



STUDENT'S SPACE ACTIVITIES AT THE WARSAW UNIVERSITY OF TECHNOLOGY AND STUDENT'S SATELLITE "PW-SAT2"

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**Faculty of Power and
Aeronautical Engineering**

WARSAW UNIVERSITY OF TECHNOLOGY

**Politechnika
Warszawska**

Students' Space Association past activities

- Hands-on projects:
 - ESA education projects
 - Parabolic Flight Campaign (1994, 1995, 2002, 2003, 2004)
 - Rexus/Bexus (23 November 2010)
 - SCOPE (2011)
 - Satellite projects
 - SSETI Express (27 October 2005)
 - YES2 (14 September 2007)
 - ESEO
 - ESMO
 - PW-Sat (launched on 13 February 2012)
 - Rovers: Husar, Skarabeusz, Ares, ROV
 - and many more...



Visits, conferences



Participation at Cospar 2000



COPUOS meeting



ILA 2000



Le Bourget



COPUOS meeting 2019



Visits at optical observatory at Toruń, Poland

- Founded in 1996 – 23rd anniversary this year
- Largest space-related student scientific organization in Poland – more than 100 members
- Supervisor: dr hab. inż. Jan Kindracki
- 4 large sections with many projects



Balloon section



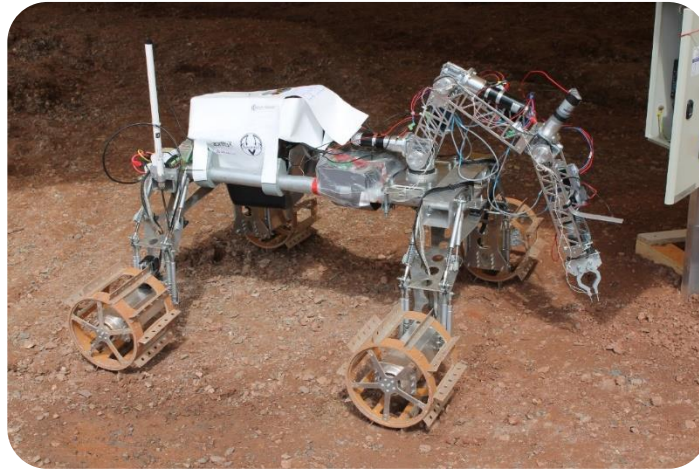
- Stratospheric balloons missions since 2013
- 5 major missions: Światowid 1, Światowid 2, Światowid 3, PW-Launcher 1, Televisor
- 3 projects: **PARTICULA** (micrometeorites collector), **CAPELLA** (extremely large antenna), **BULMA** (micro lifeform&meteorite assembler, accepted for REXUS/BEXUS 2016)



SKA Robotics



- Founded in 2015, devoted to rovers and robots
- Takes part in URC, ERC (rover competitions)
- Beneficiary of EU programme (Najlepsi z najlepszych) with *Ares II & III* rovers and *Triton* underwater robot



Rocketry section



- Two families of rockets: A and H
- Educational rocket and CanSat launcher
- Successful launches and ambitious plans



H1 ROCKET

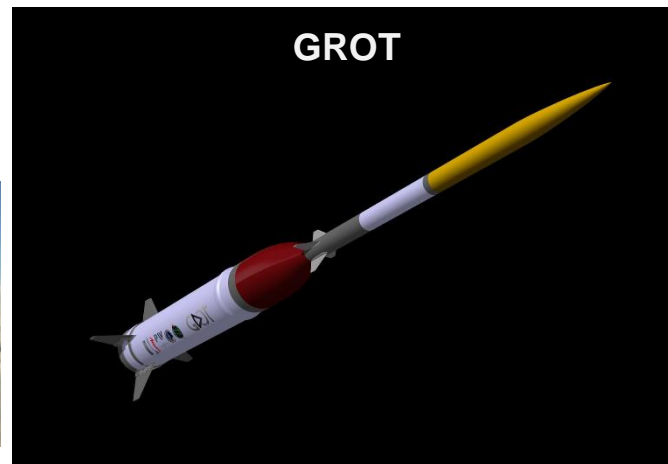
- First Flight– 2013
- Altitude 6700m
- Velocity - Mach 2,7



