

Results of the OPS-SAT Nanosatellite Mission

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OPS-SAT Mission Statement

“OPS-SAT is a safe, hard/software laboratory, flying in a LEO orbit, reconfigurable at every layer from channel coding upwards, available for authorised experimenters to demonstrate innovative mission operation concepts.”

OR

Make a Cubesat that behaves like an advanced ESA satellite (as far as the ground can tell) and then let experimenters configure and take control of it.

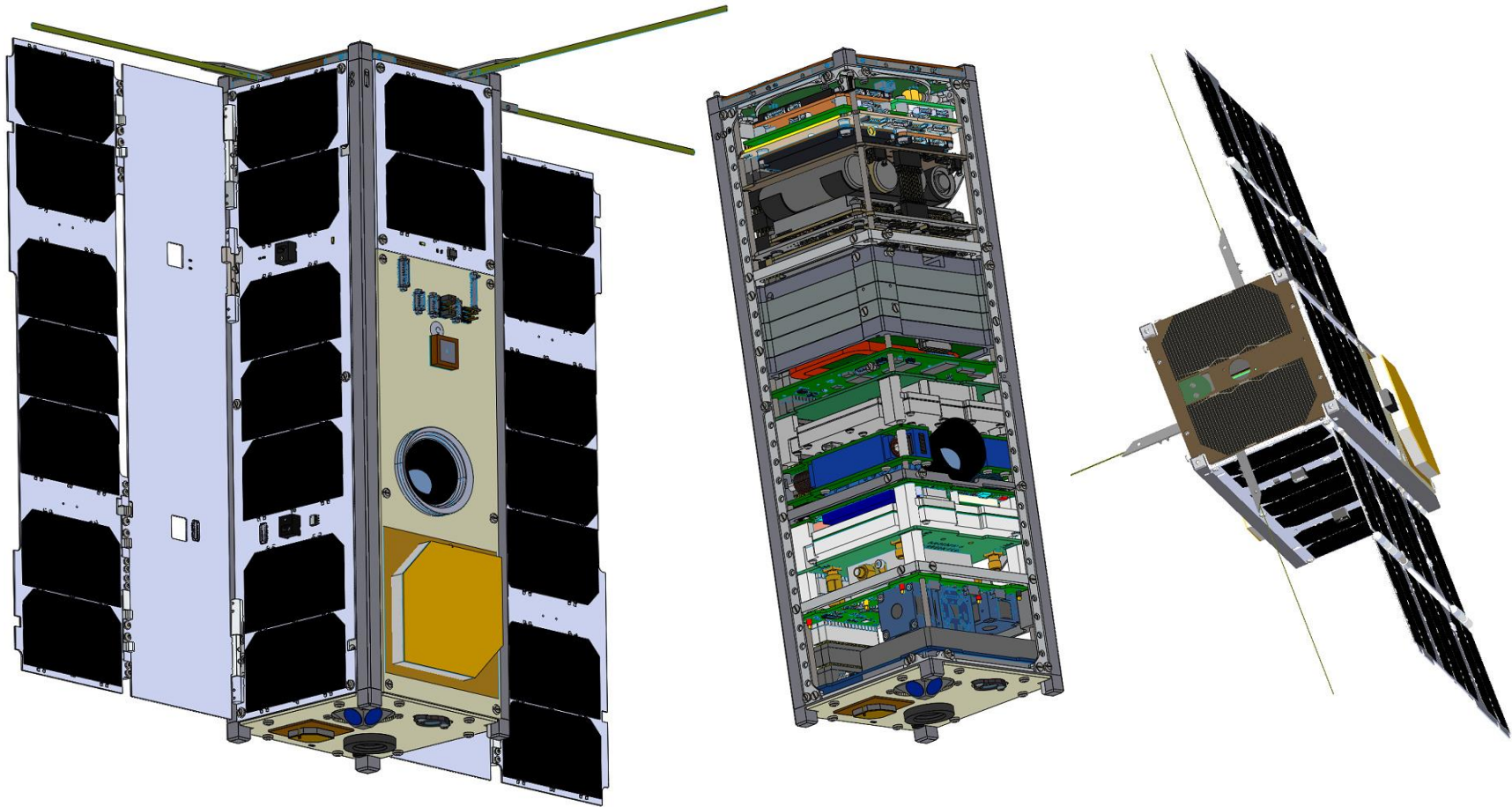


OPS-SAT

OPS-SAT Overview

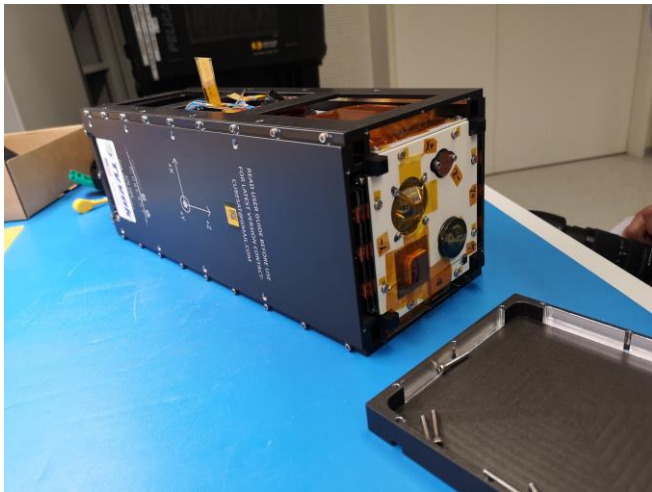
3U CubeSat: 10x10x30 cm with deployable solar arrays

Power: 24 W



Launch

Launch by ARIANESPACE on Soyuz-FREGAT from Kourou
SSO orbit with 0600 LTAN, 515 km circular
Launch: 18 December 2019



Core of the Satellite

(Satellite Experimental Payload Processor - SEPP)

- 2 x System on Module
- Altera Cyclone V
- in cold redundancy
- 2 x ARM-9 processor

Memory

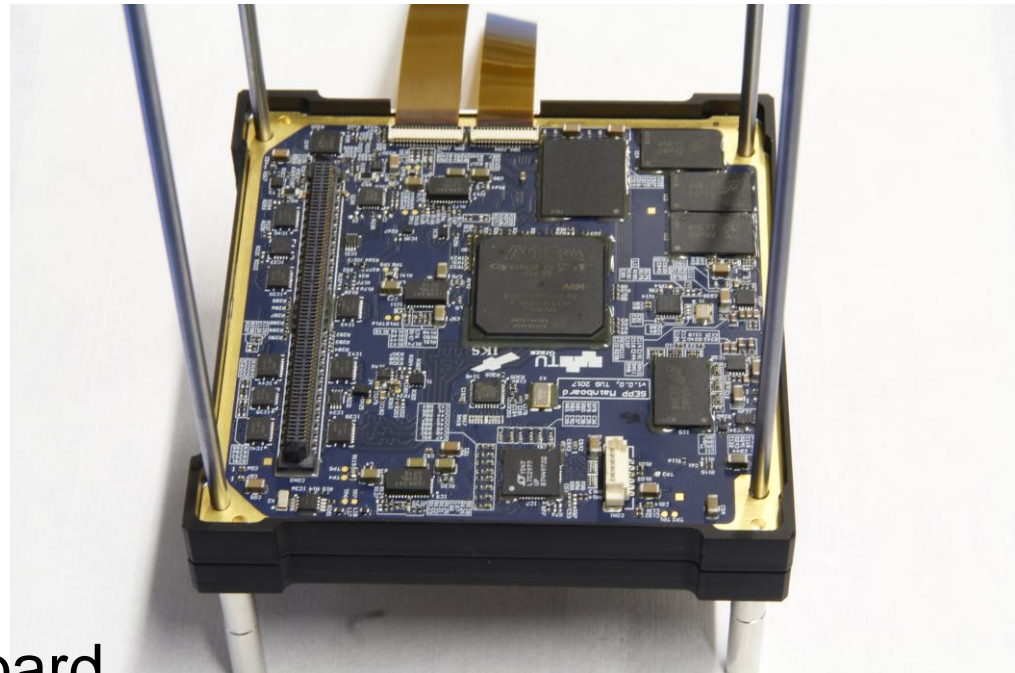
- 1 GB DDR3 RAM (ECC)

