OPS-SAT-2 missions: Optical and quantum communication in-flight experiment opportunities for European & Canadian industry

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WHAT IS AN OPS-SAT MISSION?

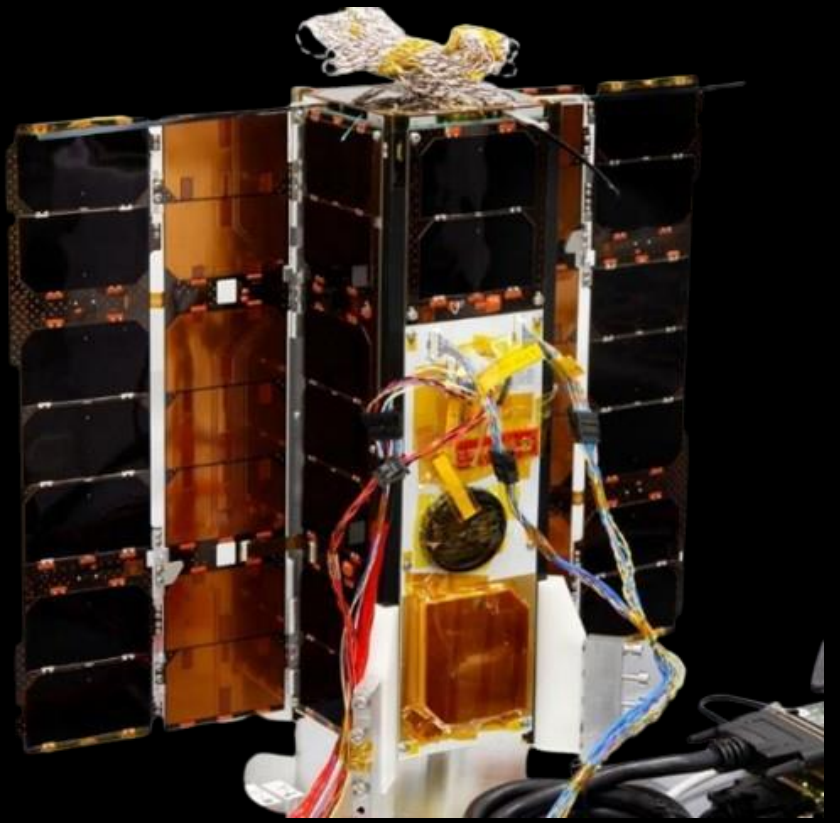
Any mission that supports the OPS-SAT Space Lab Service

What is this?