FOK



GROT



TUCAN





 PW-SAT2

2013

beginning

3/12/2017

launched into
orbit

38

members

~100

people involved
since beginning

11

teams

9

WUT faculties

12/19

intermediate and
diploma theses

>15

internships

>24

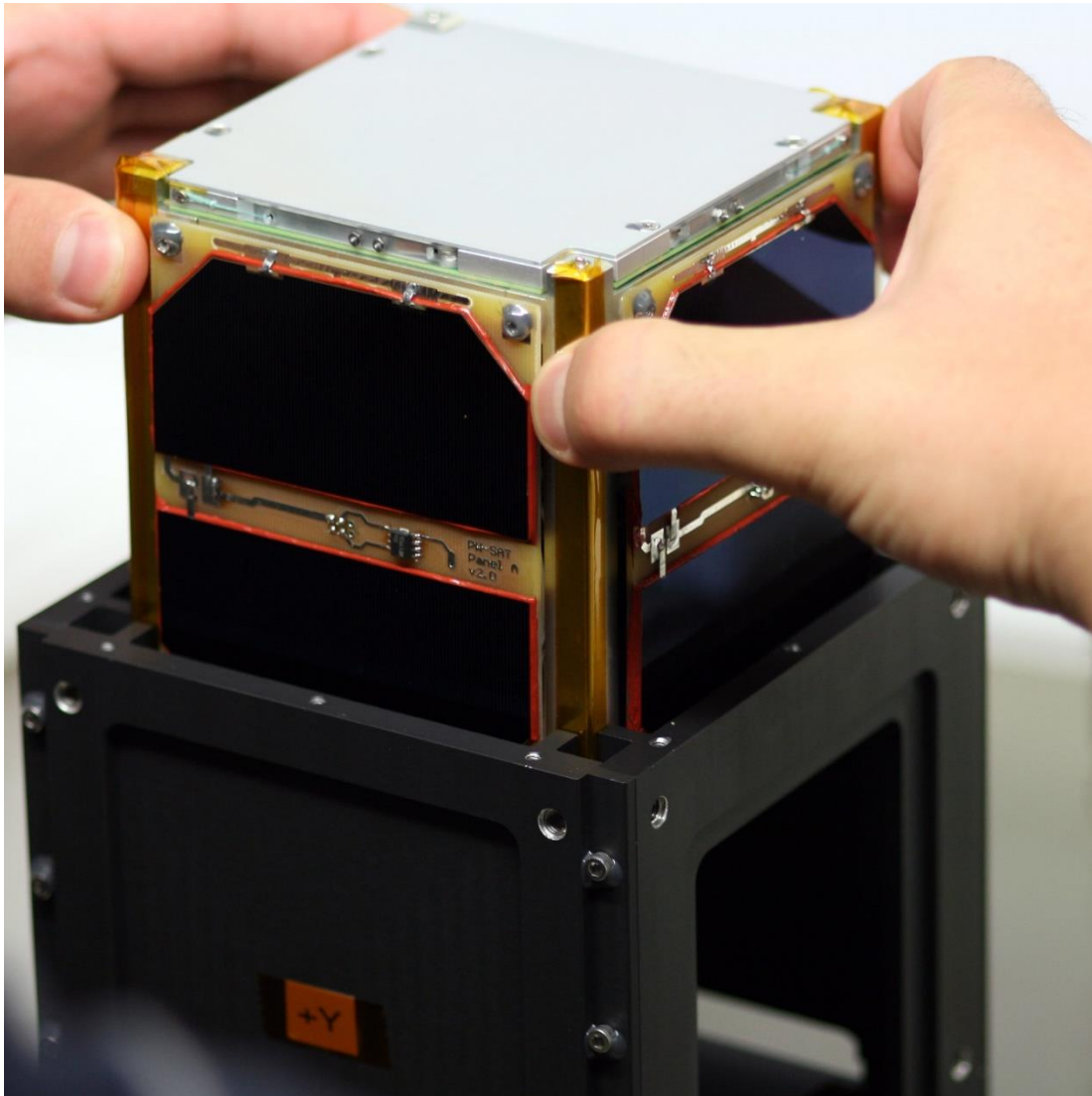
people working in
space industry

>1200

pages of
documentation

8

teams consulting
with experts



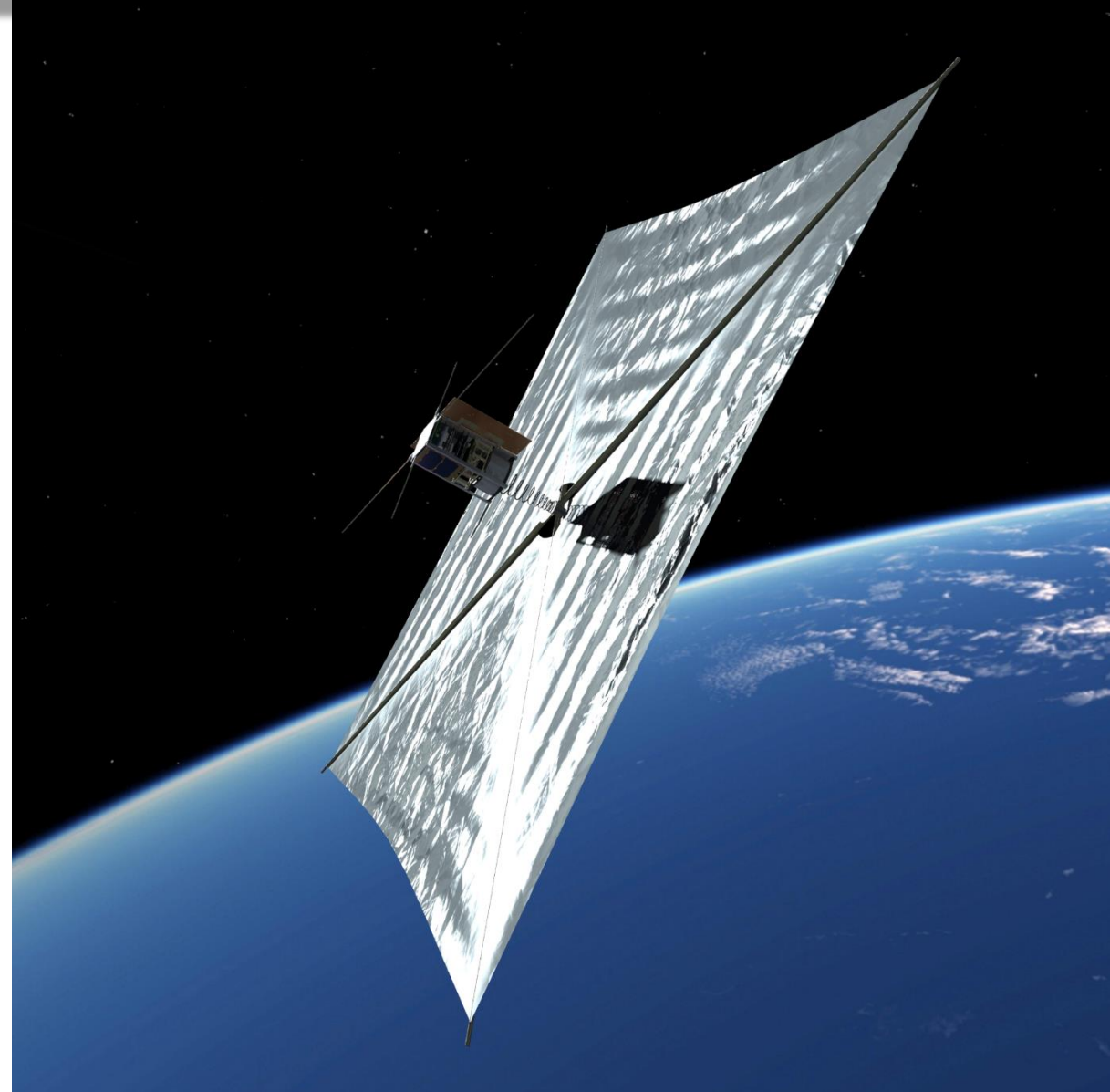
Credit. Andrzej Kotarba

- Launch - 13 Feb 2012 on Vega
- Deorbited on 26 Oct 2014
- Valuable experience that was used during development of PW-Sat2

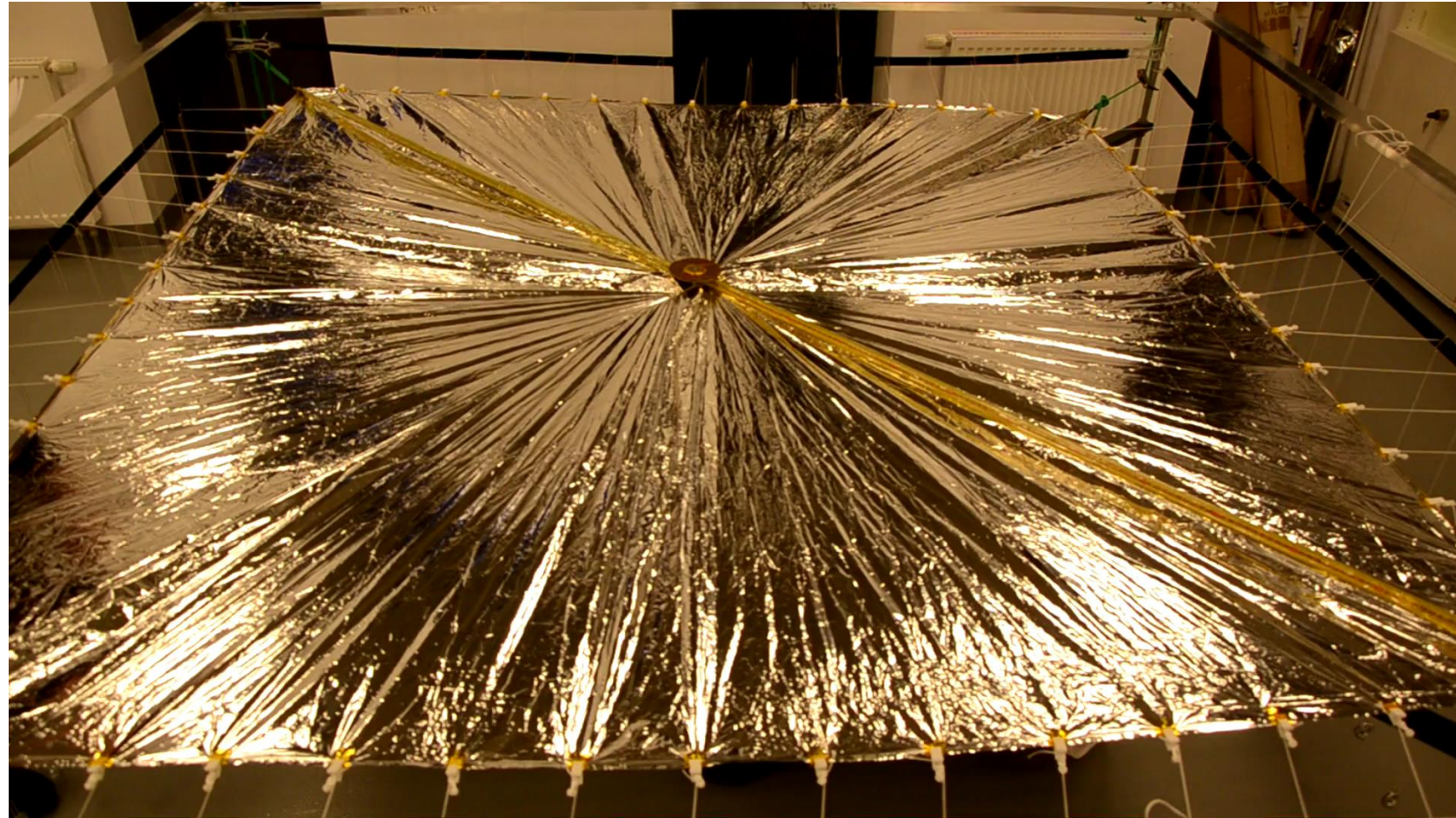
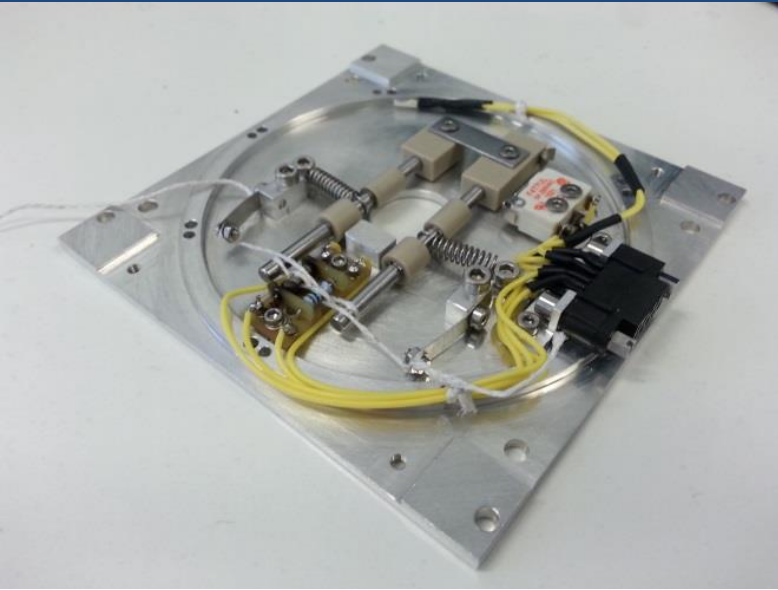
- **Deorbit sail** of 4m² area



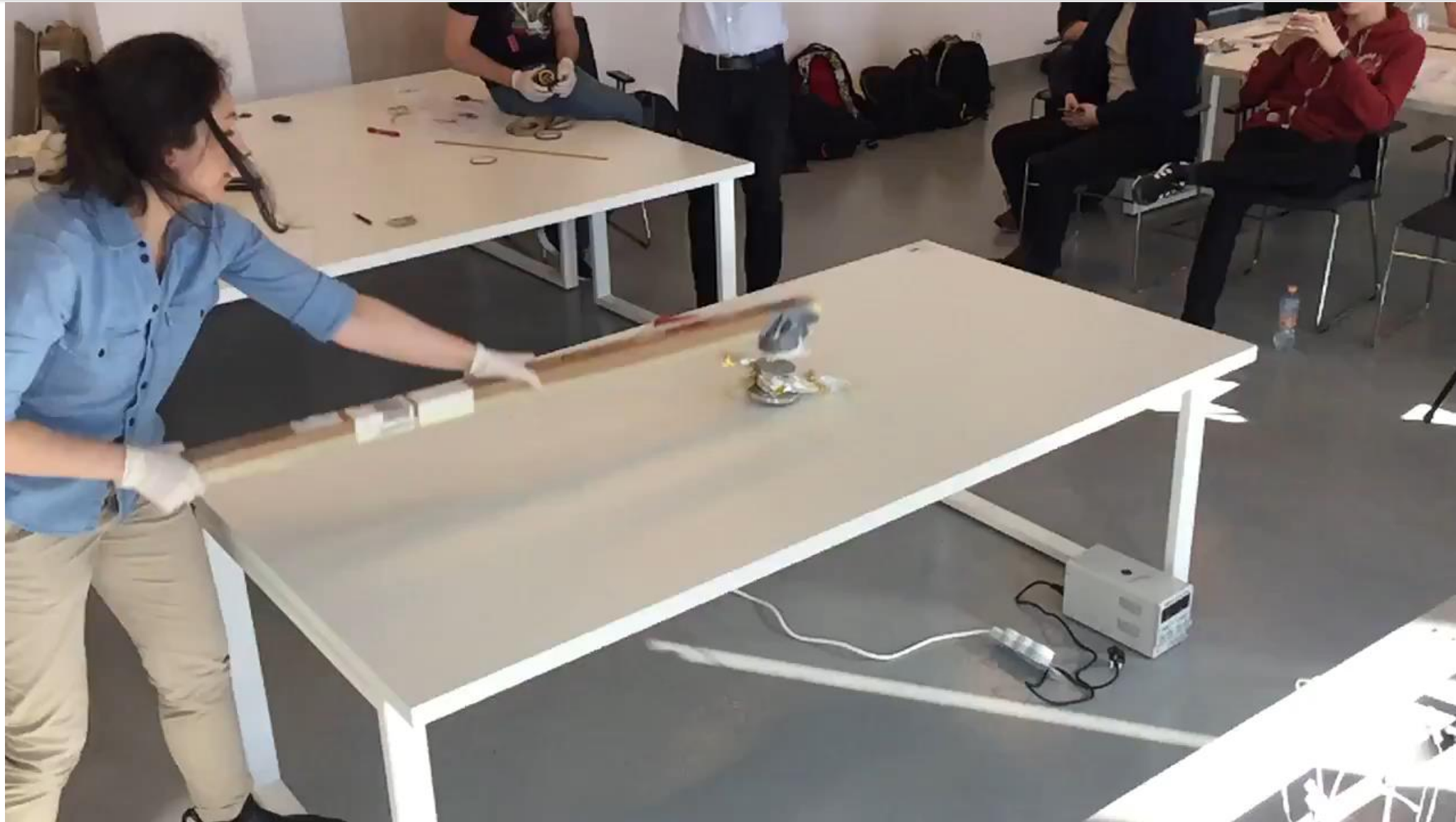
- 2nd place in the international competition
- Fully automated deorbit system



