

A?

Aalto University
School of Electrical
Engineering

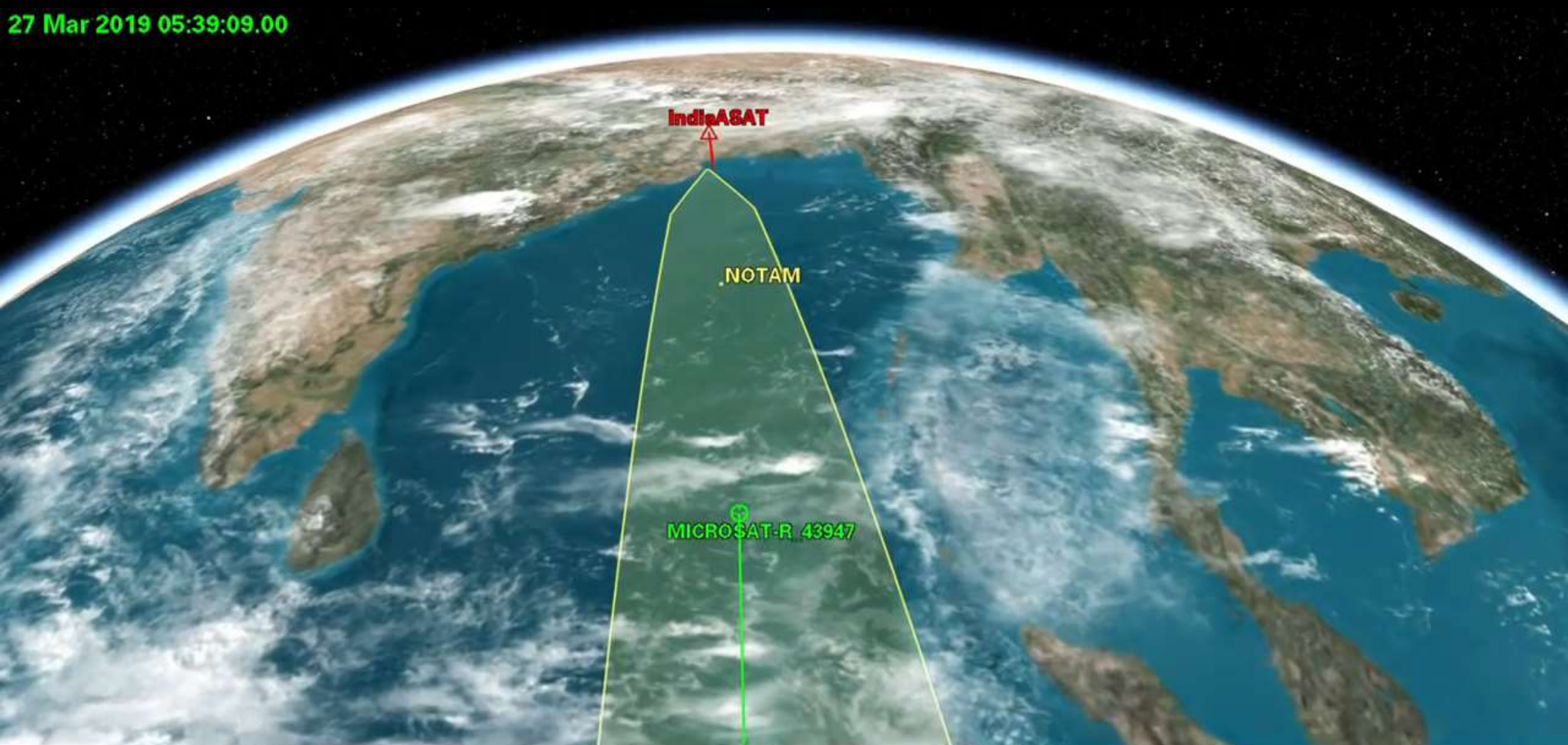
Finnish Centre of Excellence in Research of Sustainable Space