Mass Memory

- 8 GB

Direct interface to SDR board

By TU Graz



CCSDS compatible Telemetry

OPS-SAT behaves like any ESA spacecraft up to frame level

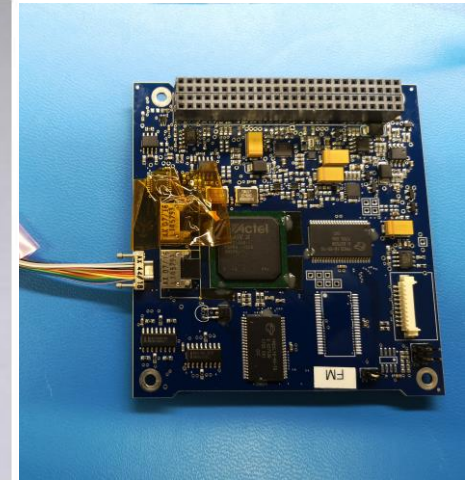


S-band transceiver with diplexer

By Syrlinks



50 Mbit/s X-band transmitter

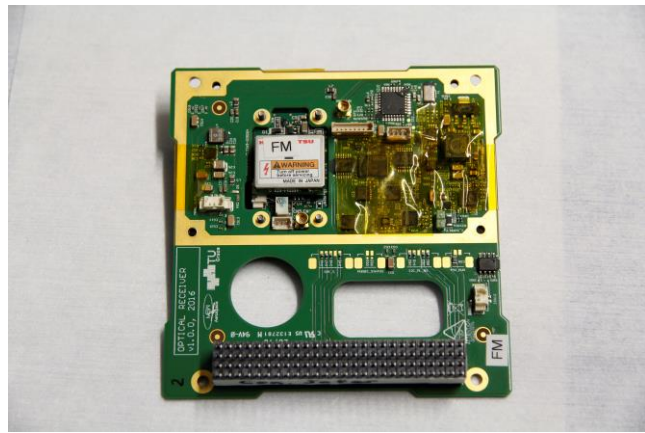


CCSDS Engine with ESA IP Core

By SRC/Creotech

Implements MO (mission operations) services at packet level (GMV Poland)

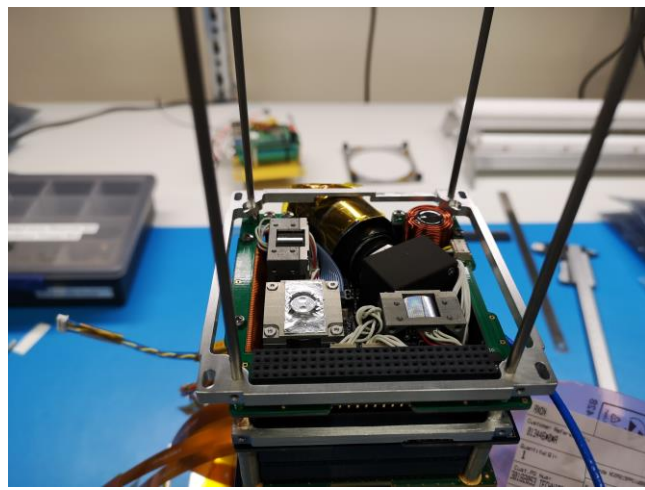
Payloads of Opportunity



Optical Receiver (MEW Aerospace)



Software-defined Radio Receiver (MEW Aerospace)



Fine ADCS (BST)