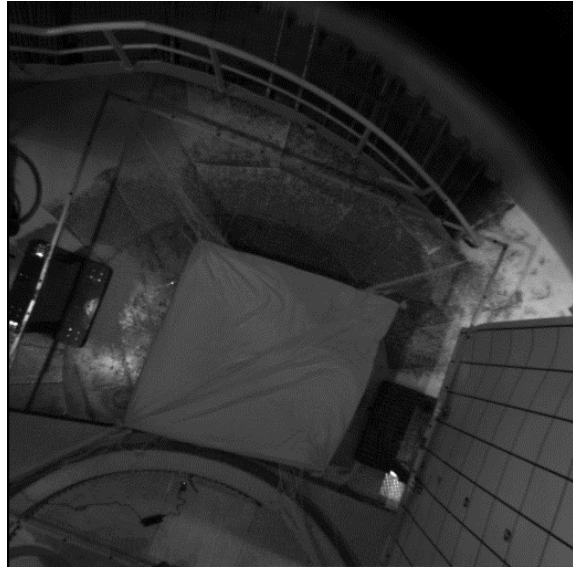
Sail folding



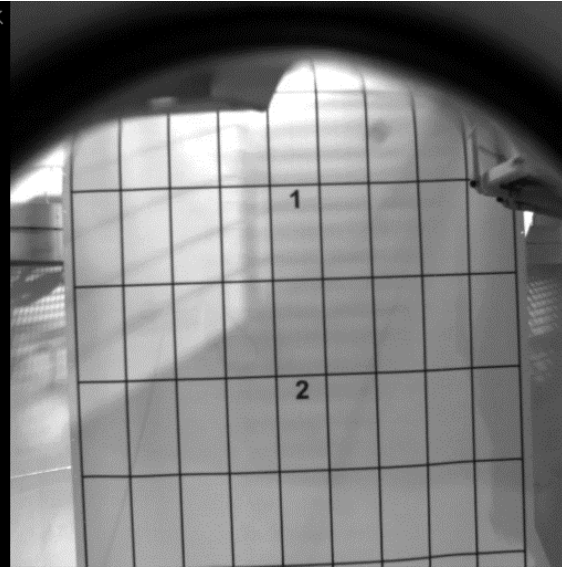
Sail test campaign



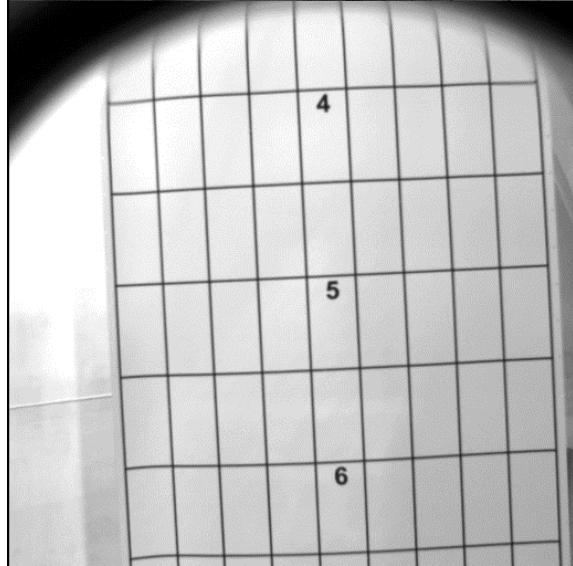
Test campaign at Drop Tower ZARM Bremen



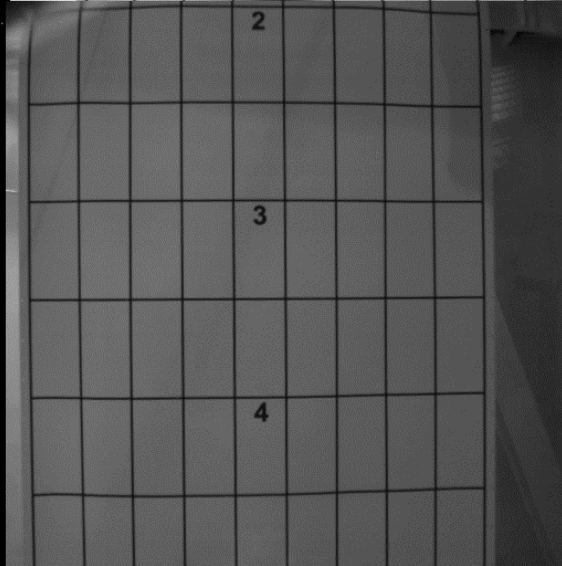
FASTCAM MC2-10K
250 fps
1/250 sec
512 x 512
Start
frame : 1570
+00:00:06.280
Date : 2017/11/30
Time : 11:29



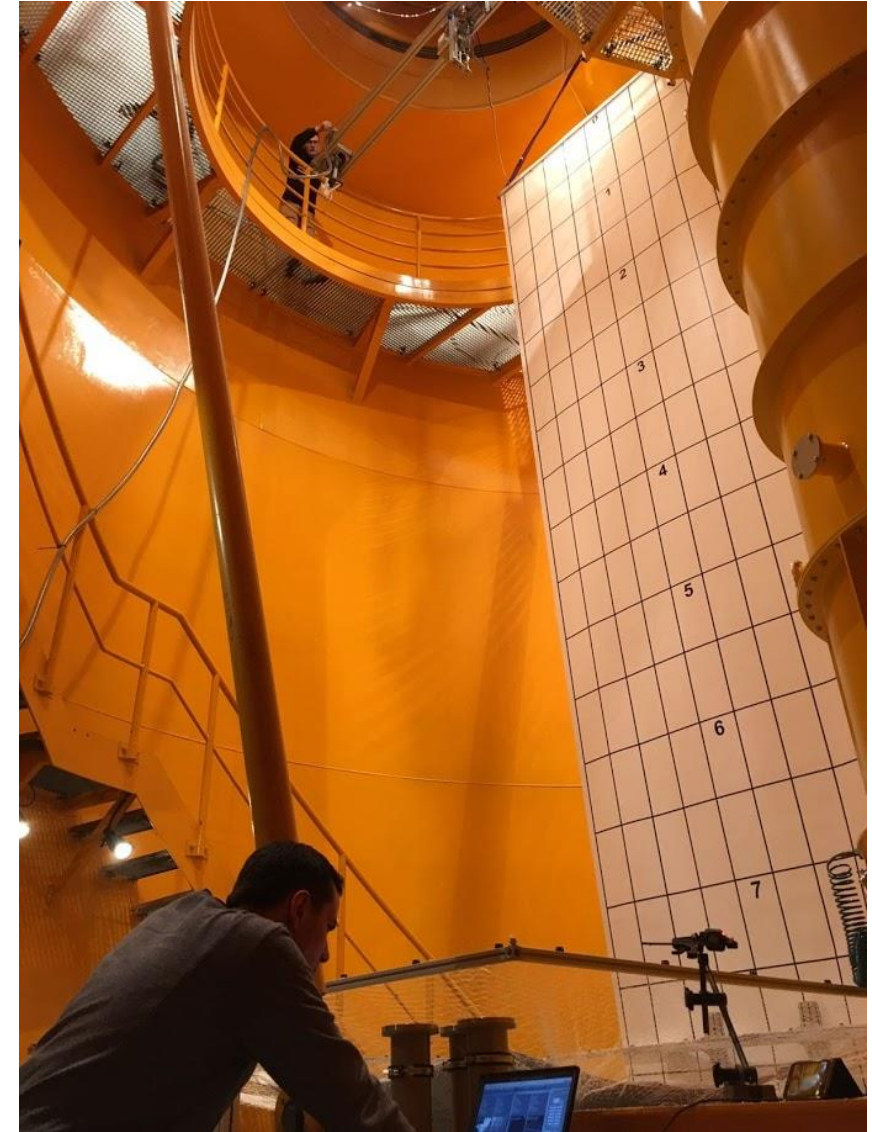
FASTCAM MC2.1-1...
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1/250 sec
512 x 512
Start
frame : 1570
+00:00:06.280
Date : 2017/11/30
Time : 11:29



