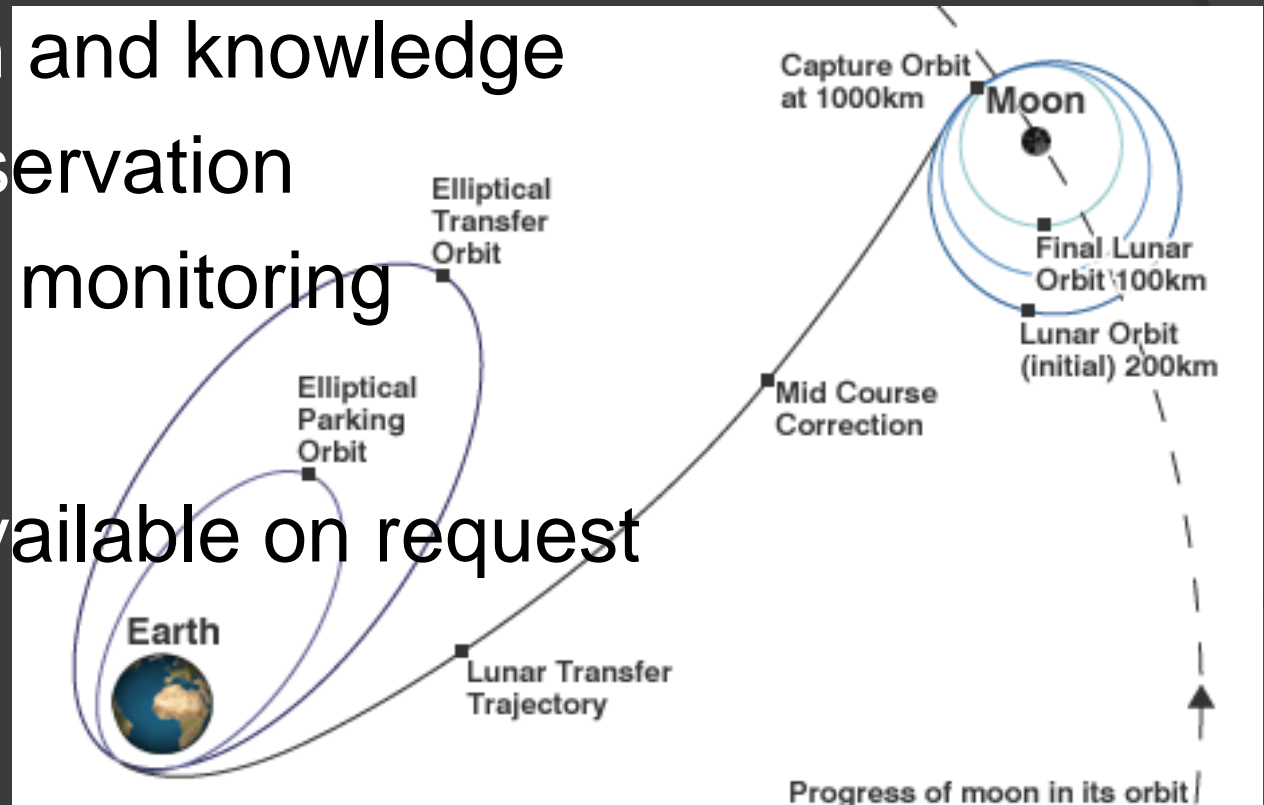
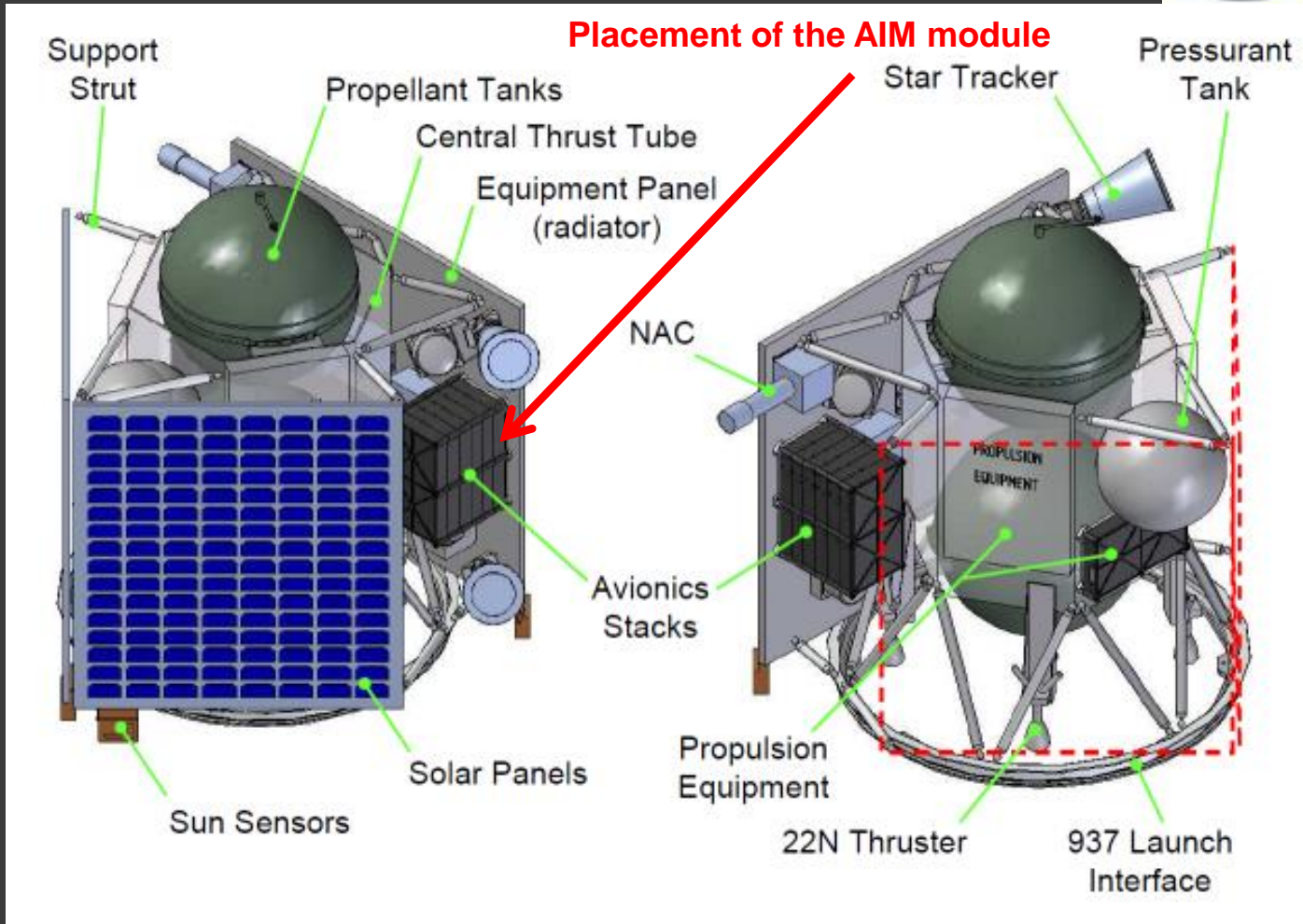