Jaan Praks, Minna Palmroth, Rami Vainio, Pekka Janhunen, Emilia Kilpua

Finnish Centre of Excellence in Research of Sustainable Space

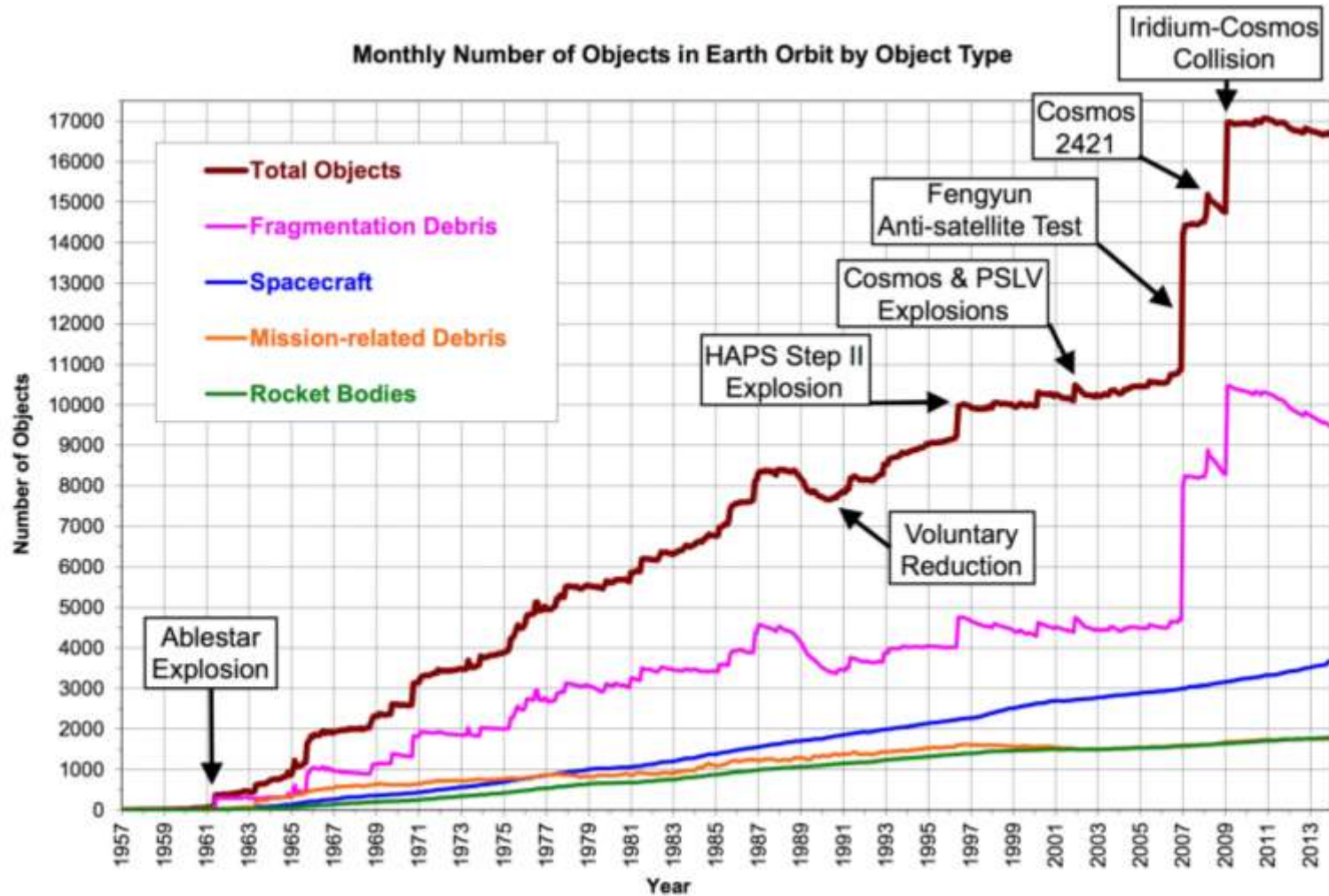






Originally deduced the target was Microsat-R based on Indian PM statements and NOTAM filing.