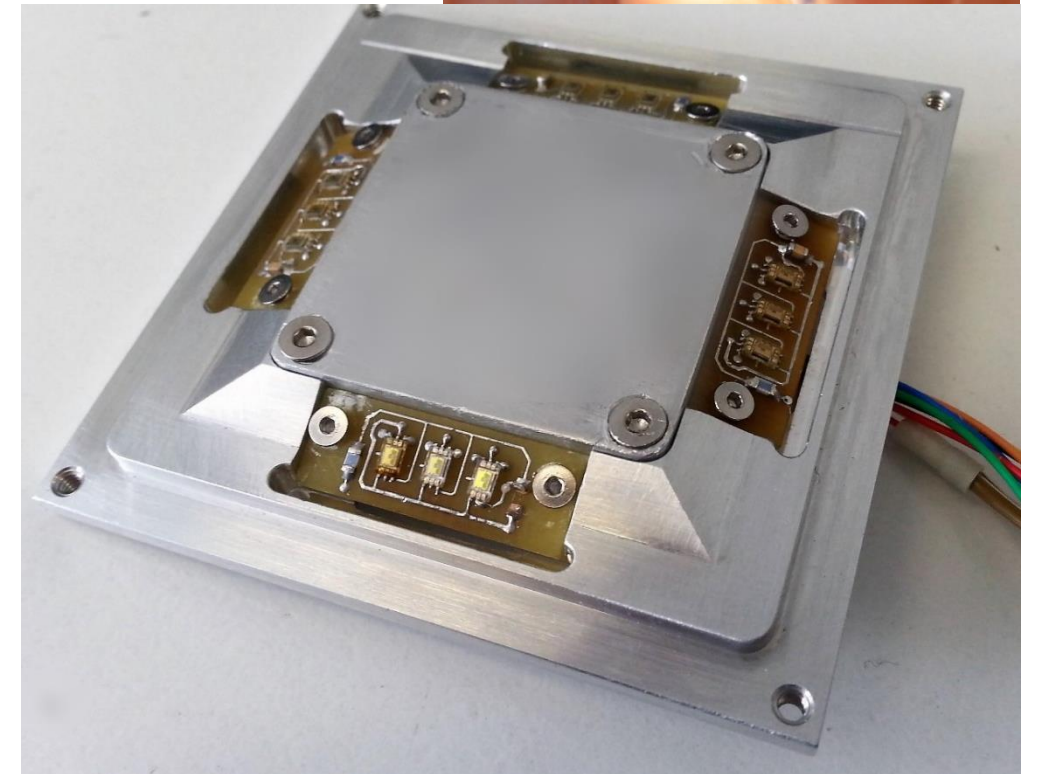
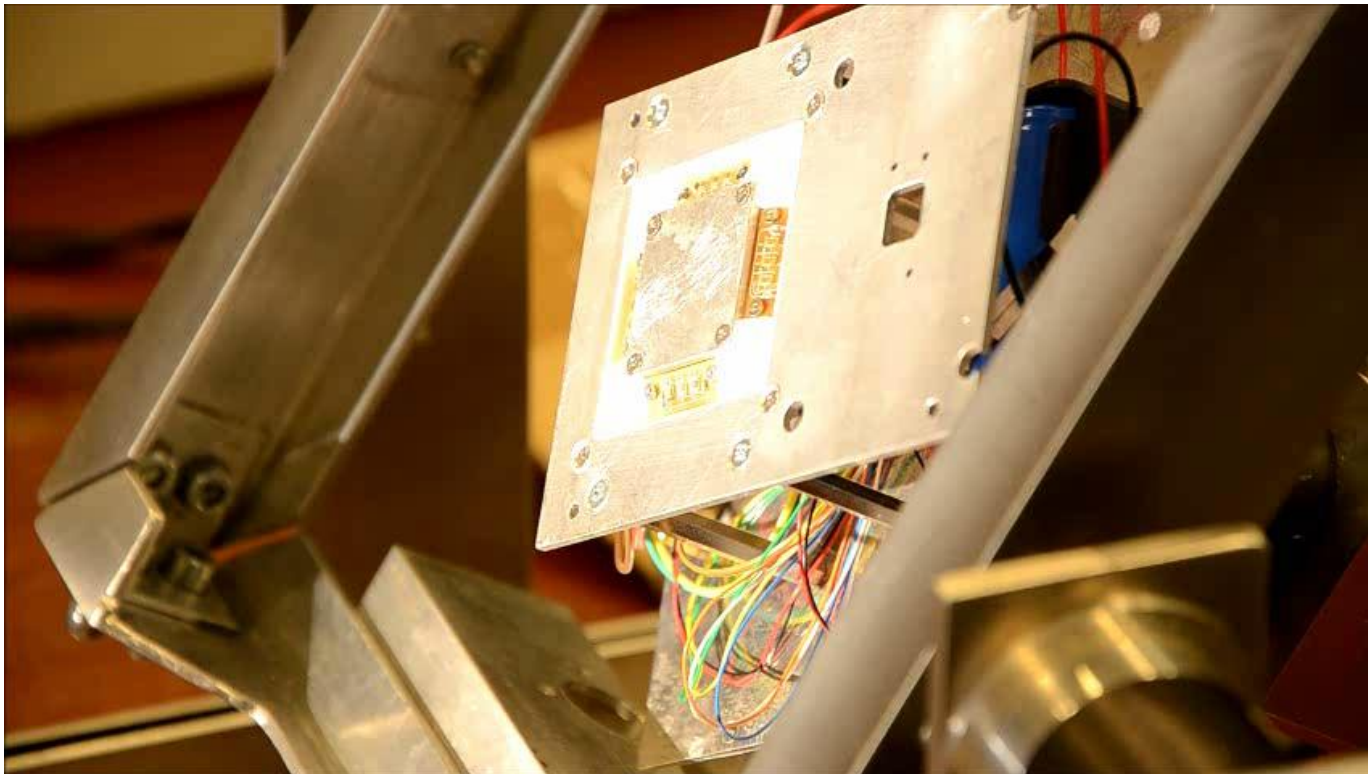
FASTCAM MC2.1-1...
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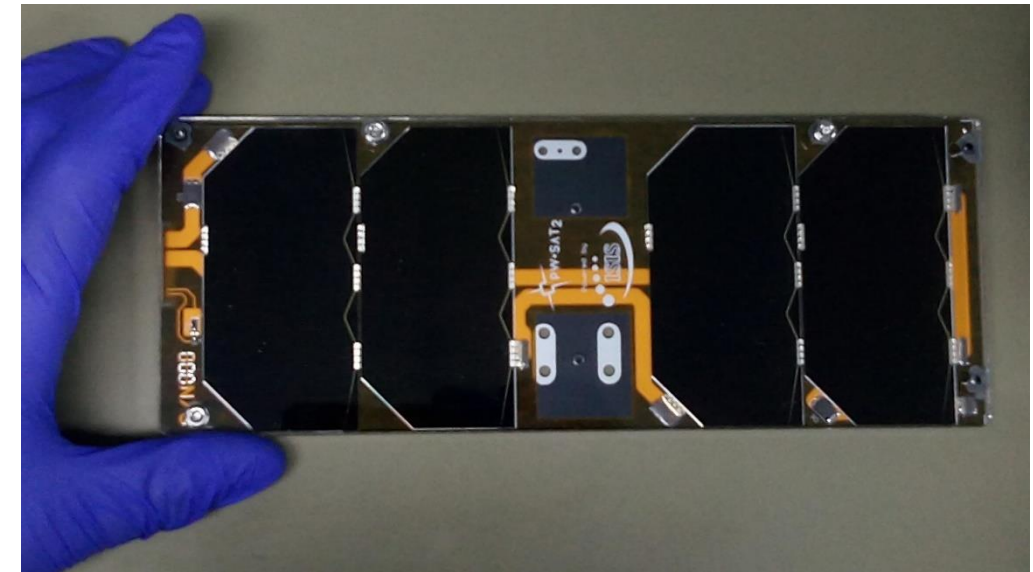
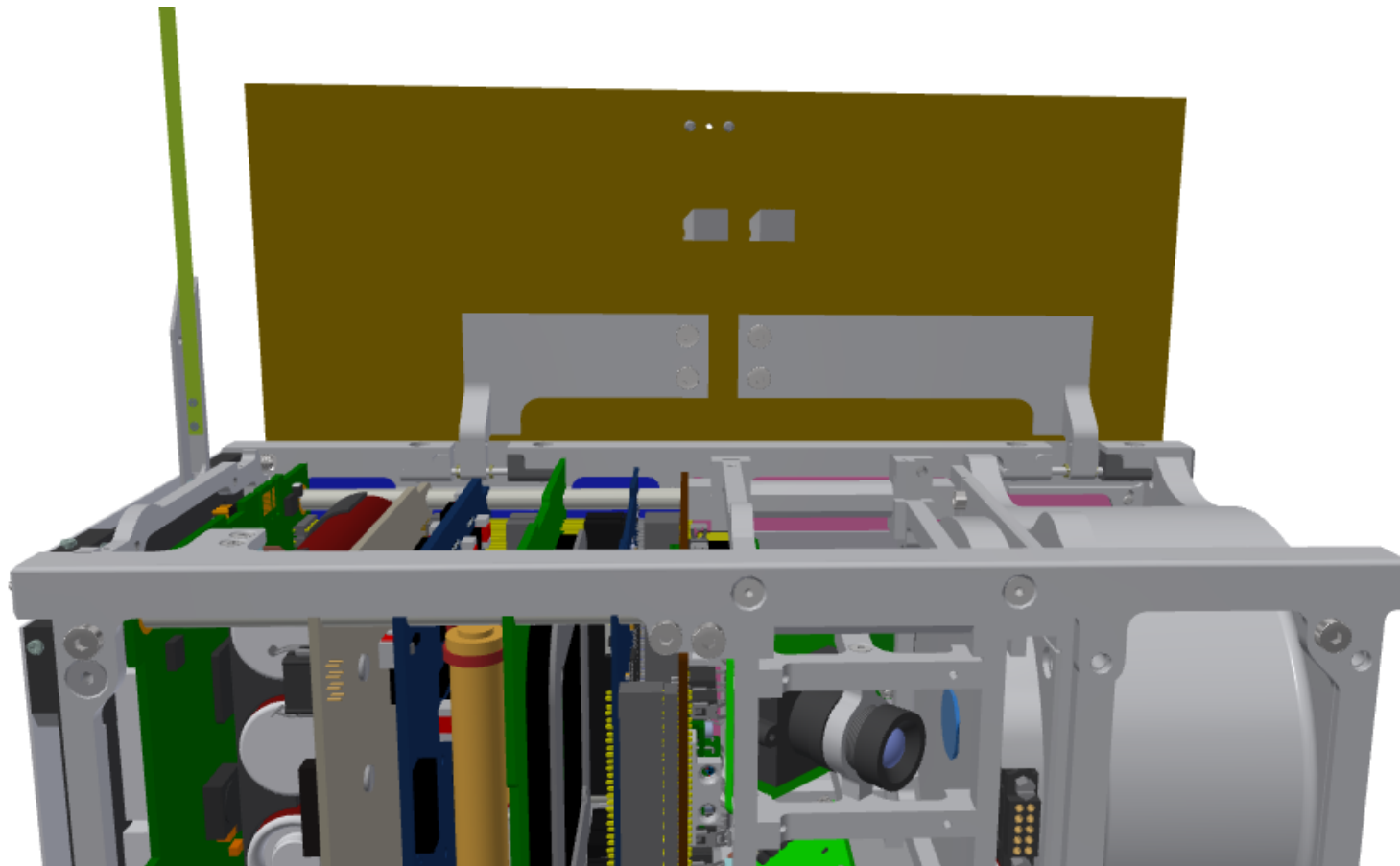
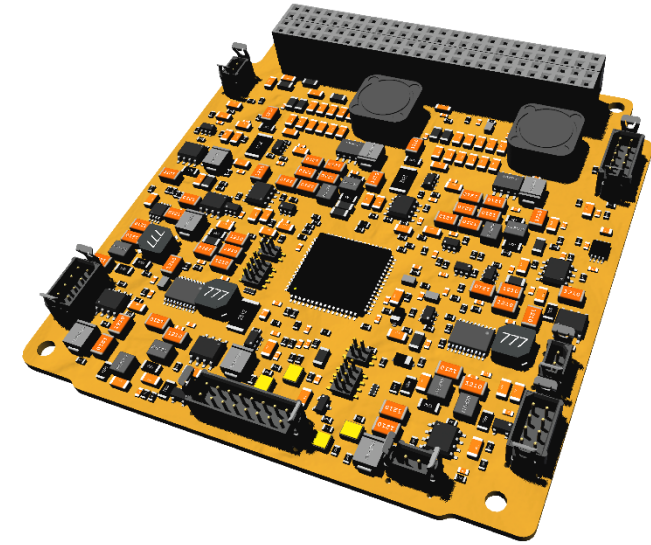


