

TARTU OBSERVATORY
space research centre



ESTCUBE⁺

per solem ad astra



The Estonian Student Satellite Programme: providing skills for the modern engineering labour market

 UNIVERSITY OF TARTU

First Symposium on Space Educational Activities

Andris Slavinskis et al.

09.12.2015





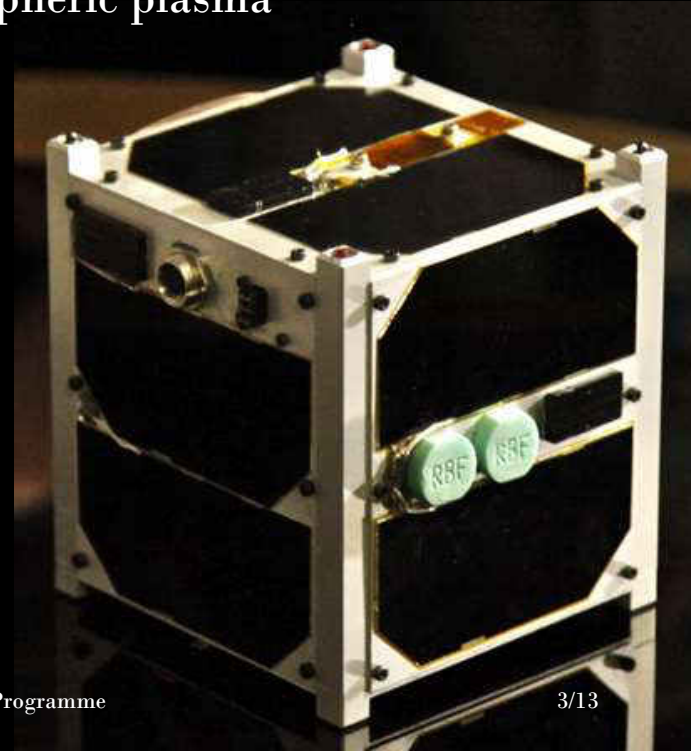
Outline

- ESTCube-1
- Contribution to Aalto-1
- European Student Earth Orbiter optical payload
- ESTCube-2/3
- Science Task Force
- Space Club Astronauts
- Future Work Skills 2020



ESTCube-1

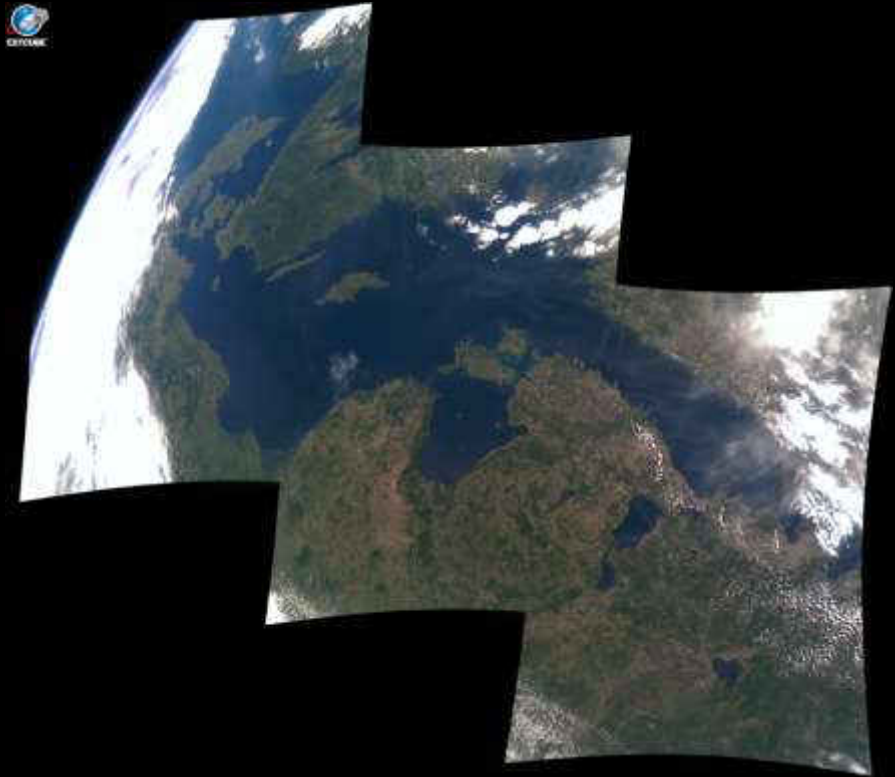
- Project started in 2008
- First Coulomb drag propulsion in-orbit experiment (electric solar wind sail and plasma brake)
- 10-metre tether interacts with ionospheric plasma
- Launch in May 2013
- Supported by ESA PECS