Space Debris



**business
as usual**

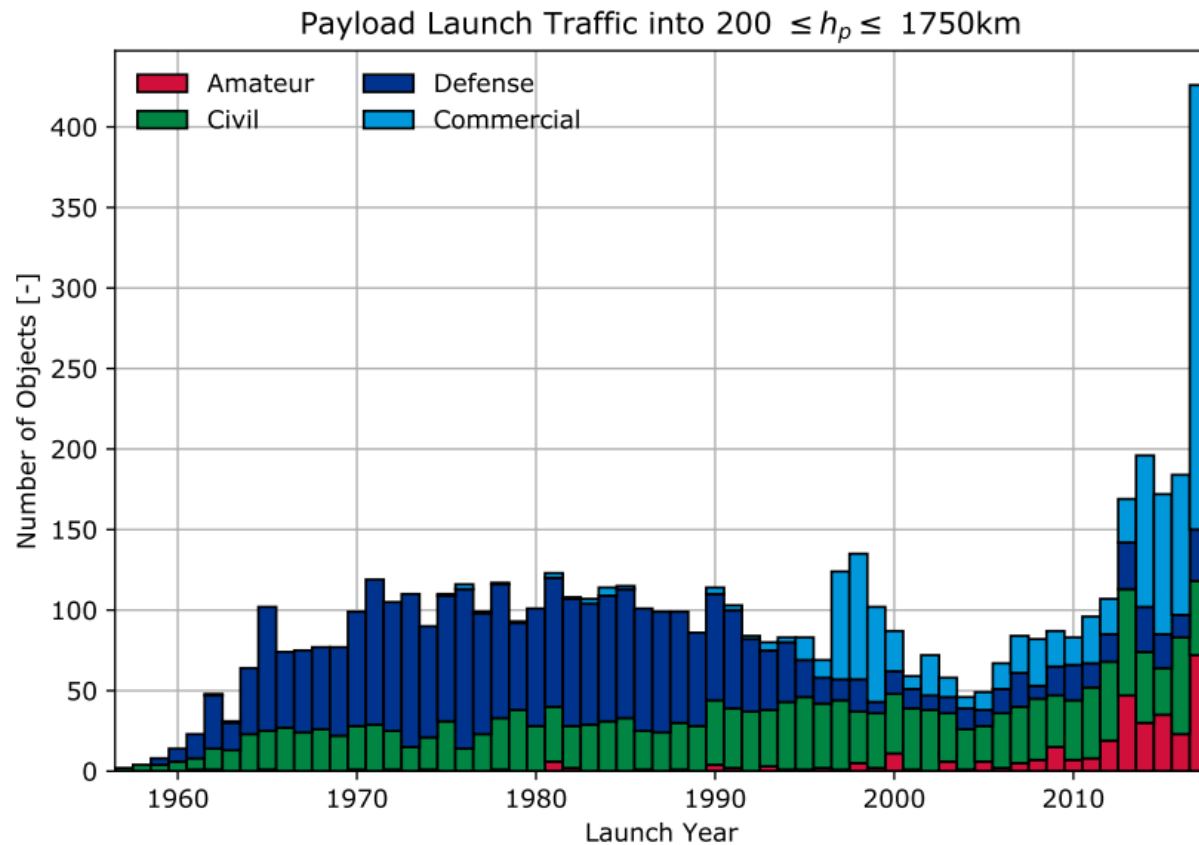
**object
count**

time

2010



Payload traffic to LEO





FORESAIL

FINNISH CENTRE OF EXCELLENCE IN RESEARCH OF SUSTAINABLE SPACE



SUOMEN AKATEMIA
FINLANDS AKADEMI
ACADEMY OF FINLAND



HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI



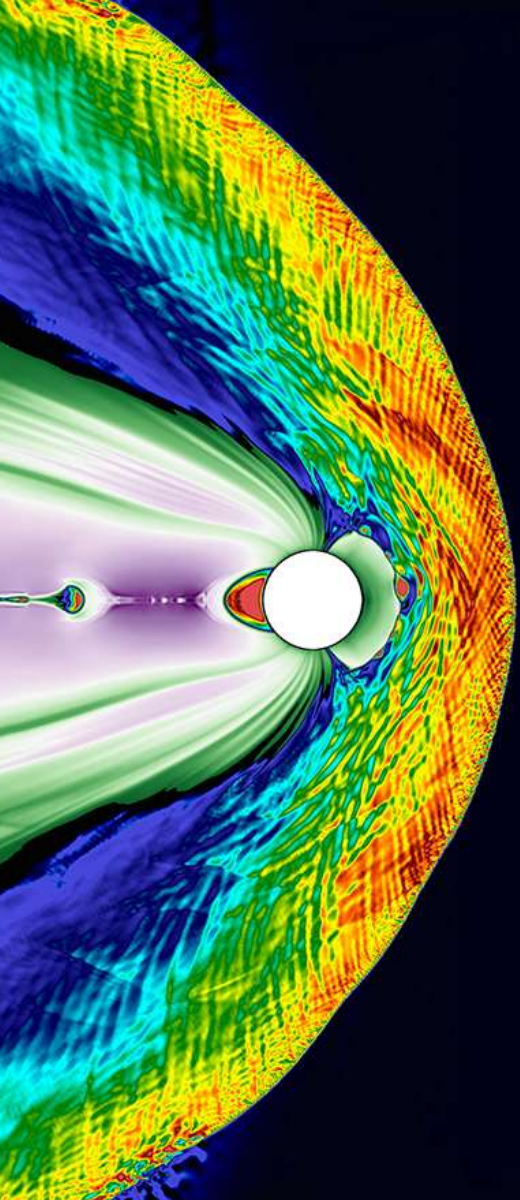
Aalto University



UNIVERSITY
OF TURKU



FINNISH METEOROLOGICAL
INSTITUTE



Combining best space environment models, particle instruments and nanosatellites in Finland to develop technology for more sustainable space.

Goals

- Better knowledge of radiation physics in space
- Awareness of sustainability issues
- Science Space Program for Finland
- Deorbiting technologies for small satellites
- Solutions for radiation tolerant Cubesat platform
- Science instruments for future space
- Renewal of space scientists and engineers





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LASATOR

Modelling team

University of Helsinki

Instruments team

University of Turku

Propulsion team

Finnish Meteorological Institute

Platforms team

Aalto University

Observations team

University of Helsinki





**UNIVERSITY
OF TURKU**

al electron count 10.10. - 17.10.2017



Modelling team
University of Helsinki

Instruments team
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Aalto-1



Aalto-1 Aalto-2 Aalto-3 Foresail-1 Foresail-2

ASPECT Suomi 100

Modelling team

University of Helsinki

Instruments team

University of Turku

Propulsion team

Finnish Meteorological Institute

Platforms team

Aalto University

Observations team

University of Helsinki



Modelling team

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Instruments team

University of Turku

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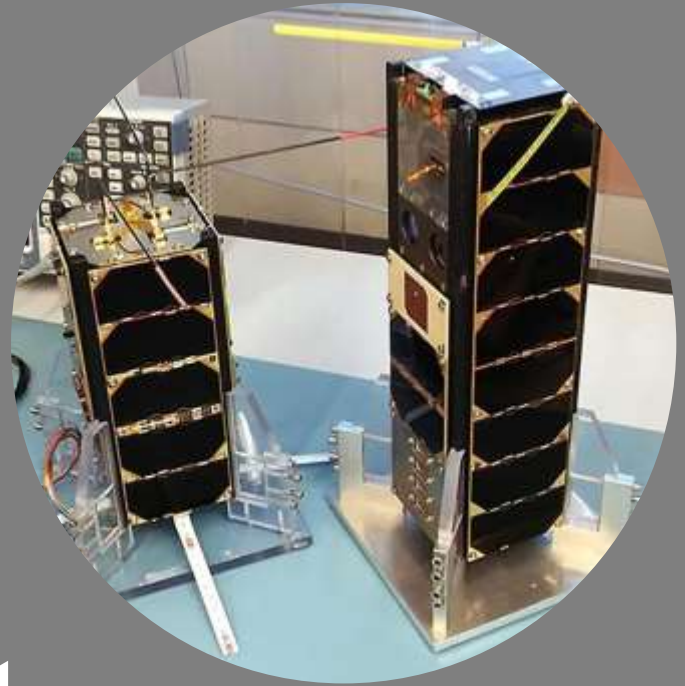
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Foresail technology development



Particle detectors for CubeSat

RADMON

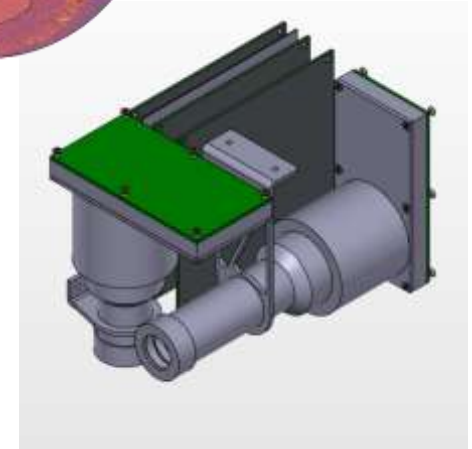
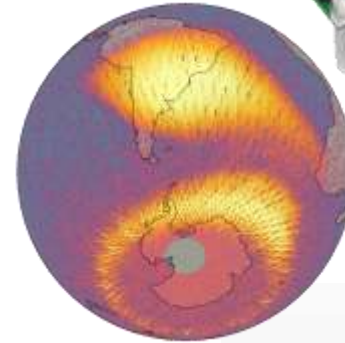
Measuring the flux of >700 keV electrons and >10 MeV protons
Mass: 354 g, power consumption: 1 W