- Sun Sensor (SunS) with accuracy of 1°
 - Custom design
 - Readouts to be compared with a commercial sensor



Additional payloads

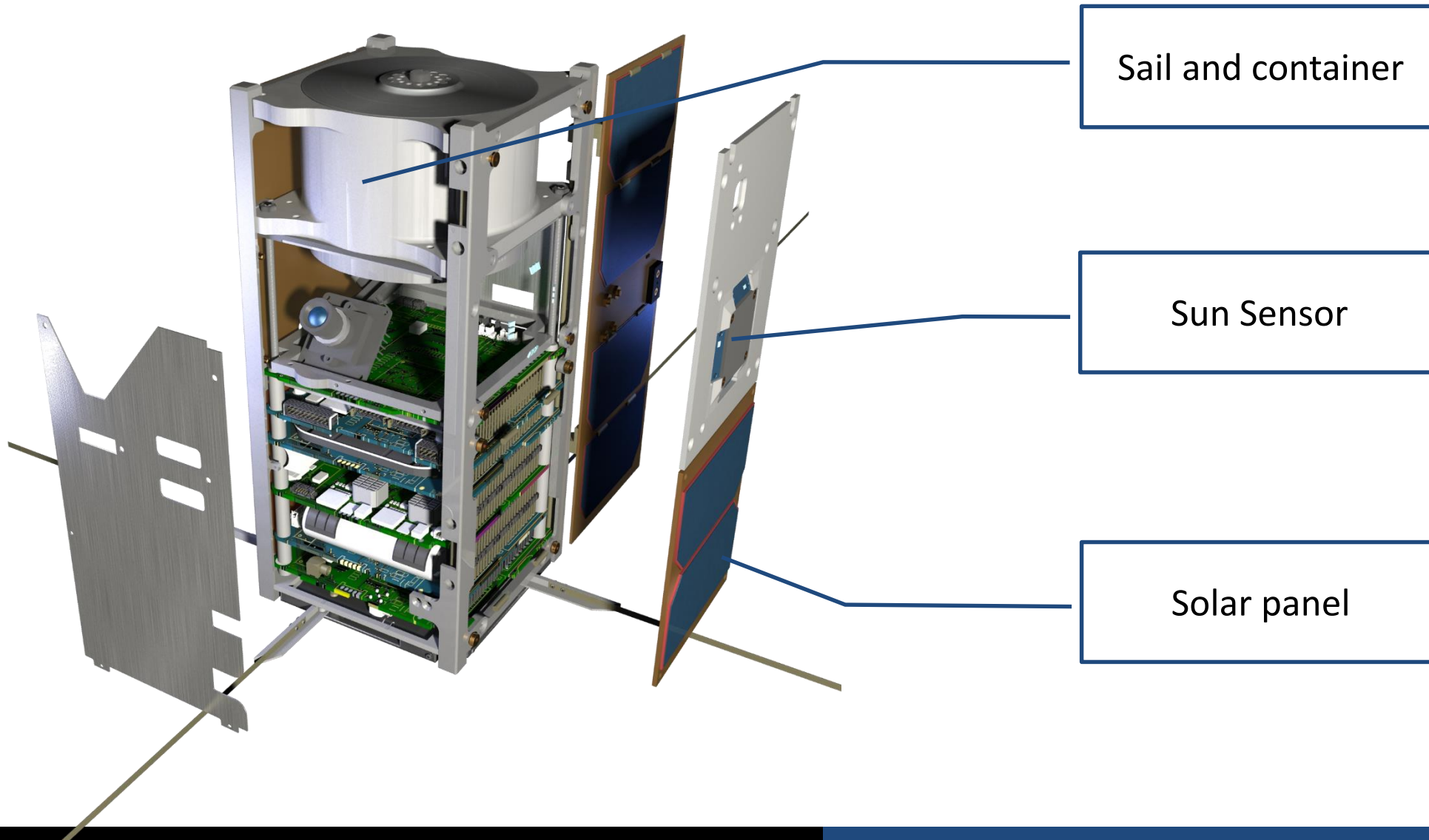
- Deployable solar arrays with custom hinges
- EPS – custom electric power system