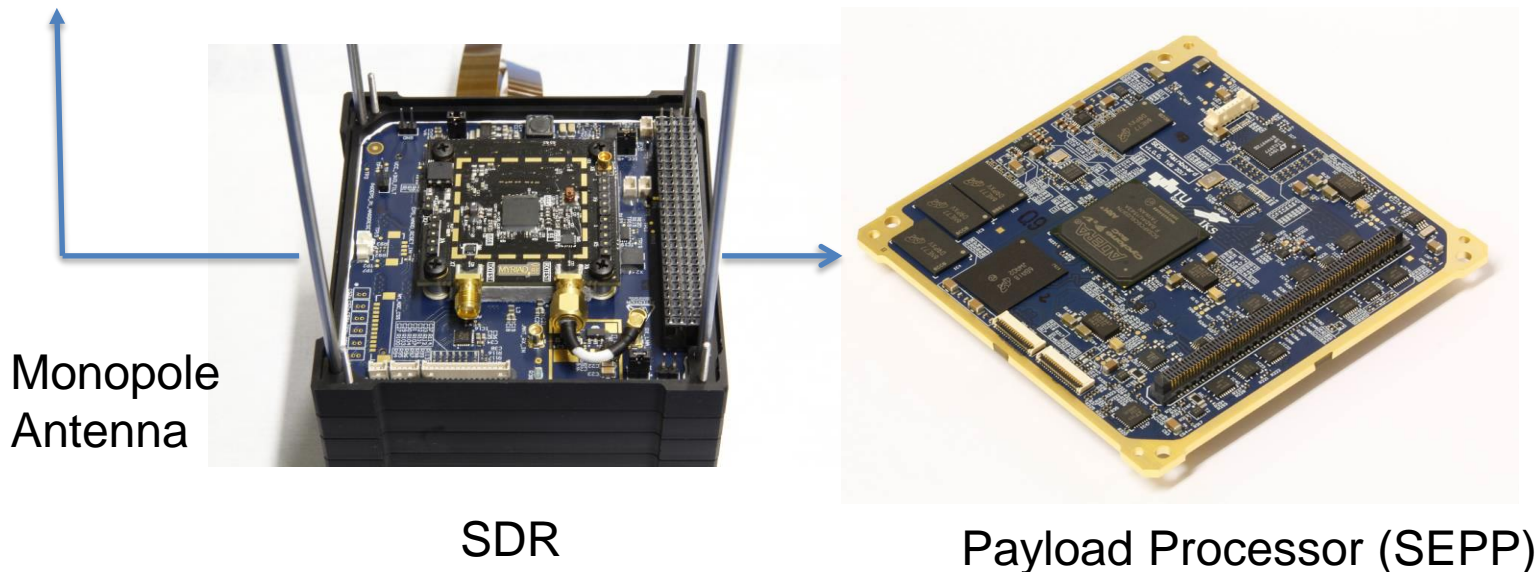


Camera (BST)