PATE

Two perpendicular particle telescopes
electrons in the range 80–800 keV
ions/ENAs in the range 300–8000 keV
Mass: 1000 g (TBC), power consumption: 1 W (TBC)

REPE

TBD



Coulomb drag deorbiting devices

Plasma Brake (Aalto-1)

Mass: 259 g

Power consumption: 1 – 1.6 W

Tether length: 100 m

Applied voltage: 1000 V



Aalto-1

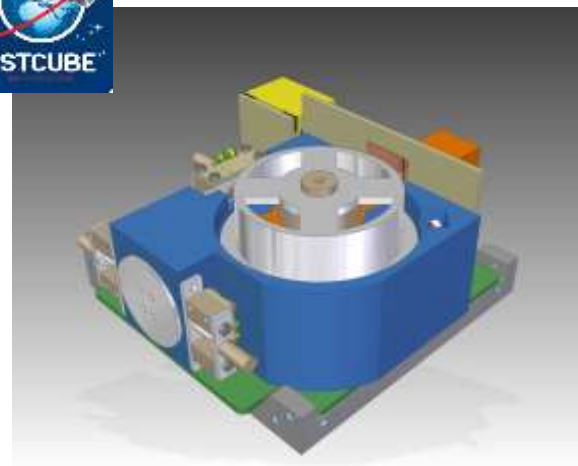
Plasma Brake (Foresail-1)