Secondary payload PW-Sata2



PW-Sat2 Subsystems

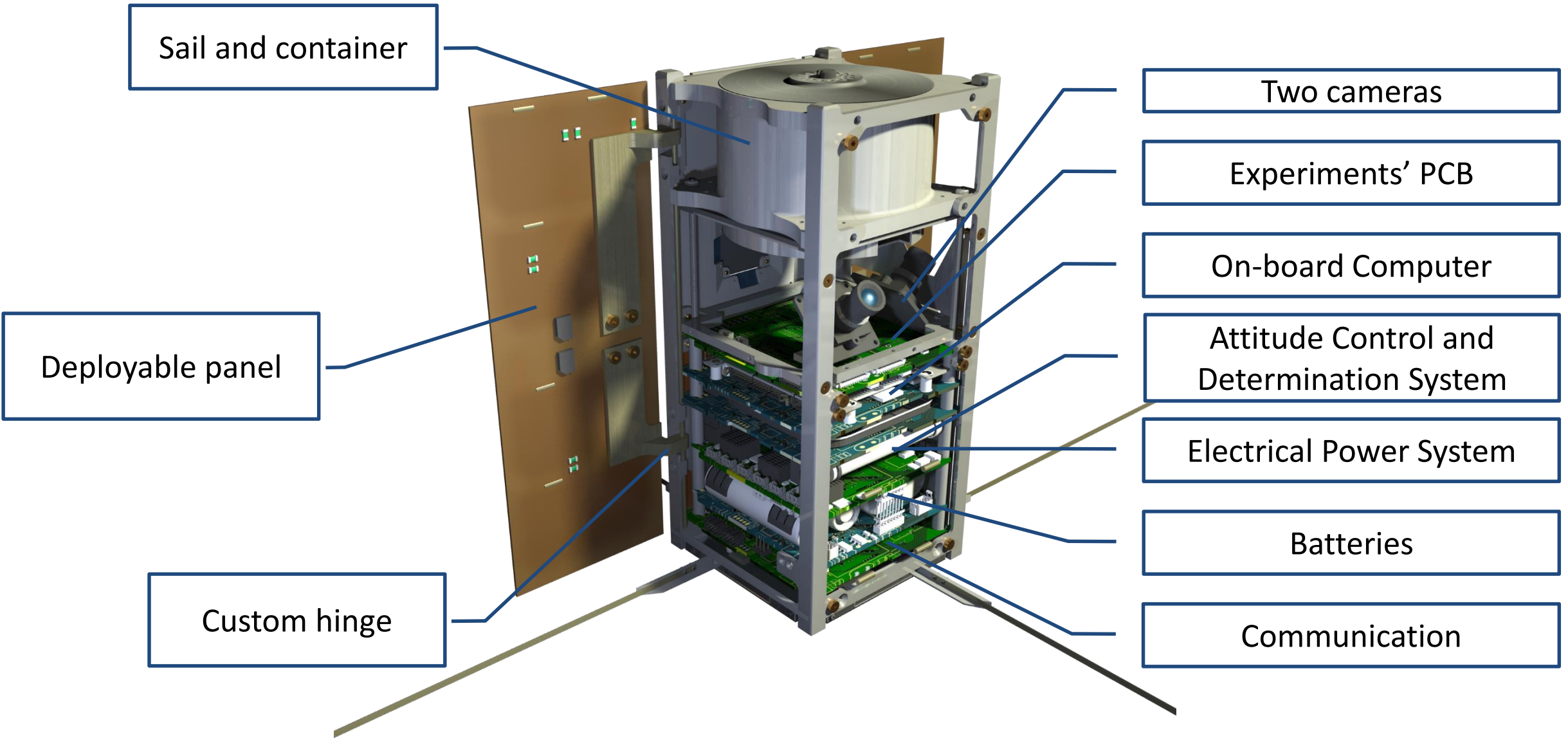


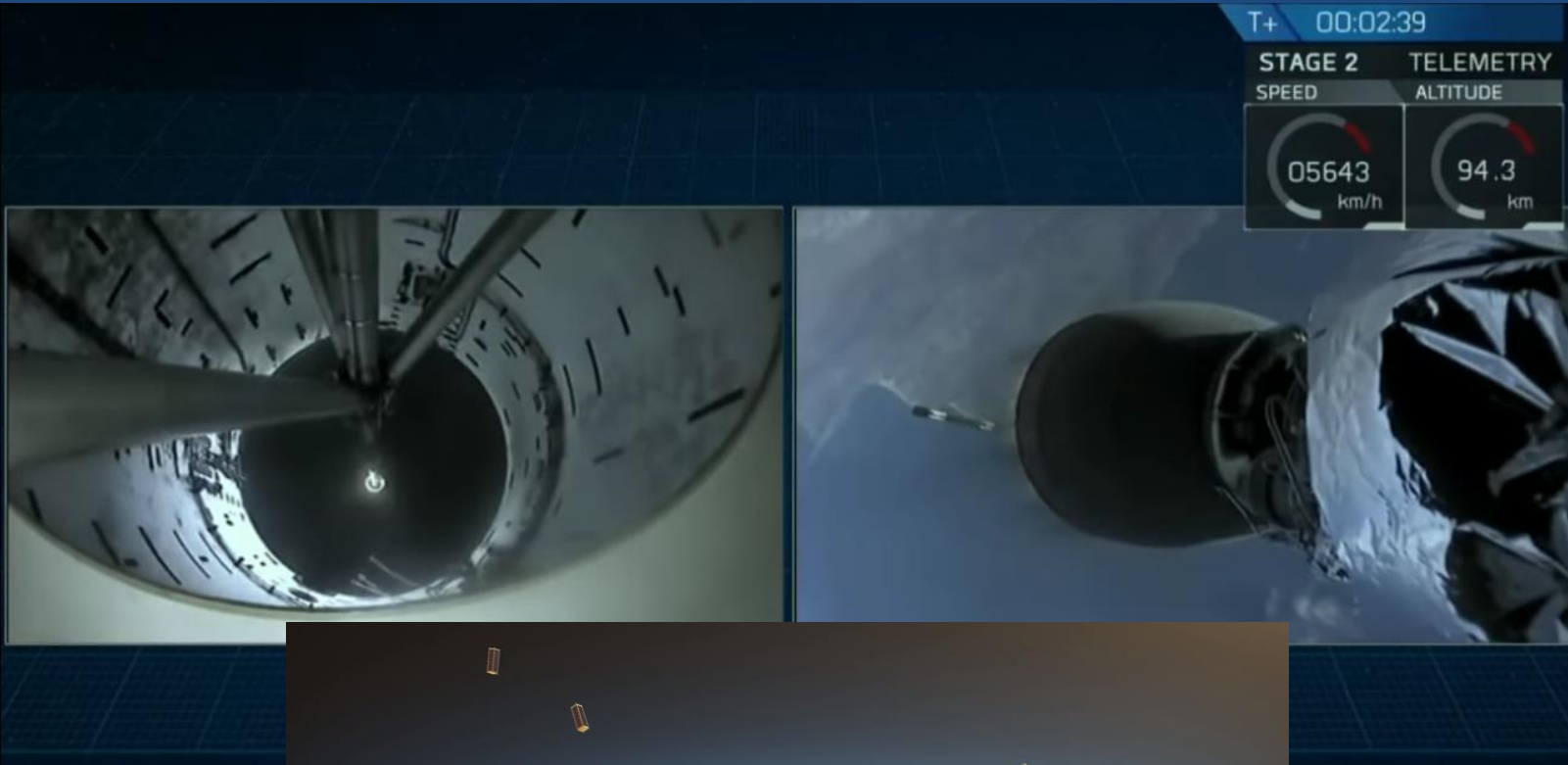
Sail and container

Sun Sensor

Solar panel

PW-Sat2 Subsystems

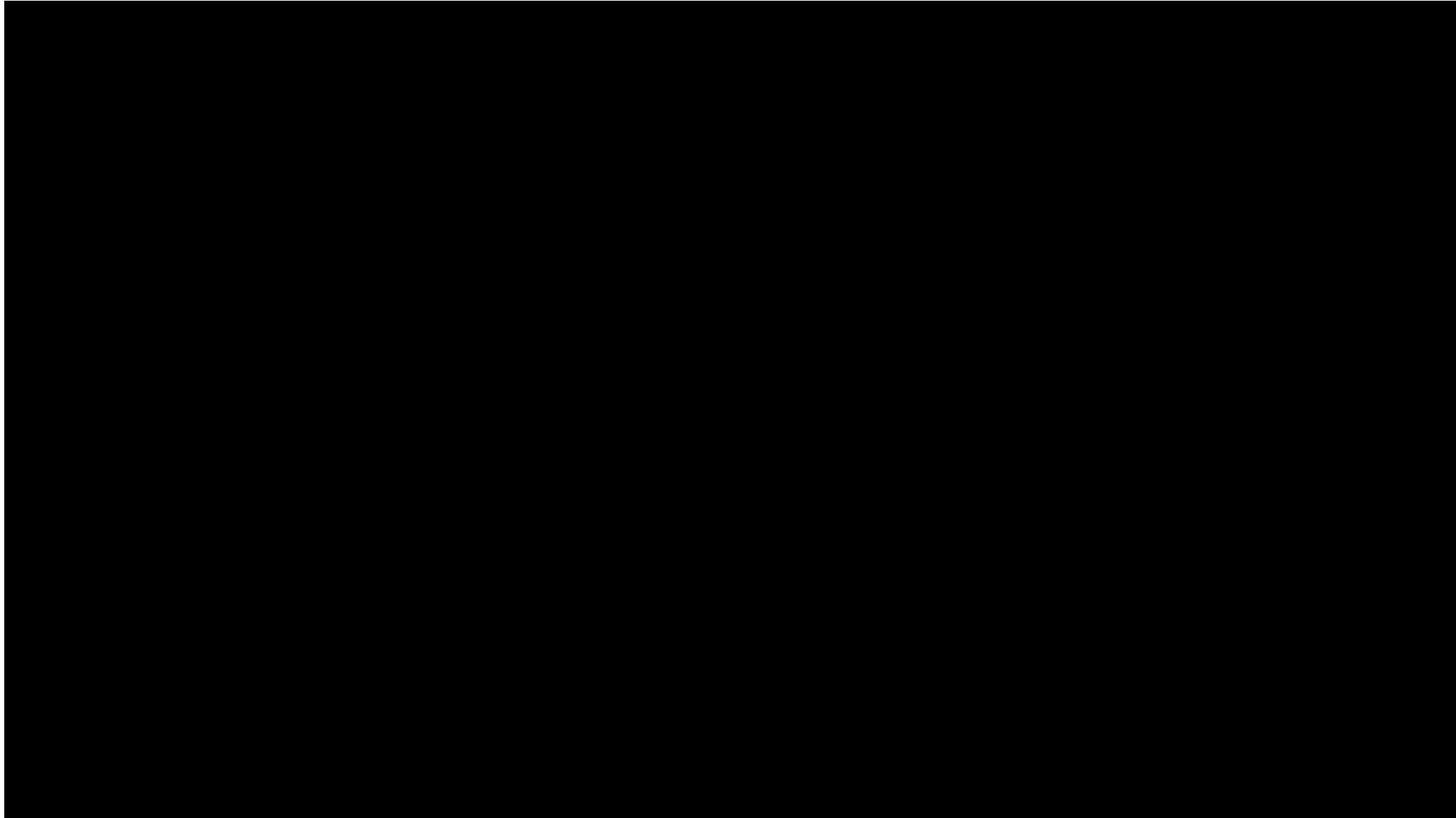




Falcon 9, SpaceX Vandenberg Air Force Base



Mission Animation












Primary Ground Station
Faculty of Electronics and Information Technology
Warsaw University of Technology
Warsaw, Poland

Secondary Ground Station
Future Processing
Gliwice, Poland













Dashboard

Charts

Detailed Telemetry

HAM Radio

On-board Cam

SOFTWAREMILL

Sign In

Welcome to **PW-Sat2 Ground Station!**

This service allows you to follow satellite's data received by the PW-Sat2 team and amateur radio people from all over the world!
If you are HAM radio enthusiast we encourage you to receive signals from the PW-Sat2 - check out **HAM Radio** pages!
Take part in our contest for HAM radio!

LATEST TELEMETRY HIGHLIGHTS

 35d 10h 29m 26s SATELLITE MISSION TIME	 No active experiment CURRENT EXPERIMENT	
 5.3 °C BATTERY TEMPERATURE	 7.2 °C COMM TX PA TEMPERATURE	 -2.0 °C OBC TEMPERATURE
 7.46 V BATTERY VOLTAGE	 0.0 mA BATTERY DISCHARGE	 9.38 mA BATTERY CHARGE

LATEST FRAMES

- 2019-01-09 10:58:07 [download](#)
- 2019-01-09 10:57:49 [download](#)
- 2019-01-09 10:56:52 [download](#)
- 2019-01-09 10:56:47 [download](#)
- 2019-01-09 10:56:06 [download](#)
- 2019-01-09 10:56:06 [download](#)

SATELLITE ALTITUDE

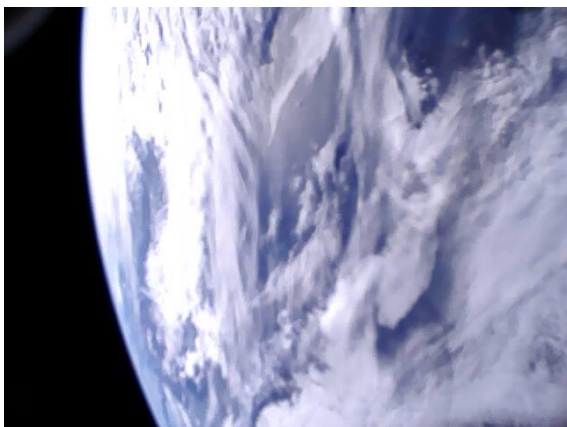
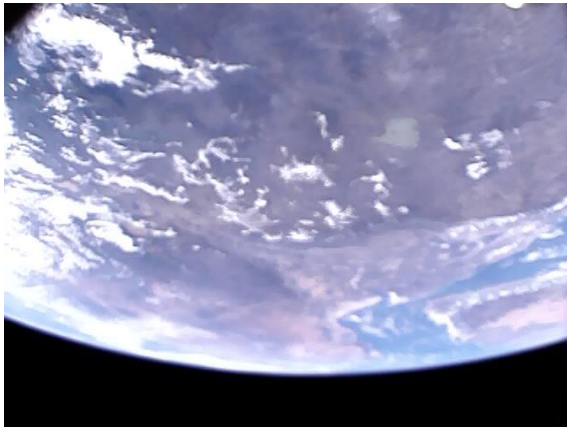