In-orbit experience

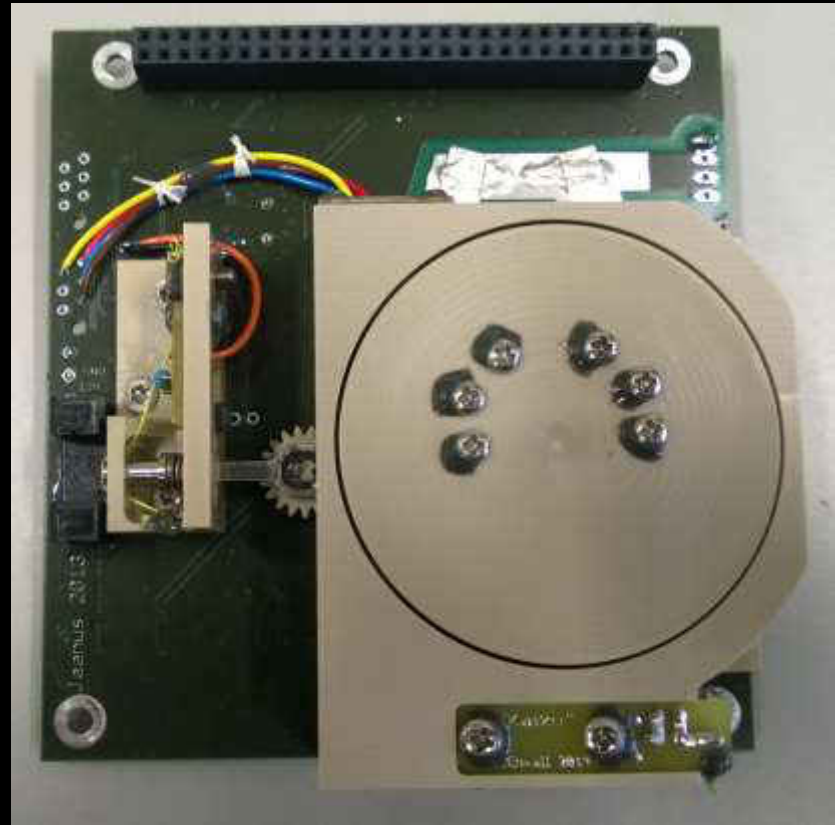
- Satellite bus worked well
- In-orbit software updates
- 300 images
- Residual magnetic moment
- Cover glass
- Re-calibration of sensors
- Tether deployment was not confirmed
- Jammed motor
- Spin rate of 840 deg/s





Aalto-1

- Satellite built by Aalto University, Finland
- Second Coulomb drag propulsion experiment
- 100-m tether
- Improved tether deployment system
- ESTCube team contributed with motor electronics
- Planned launch in March 2016





ESEO optical payload

- European Student Earth Orbiter
- Primary camera
 - Based on ESTCube-1 camera
- Secondary camera
- Supported by ESA PECS





ESTCube-2/3

- New generation tether and deployment system
- 1-km tether can be used for deorbiting from 600-700 km in 2-4 years
- Subsystem prototypes have been developed
- On-going fundraising
- CubeSat size options
 - One unit: Coulomb drag device and camera
 - Two units: high frequency communications and reaction wheels
 - Three units: propulsion for spin control
- ESTCube-2
 - Low Earth orbit
 - Ideally, platform for ESTCube-3
- ESTCube-3
 - Solar wind intersecting orbit



Science Task Force

- Secondary school pupils solving science and engineering problems
- Every summer since 2012
- Summer 2015
 - Twelve pupils
 - Three from Latvia
 - Three-axis Helmholtz coil
- Some join the team as students





Estronauts

- Space club for primary school pupils
- Since 2008





Future Work Skills 2020*

- **Sense-making: deeper meaning or significance**
 - Independent work to solve problems
- **Social intelligence: make, sense and stimulate interactions**
 - Diverse multinational teams
 - Communication with audience and media
- **Novel and adaptive thinking**
 - Significant contribution to science and space exploration
 - In-house (nanosatellite) developments
- **Cross-cultural competency**
 - Partners and co-workers from around the world
- **Computational thinking: abstraction of vast amounts of data**
 - Very important for science and engineering

*A. Davies, D. Fidler, and M Gorbis. Future Work Skills 2020. Research Institute Report SR-1382A, Institute for the Future for University of Phoenix, 2011.



Future Work Skills 2020

- **New-media literacy: critically assess and develop content**
 - Outreach activities for different audiences
- **Transdisciplinary**
 - Various fields of engineering and science, applications, fundraising, media
- **Design mindset: develop tasks and processes for desired outcome**
 - Leading and management of teams
- **Cognitive load management: filtering of information**
 - Literature reviews, work of former members, other engineers
- **Virtual collaboration**
 - Students work from different physical locations
 - Confluence, JIRA, e-mail, Skype, Hangouts, DropBox, Google Docs, etc.



ESTCube Programme in numbers

- Students: > 200
- Bachelor theses: > 30
- Master theses: > 20
- Journal articles: 13 + 3
- Conference papers: 9
- Posters: 7
- Technical presentations: > 50
- Popular science article: > 50
- Popular science talks: > 30
- Pupils: > 30
- Facebook followers > 5000
- Deed of the year: 1
- Man of the year: 1
- Spin-off companies: 4



andris.slavinskis@estcube.eu — fb.com/estcube — estcube.eu