Image source: ISRO

# ESMO Spacecraft



# ESMO Teams

- Universities around Europe

- Complete list

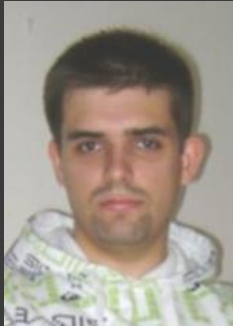
<http://esmo.edu.esa.int/content/teams.aspx>



- Czech Technical University in Prague

- Responsible for **AOCS Integration Module** (AIM)
- Group email: **esmo.czech@gmail.com**

# ESMO CZECH Core Team



## ◎ Pavel Pačes

- PhD student, Assistant professor at CTU
- Project leader and all kinds of necessary work

## ◎ Jaroslav Laifr

- MSc student at CTU (**dept. of meas.**), future PhD student
- Space resistant electronics expert, group leader

## ◎ Ondřej Bruna

- MSc student at CTU (**dept. of contr.**), future PhD student
- Mission software expert, group leader

## ◎ Bronislav Robenek

- Bc student at CTU (**dept. of cyber.**)
- Quality assurance

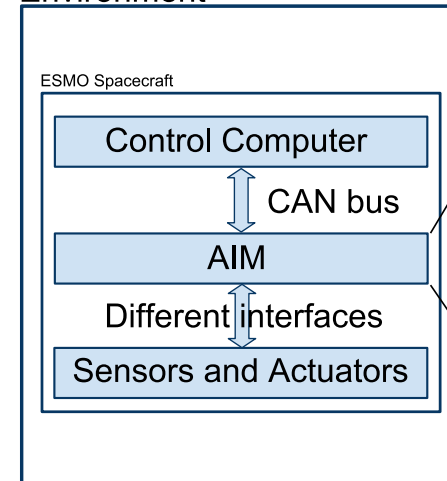
## ◎ Jan Petras

- Bc student at CTU (**dept. of meas.**)
- HW and SW design

# ESMO AIM

- ⦿ **A**ttitude **O**rbital and **C**ontrol **S**ystem **I**ntegration **M**odule (AIM)
- ⦿ Interface between
  - Sensors and Actuators and
  - Control system