Tweets by @PWSat2


PW-Sat2
@PWSat2

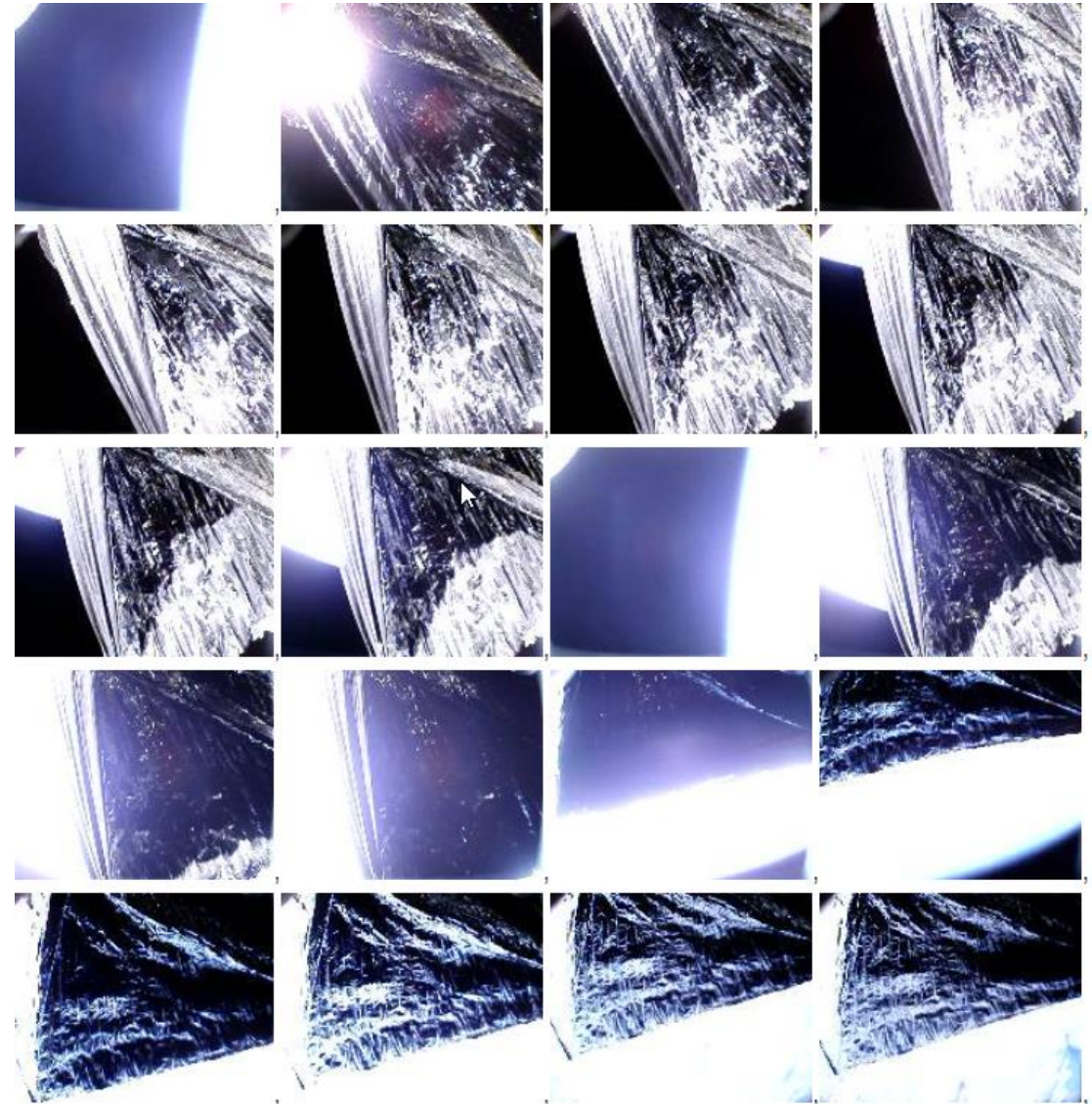
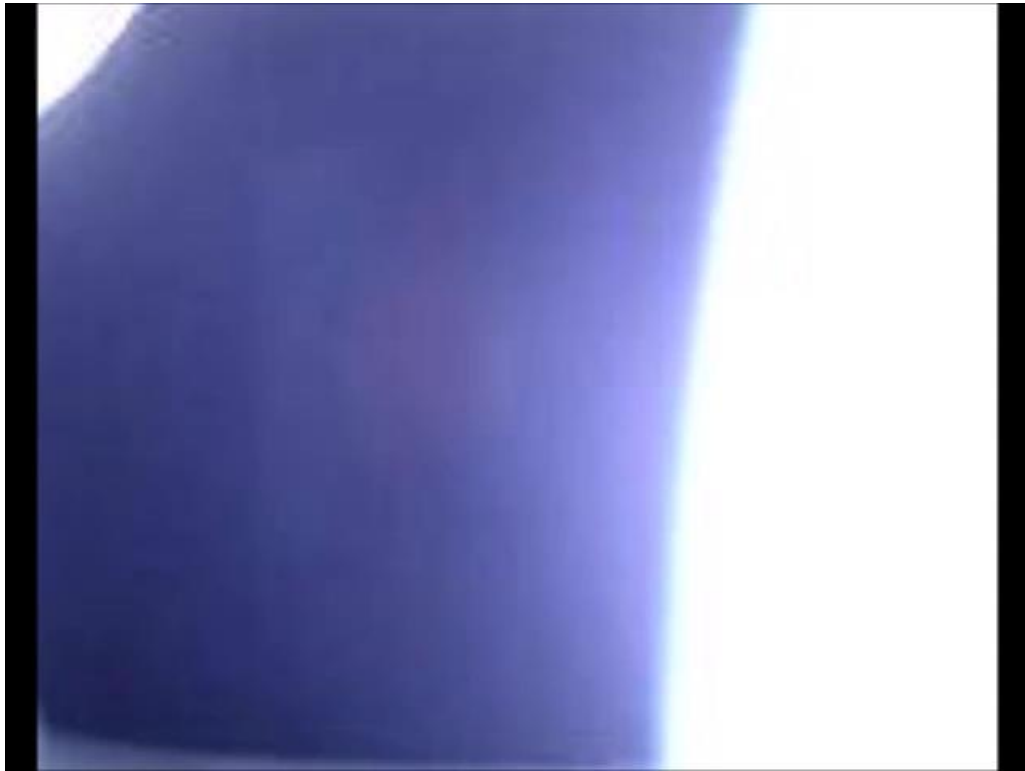