Mass: 300 g

Power consumption: 1 – 1.6 W

Tether length: 300 m

Applied voltage: 1000 V



Solar Sail

TBD

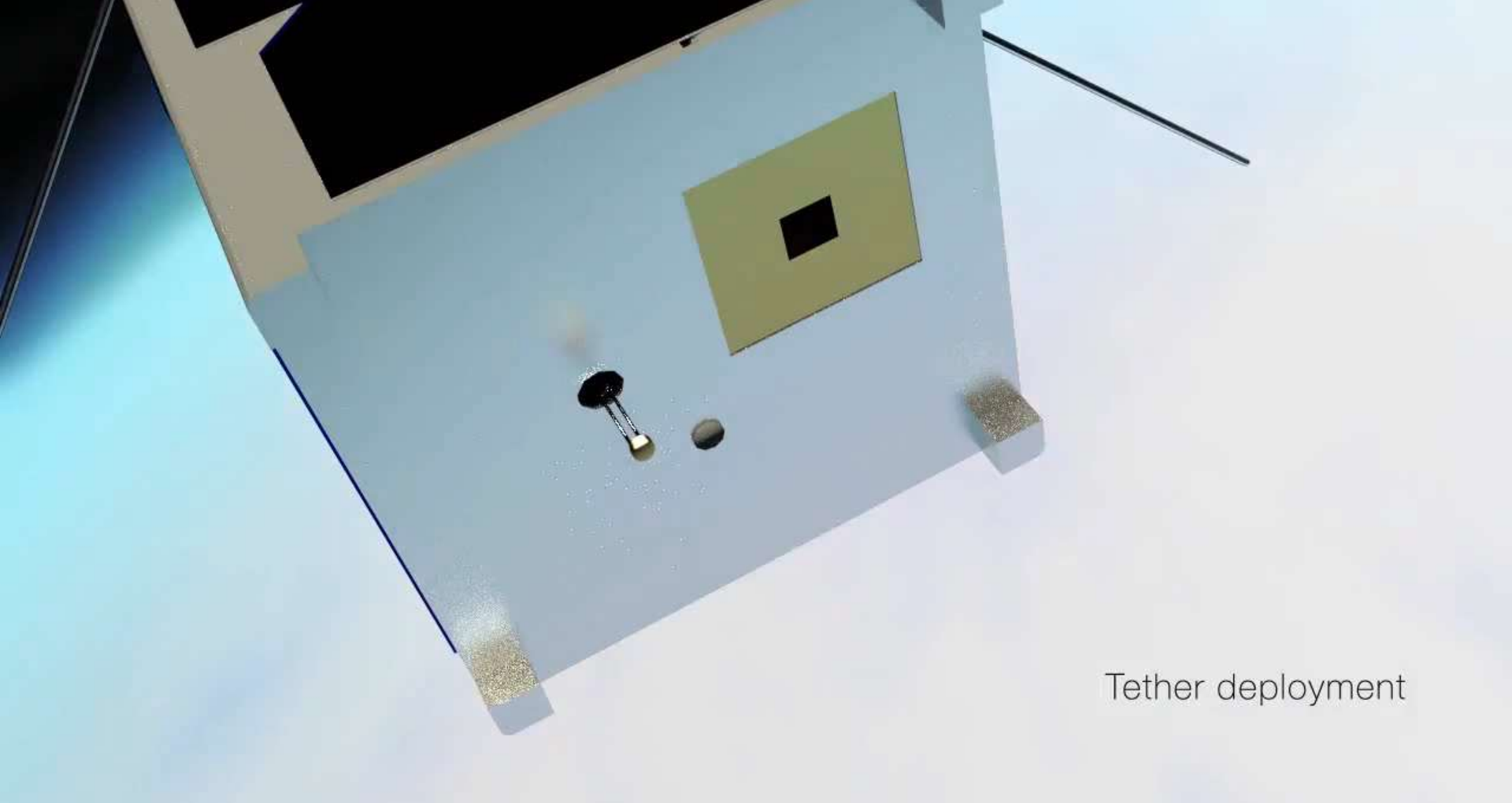


FMI



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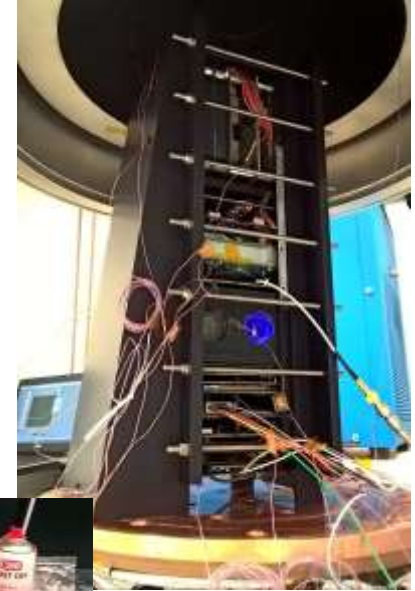
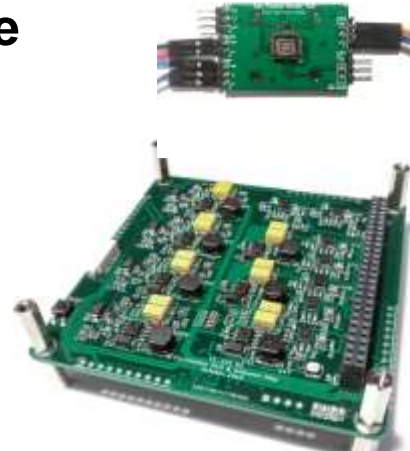
Tether deployment

In-house developed complete Cubesat solutions

Aalto has developed two complete CubeSats and launched three.

