ESEO
European Student Earth Orbiter: ESA’s Educational Microsatellite Program

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SUMMARY

- ESEO Project Goals and Organization
- ALMAspace/UniBO Microsatellite Missions Heritage
- University Network Roles
- ESEO Lecture and Training Courses
- ESEO S/C Design
- Why Low-Cost Educational Spacecraft?
- Conclusions
The European Space Agency issued an Open Invitation to Tender (ITT) in February 2012.

“...The scope of the activity includes the hands-on training of university students on the development, assembly integration, test, verification and delivery of a complete satellite system, including the satellite subsystems, the payload elements, and the ground segment systems required to operate the spacecraft and its payload; in addition, the scope of the activity includes also the preparation and the conduct of the Launch Campaign and the Launch and Early Orbit Phase.”

“The primary objective of the ESEO project is to provide students with valuable and challenging hands-on space project experience across all disciplines and throughout the full project lifecycle in order to fully prepare a well-qualified space workforce for the future.”

“Commensurate with the education objectives of the project, and with the constraints deriving from re-utilising a pre-existing spacecraft, the ESEO system elements shall therefore be designed, developed, built, tested and operated, to the maximum possible extent, by European university students.”
After ESA’s evaluation, in Dec. 2012 a contract was awarded to the ALMASpace/UniBO team:
ALMASat-1

Launched in 2012

ALMASat-EO

Launch 2014 (TBC)

ESEO

Launch 2016 (TBC)
University of Bologna
GPS Receiver and OD

Denmark Univ. of Technology
Microcamera

Hungarian Academy of Sciences
Tritel Dosimeter

Wroclaw Univ. of Technology
S-Band System

Budapest Univ. of Technology
Langumuir Probe

Technical Univ. of Delft
AODCS S/W Experiment

Technical Univ. of Munich
S-band Ground Station

University of Zaragoza
Mission Analysis

University of Vigo
GENSO for ESEO

Cranfield University
Deorbiting Device

AMSAT-UK
Educational HR Payload
To be held at the University Residential Centre of Bertinoro (FC)

1\textsuperscript{st} week:
Space Environment
Orbital Mechanics
Attitude Dynamics and Control
Mission Analysis
AGI/STK Fundamentals

2\textsuperscript{nd} week:
S/C subsystems
Remote Sensing
S/C AIV
Ground Segment
Course Test

20 students in each course, to be repeated three times in 18 months (Grants 9 ECTS)
To be held at ALMAspace’s premises (1 week), **granting 3 ECTS:**

- Mechanical Design
- Mechanical and Thermal Analysis
- Electronics Design
- Power Electronics Design
- PA/QA/SA Management

**Spacecraft Subsystems AIV Workshop (Mechanical)**
- **Spacecraft Subsystems AIV Workshop (Thermal)**
- **Solar Panels Assembly Workshop**
- **Hardware-In-the-Loop Simulations Workshop**
To be held at UniBO’s premises (4 weeks), **granting 6 ECTS:**

Students from the Universities Network are hosted (in small groups of 5 individuals) at UniBO premises for a period of 4 weeks working in close connection with personnel involved in the ESEO mission:

1) to let students gain experience in space-system design, prototyping, assembly and integration by applying knowledge and skills previously achieved during Lectures and Training Courses

2) to perform payload engineering activities under the assistance of a team of experts
European Student Earth Orbiter
WHY A LOW-COST EDUCATIONAL SPACECRAFT?

- Large scientific and technological programs have very long development times and are incompatible with hands-on education
- Let’s compare NASA/ESA/ASI Cassini-Huygens with ESA’s ESEO:

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<tr>
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<th>Cassini-Huygens</th>
<th>ESEO</th>
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<tbody>
<tr>
<td>Mission Concept</td>
<td>1982</td>
<td>2007</td>
</tr>
<tr>
<td>Start of Mission Implementation</td>
<td>1989</td>
<td>2013 (current)</td>
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<tr>
<td>Launch</td>
<td>1997</td>
<td>2016 (TBC)</td>
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<tr>
<td>Development time</td>
<td>8 years</td>
<td>30 months</td>
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<td>Number of people involved</td>
<td>+5000</td>
<td>250 (TBC)</td>
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<td>Budget</td>
<td>$3.27 Billions</td>
<td>~ 2.5 M€</td>
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<td>Cruise Time</td>
<td>7 years</td>
<td>~ 25 min</td>
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<tr>
<td>From Implementation to Target Orbit</td>
<td>15 years</td>
<td>3 years (TBC)</td>
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<td>Years of Operations</td>
<td>20</td>
<td>0.5</td>
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ALMASpace/UniBO selected as System Prime Contractor

Involvement of 10 EU Universities + AMSAT-UK

60+ students involved on site plus ~120 at their home institutions

ESEO launch currently foreseen at end 2015/beg 2016

ESEO’s “mantra”:

“I hear and I forget; I see and I remember; I do and I understand” *

Students make up in enthusiasm what they lack in experience!

* Confucius - China's most famous teacher, philosopher, and political theorist, 551-479 BC
ALMASat-1
Ground Station
Forlì, Italy