<https://radio.pw-sat.pl/gallery>

<http://mission.pw-sat.pl/master/gallery.html>

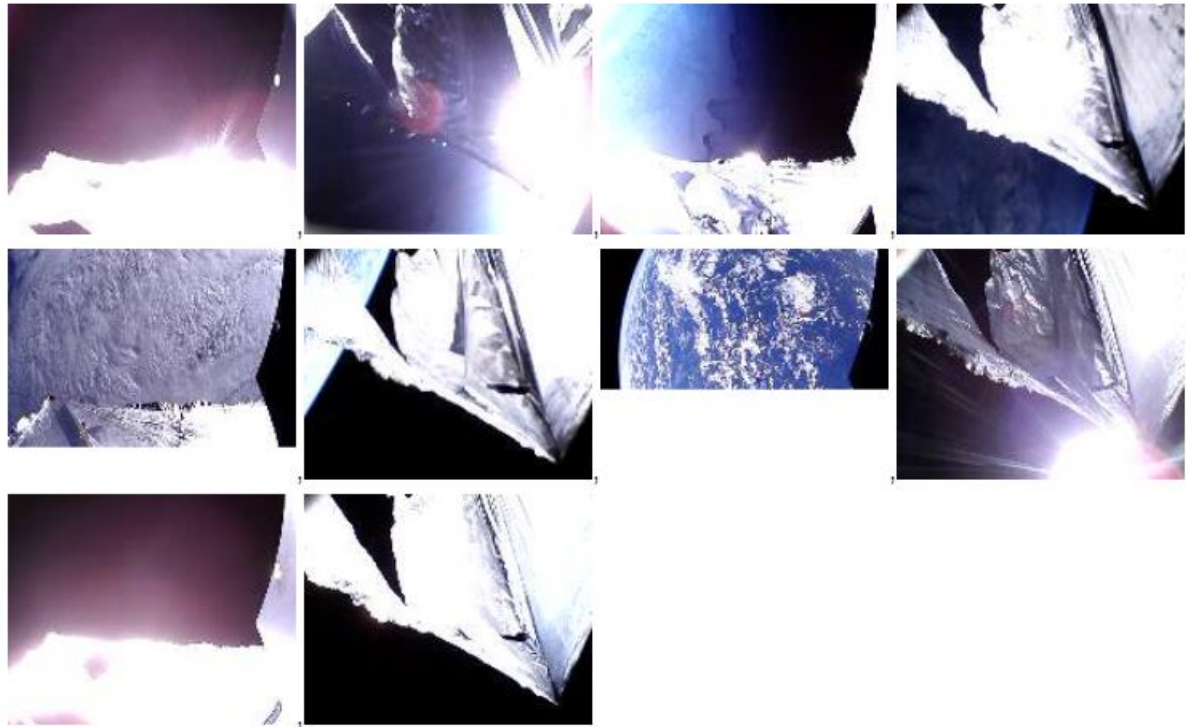


Deorbit sail on orbit analysis

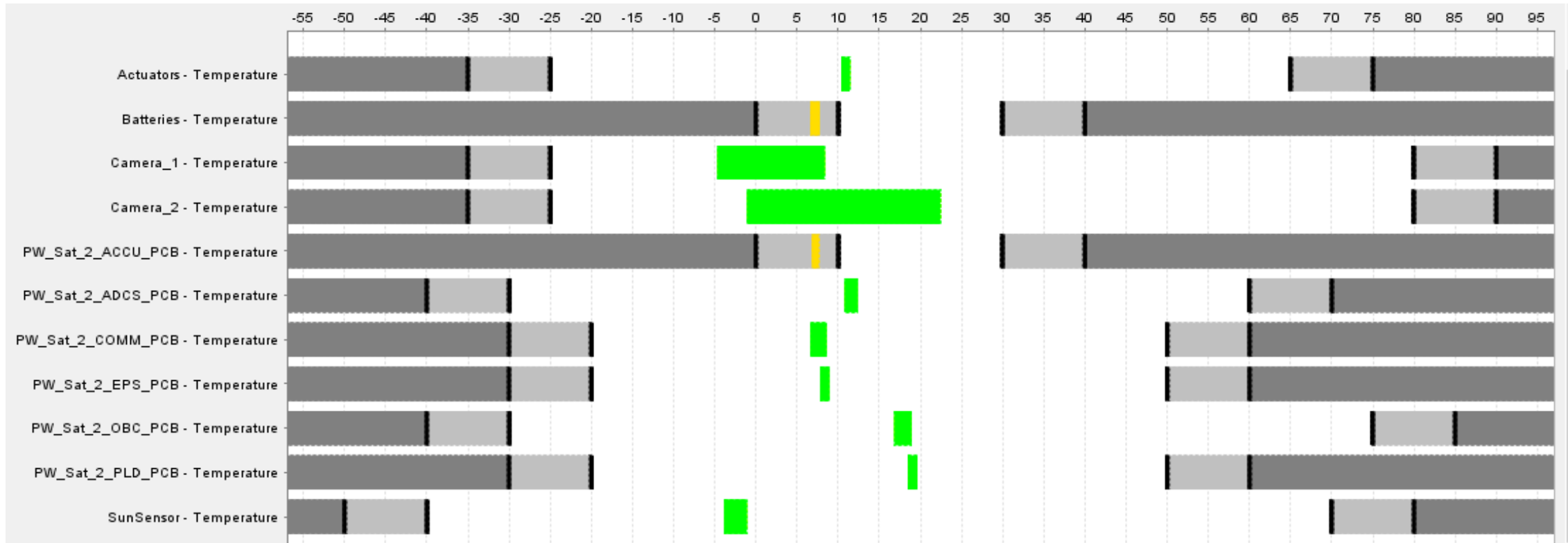
- <https://sail.pw-sat.pl/>



Deorbit sail on orbit analysis



Real vs analysis temperatures

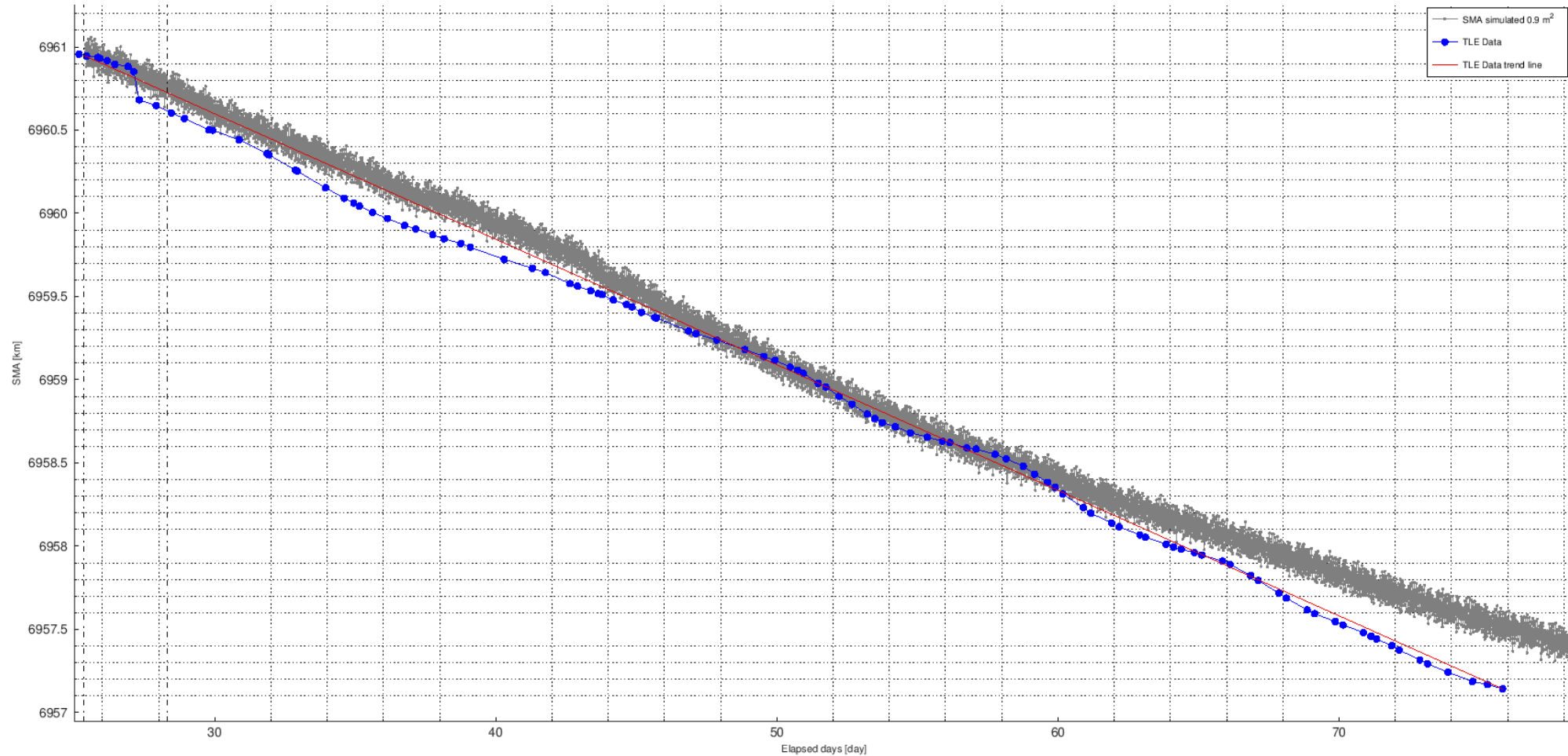


Temperature range obtained from thermal analyses in ESATAN-TMS software for a case similar to the real orbit.

Deorbit sail on orbit analysis

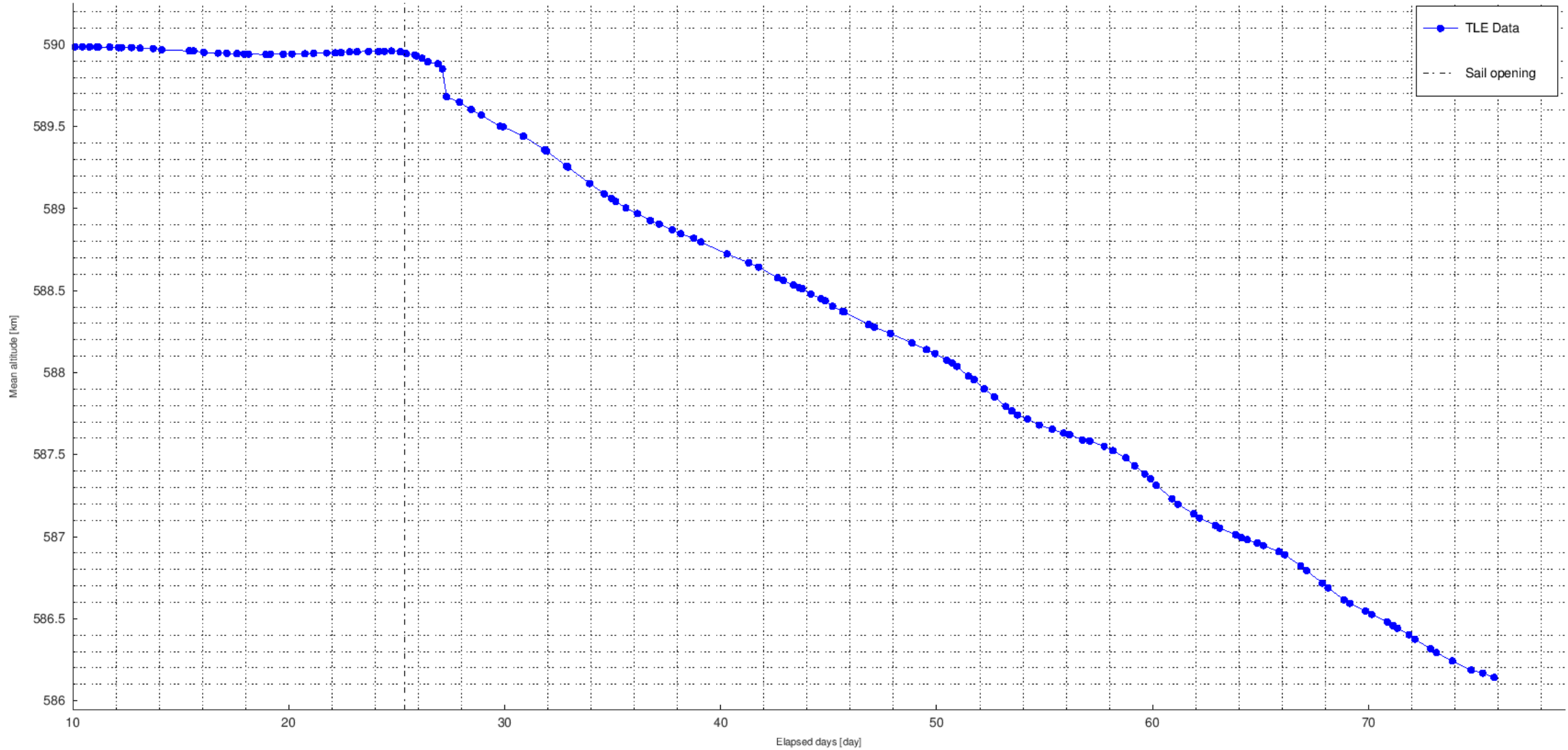
<https://sail.pw-sat.pl/>

Simulated Sail 0.9 m² vs TLE data [SMA]



Deorbit sail on orbit analysis

PW-Sat2 Mean altitude (TLE data)





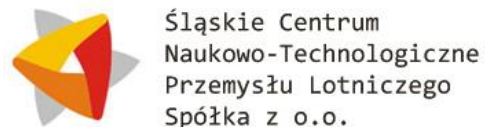
Strategic partners:



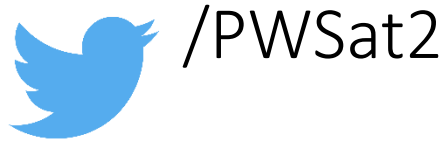
Close cooperation:



Support:



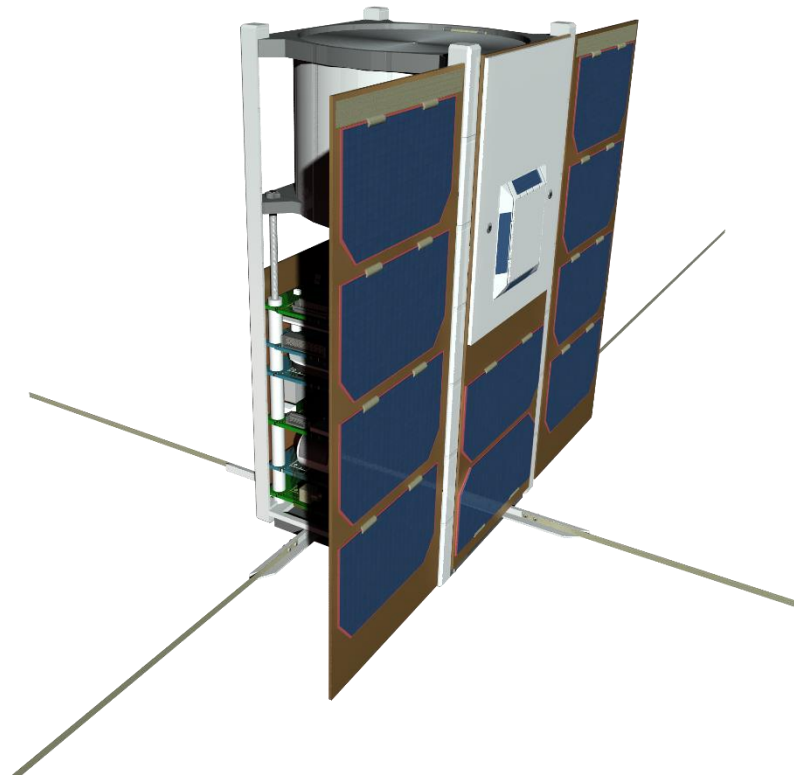
Thank you for your attention



pw-sat.pl

ska.pw.edu.pl

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PW-SAT2



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