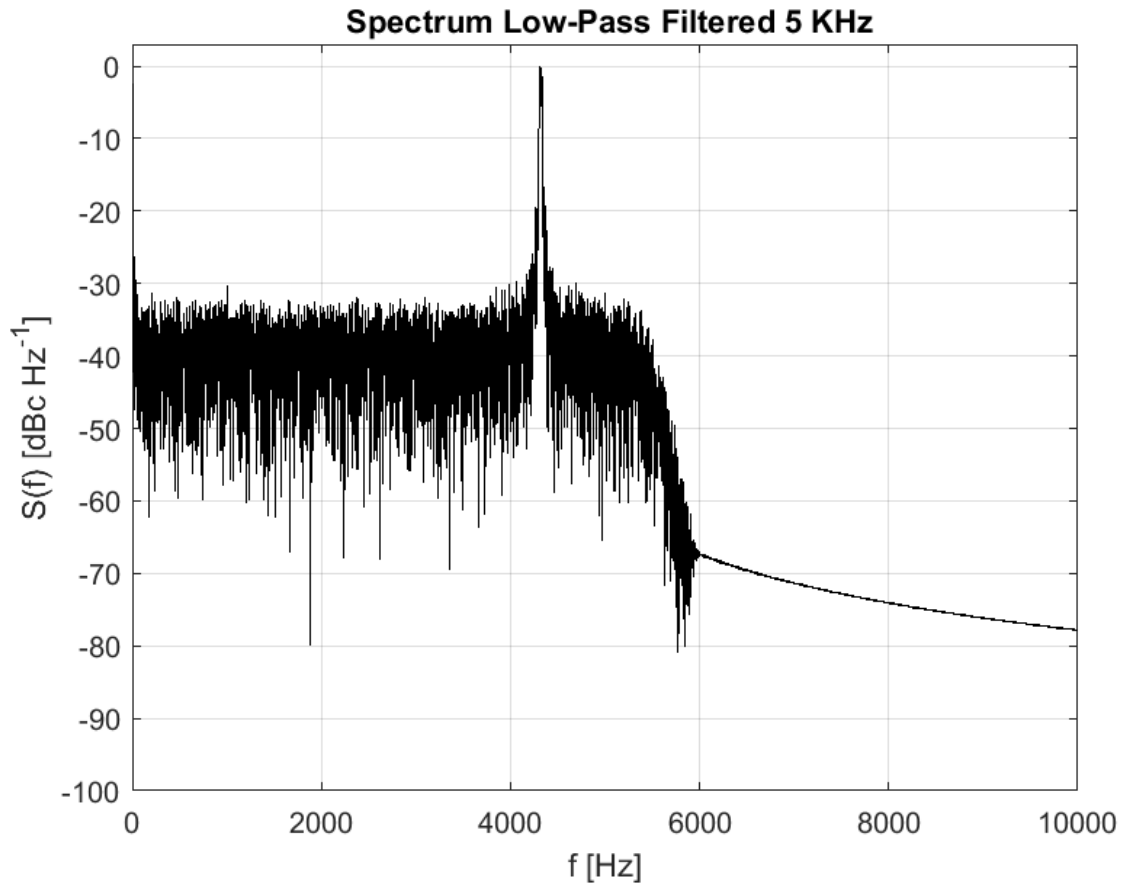
SDR- Experiment - Signal Monitoring

Measurement of interference signals in UHF and L-band using the Software Defined Radio on board of OPS-SAT

„Spectrum Analyser in Space“



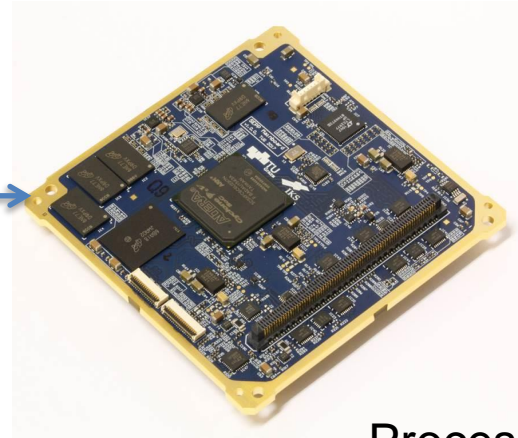
Spectrum Measurement ($f = 433 \text{ MHz}$)



Camera Experiment



Camera

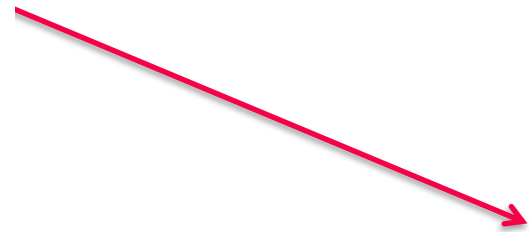
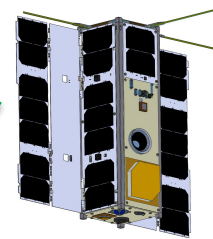


Processor



Optical Communications Experiment

- Transmission of a cryptographic key to OPS-SAT by Laser
- „One-time pad“ method
- Encryption of the 50 Mbit/s X-band Link conducted in September
- Optical receiver commissioned
- OPS-SAT tracked using retro-reflector experiment



OPS-SAT uses SMILE

SMILE is the **S**pecial **M**ission **I**nfrastructure **L**ab **E**nvironment:

- a 3.7 m S- and X-band and a amateur radio antenna
- an Operations Lab with e.g. different modems (SDR, Cortex, GOMspace), operator positions, etc ..



More information: www.esa.int/smile

Contact: smile.lab@esa.int

Summary

- OPS-SAT: technological mission for demonstrating novel operational concepts, hardware/software experiments
- MO Services, Nanosatellite MO Framework
- On-board software experiments, autonomy
- Camera produces very good results, AI software on SEPP
- SDR produces is very sensitive, 430...1700 MHz
- SpaceWire implementation very good
- Optical experiment prepared

OPS-SAT Consortium

TU Graz (Technical Lead)



UniTel IT-Innovationen (A), Prime



Subcontractors:

Berlin Space Technologies (D)



GMV (PL)



GOMSPACE (DK)



MAGNA STEYR Aerospace (A)



MEW Aerospace (D)



Space Research Centre & CREOTECH, Warsaw (PL)



Suppliers:

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Clydespace (UK)

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Thank you for your attention!