Aalto has developed all avionics subsystems in-house.

Currently three more CubeSats are under development.







CubeSat platform for GTO

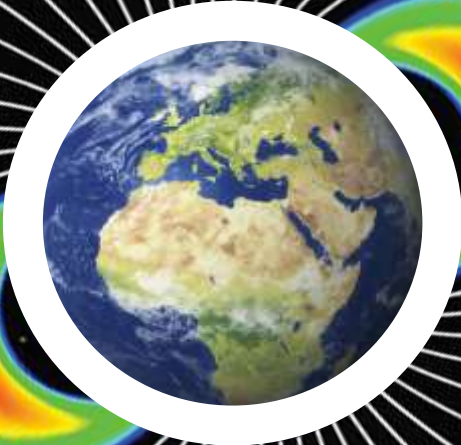
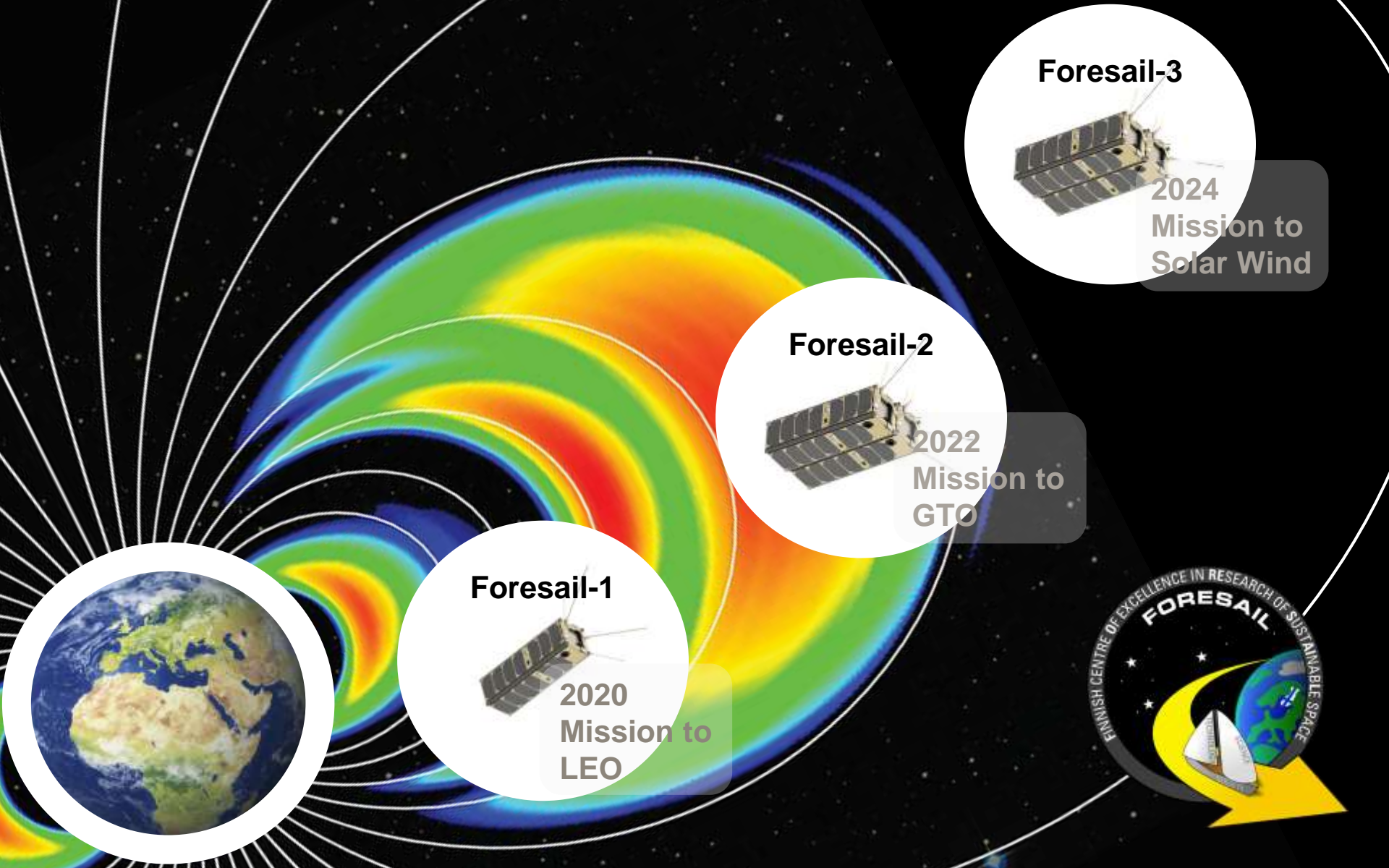
- Radiation tolerant avionics
- Radiation tolerant software
- Modular shielding structure
- **CubeSat attitude solution for GTO**
 - (developed in collaboration with Aurora Propulsion)