Environment



AIM module requirements

- Timing
- Sensor and actuator interfaces
- Control Computer interface

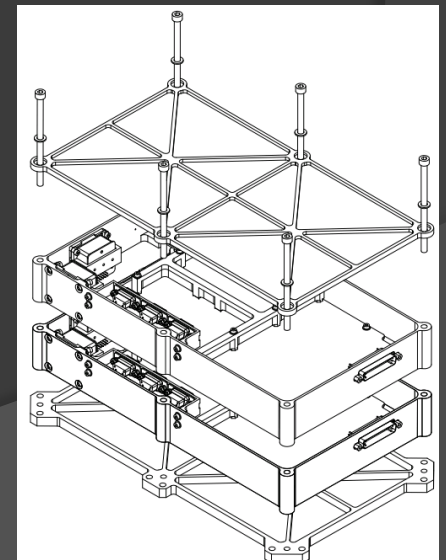
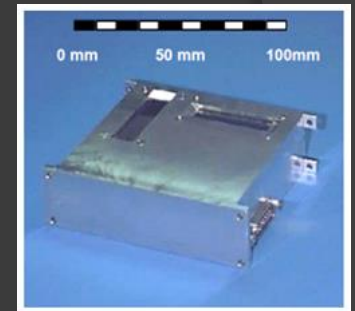
- HW design
- SW design
- Test system
- Testing



# ESMO AIM (one module)

Spacecraft will carry two AIM modules (AIM0 and AIM1). Each module:

- Analogue to digital signal conversion (1÷10 sps)
  - 1x Sun Sensor (4 voltages, 120° field of view)
  - 3x gyroscopes - expected SiRRS01 (3 voltages, 3 temperatures, 3 internal test values)
- Requested accuracy  $< 1^\circ$
- Built-in test: bit flip, HW and SW consistency, failure recovery





# CZECH Team responsibilities

- Project management
- Derived requirements specification
- Design, development and verification planning
- AIM module design and manufacturing
- Module testing
- Delivery of two Flight Models

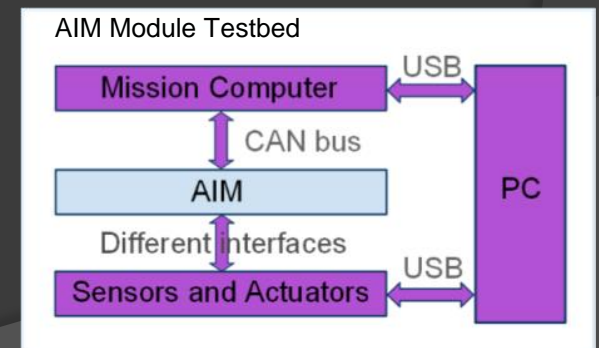
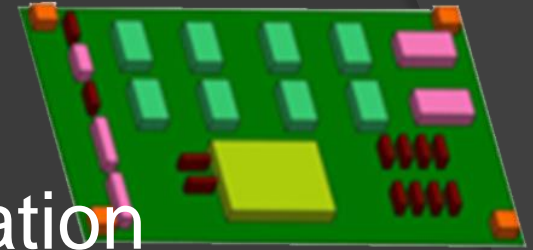


Image sources: ESMO AIM Team

# Unsolved problems

Some facilities are not completely available at CTU

- Clean room or laminar flow cabinet
- Clean lab space
- Vibration test bed
- Vacuum test chamber
- Thermal-Vacuum test chamber

→ But these facilities are in the Czech Rep.

# We are looking for sponsors

ESMO CZECH team looks for sponsors in following areas:

## ⦿ Travelling

- Different reviews with other teams (PDR, SRR, CDR, QR, etc)

## ⦿ Material

- Parts, mechanical components, ...

## ⦿ Module Assembly

- Clean lab. facilities, clean lab space, ...

## ⦿ Module Testing

- Shaker tables, thermal-vacuum chambers, ...

→ Any kind of sponsoring is welcomed

# Current sponsors

- ◎ CTU in Prague
  - Labs., meeting rooms, internet connection, travel expenses for kick-off meeting at SSTL England
- ◎ Vector GMBH
  - CANbus connectivity
- ◎ Freescale Semiconductors
  - Electronic components, development SW
- ◎ Frentech Aerospace s.r.o. (Brno)
  - Mechanical components
- ◎ G.L.Electronics
  - Discount for clean lab soldering services (it is still expensive)

# ESMO CZECH Near Future

Spring 2011

- ⦿ Sign of Contract  
(among SSTL and CTU in Prague)
- ⦿ Total Ionizing Dose Test at Nuclear Research Institute Rez plc.
- ⦿ Preliminary Design Review at ESTEC  
(May 2011)
  
- ⦿ We look for more:
  - Sponsors (any kind – e.g. t-shirts, ...)
  - Participating students:
    - With interest in analysis:
      - Structural, Resonance, FMEA, Thermal, ...



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For any question please use:

**[esmo.czech@gmail.com](mailto:esmo.czech@gmail.com)**