Aalto-yliopisto

Foresail missions



Foresail-1



2020
Mission to
LEO

Foresail-2

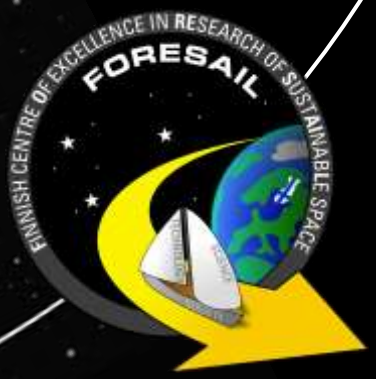


2022
Mission to
GTO

Foresail-3

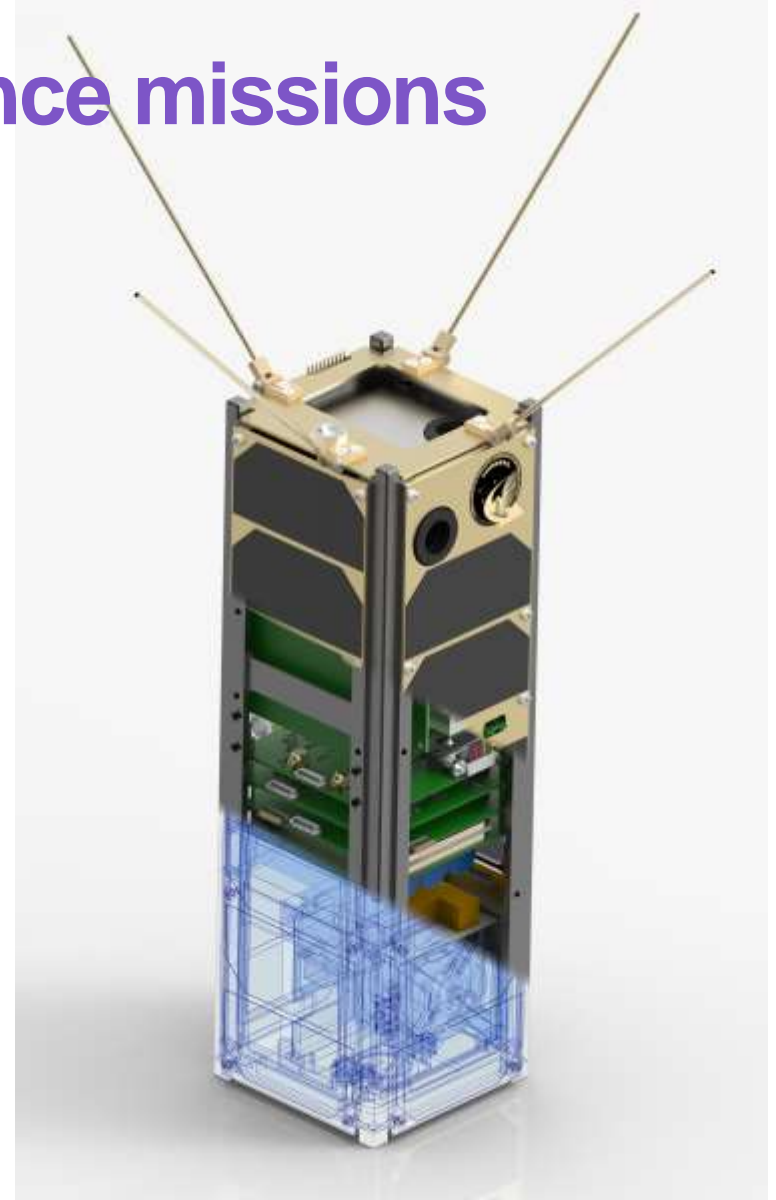


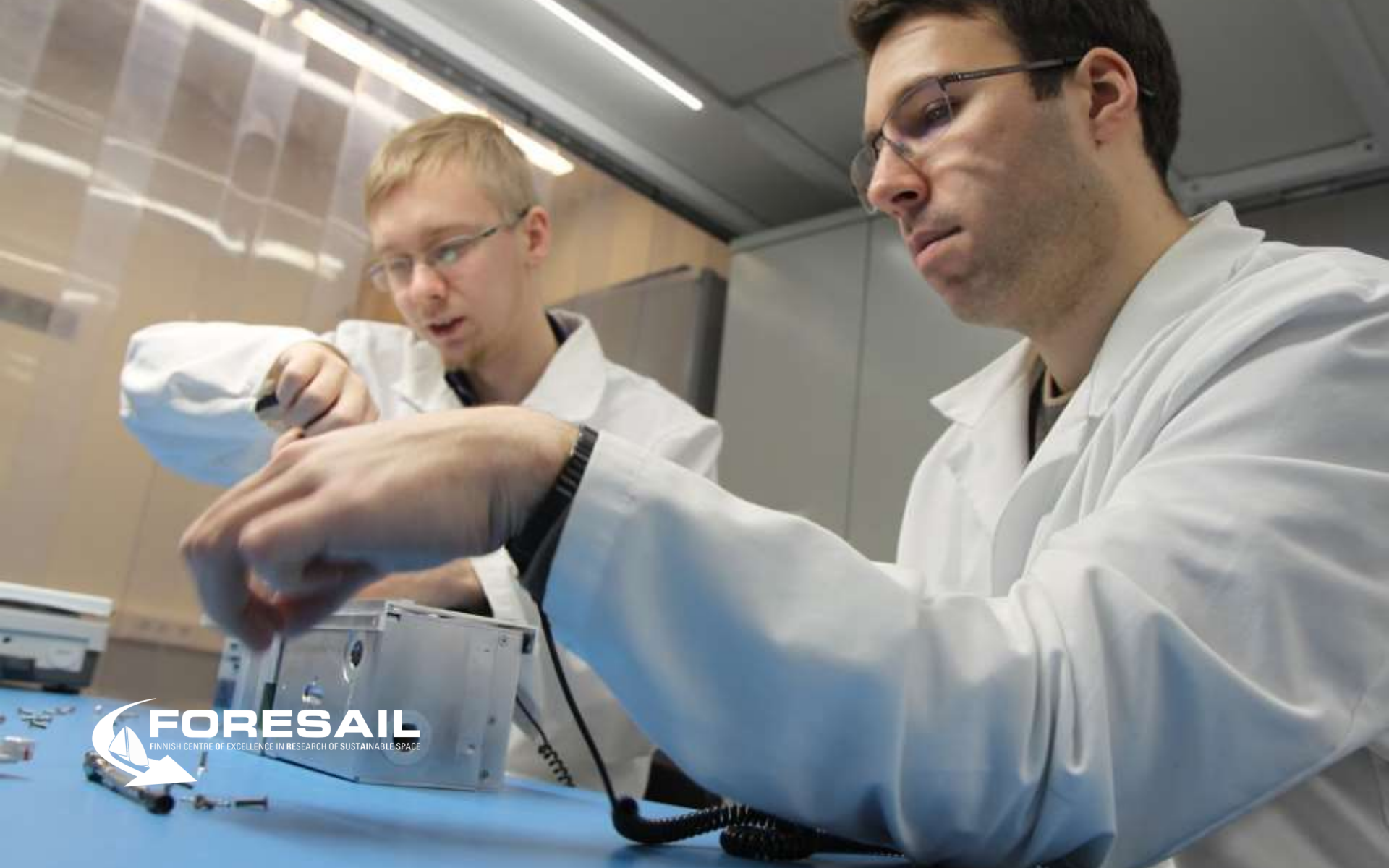
2024
Mission to
Solar Wind



Reliable platform for science missions

Operate in Space for 5 years
Radiation tolerant electronics
Radiation tolerant software
Deorbit the satellite





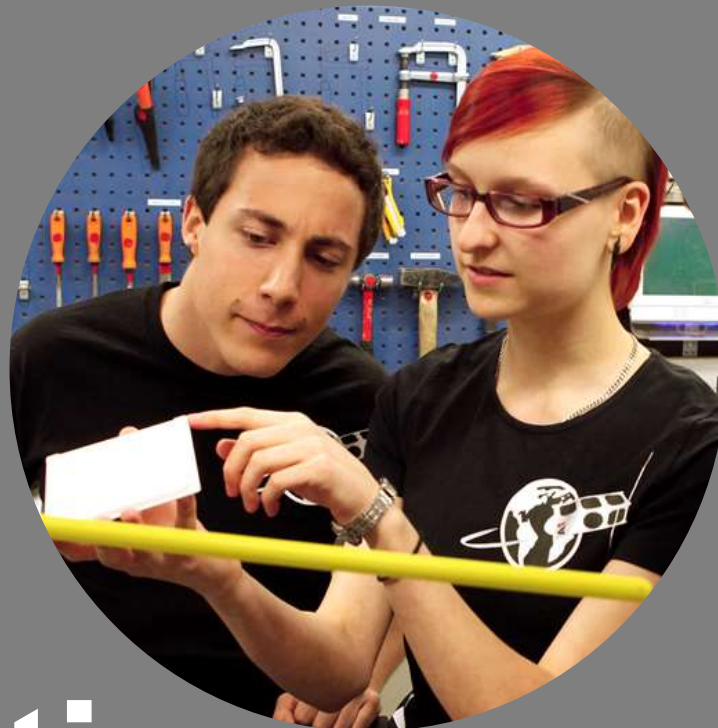


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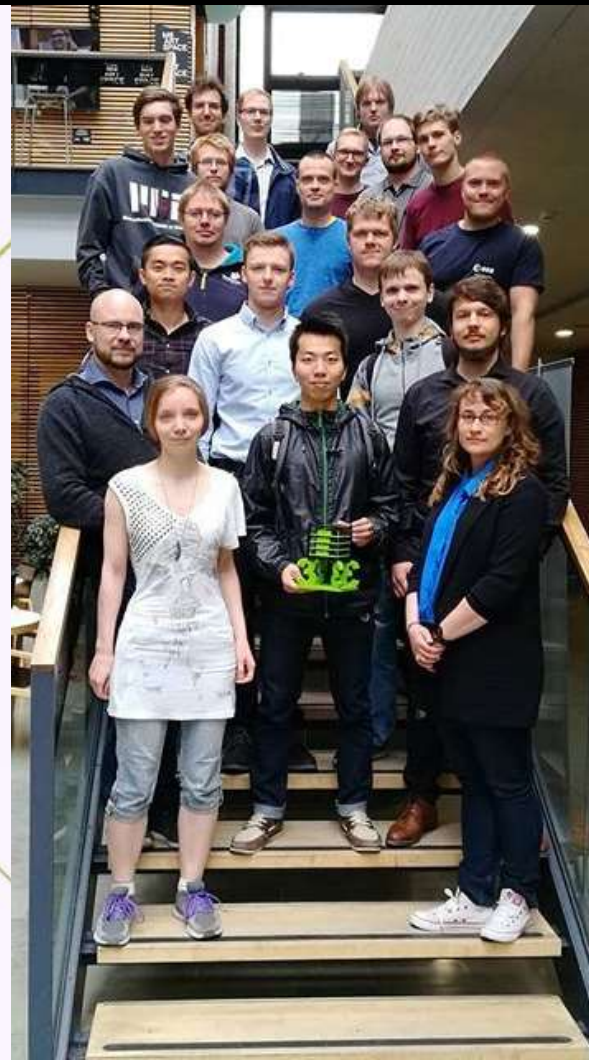
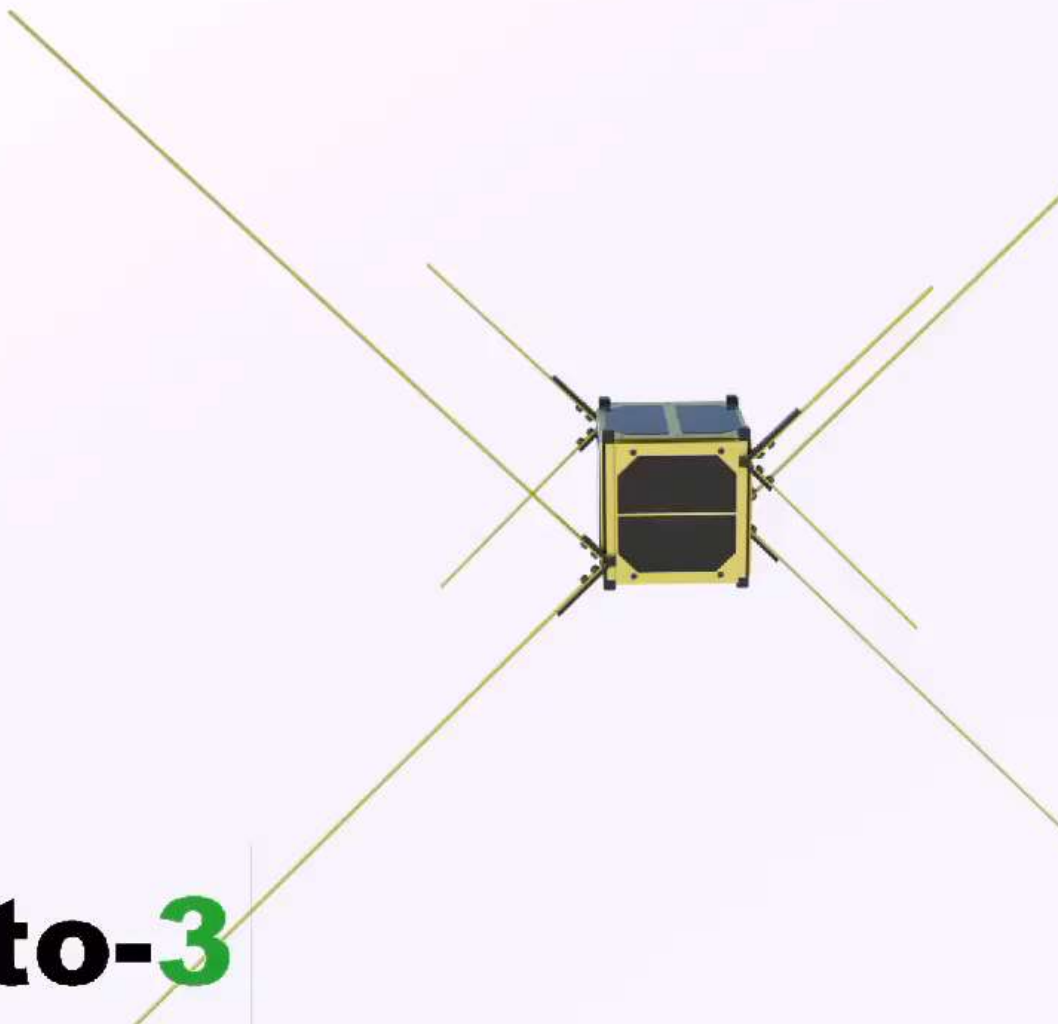
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Educating next generation

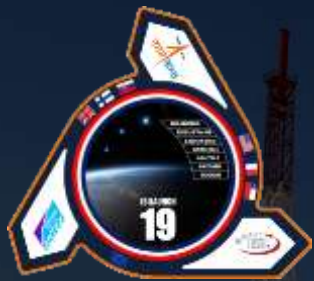


Aalto-3





Made in Aalto University



NOKIA



Turun yliopisto
University of Turku

Together
ahead. **RUAG**



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New Space Players



Reaktor
Space Lab

AURORA
PROPULSION TECHNOLOGIES

Kitsat

ICEYE



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Supporting community

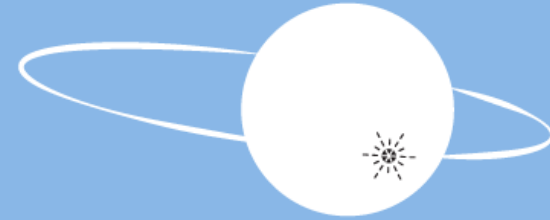
Aalto University, Foresail and Business Finland are the organizers of the biggest New Space event in Scandinavia



BUSINESS
FINLAND

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Finnish Satellite Workshop 2019

www.spaceworkshop.fi



ICEYE

Reaktor
Space Lab RSL



Together
ahead. RUAG

EXO
LAUNCH

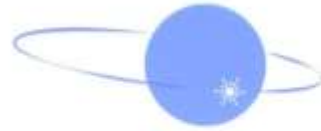
VTT





Viktorija Paulokaitė

AI BUSINESS FINLAND FORESAIL



Finnish Satellite Workshop 2019



Viktorija Paulokaitė



Viktorija Paulokaitė



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Building Finnish Space Infrastructure



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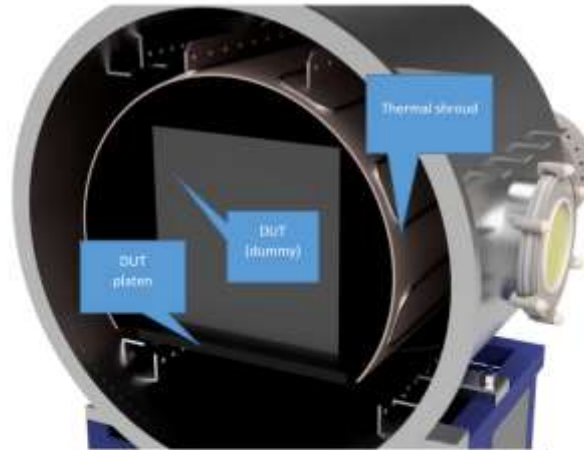


Figure 3 - Turbo equipped system - chamber door removed for visual presentation



Figure 4 - Turbo equipped system - utility forger (front)





Let's work together for more sustainable future in space!