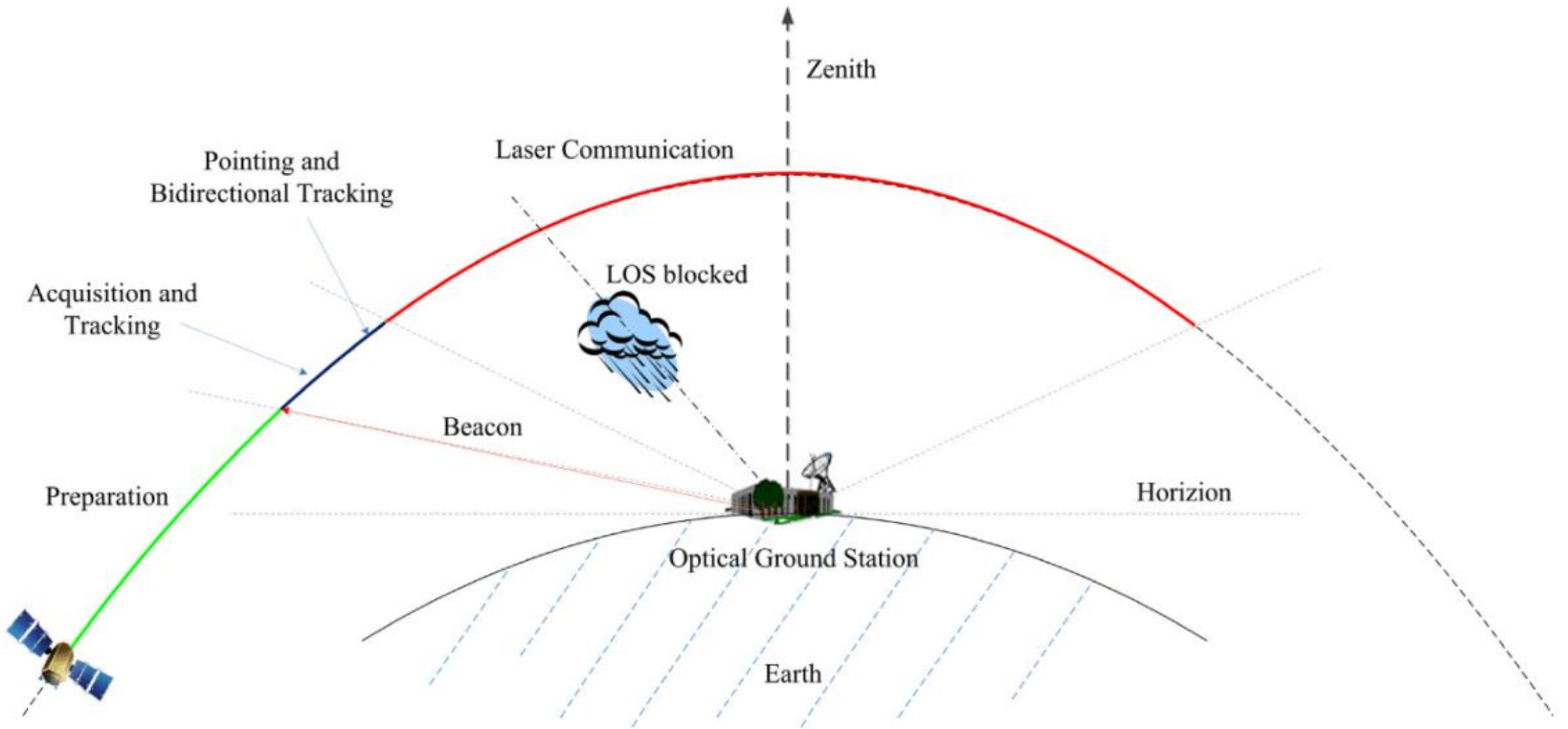
- An ESA service that provides access to OPS-SAT mission space elements for **all** European/Canadian industry and institutions, using a **fast, cost free, non-bureaucratic process**
- The space elements need to carry **powerful, reconfigurable** equipment, arranged in a safe way so they can be used for in-flight experimentation **not possible or desirable** on other missions
- OPS-SAT Space Lab arranges the testing of these experiments and assumes the **risk** of executing them

WAS THERE AN OPS-SAT-1?

- Yes, 3U CubeSat, launched Dec 18th 2019
- 134 teams from 26 countries performed 284 different types of experiments
- Experiments covered on-board AI/ML, Cyber Security, GNSS jamming, new protocols..
- Teams from academia, start-ups and large corporations including all European large primes, EU commission, NASA, JAXA, DLR, CNES
- Mission internationally recognized, sharing the SpaceOps Outstanding Achievement award with NASA JPL's Ingenuity Mars helicopter team
- Satellite deorbited on the 22nd of May 2024



WHY OPS-SAT-2?



Citation: Shuai Bai, Jianyu Wang, Jia Qiang, Liang Zhang, Juanjuan Wang, "Predictive filtering-based fast reacquisition approach for space-borne acquisition, tracking, and pointing systems," Opt. Express **22,** 26462-26475 (2014);
https://www.osapublishing.org/oe/abstract.cfm?uri=oe-22-22-26462

It's not so easy!

Many unknowns!

Operational data hard to get

To accelerate this process the ESA ARTES ScyLight Strategic Programme has adopted the OPS-SAT concept under an open call called OPS-SAT-2

OPS-SAT VOLT – 50% OF MISSION FOR SPACE LAB

Quantum-Classical Optical Communications

- CCSDS O3K Standard Compatible
- Reconfigurable FPGA for Optical Comms
- Quantum Random Number Generator
- BB84 QKD Protocol

Beam steering Primary Telescope

- 80 mm telescope with Fast Steering Mirror
- Fine pointing accuracy << 5 urad
- Auxiliary fixed downlink telescope

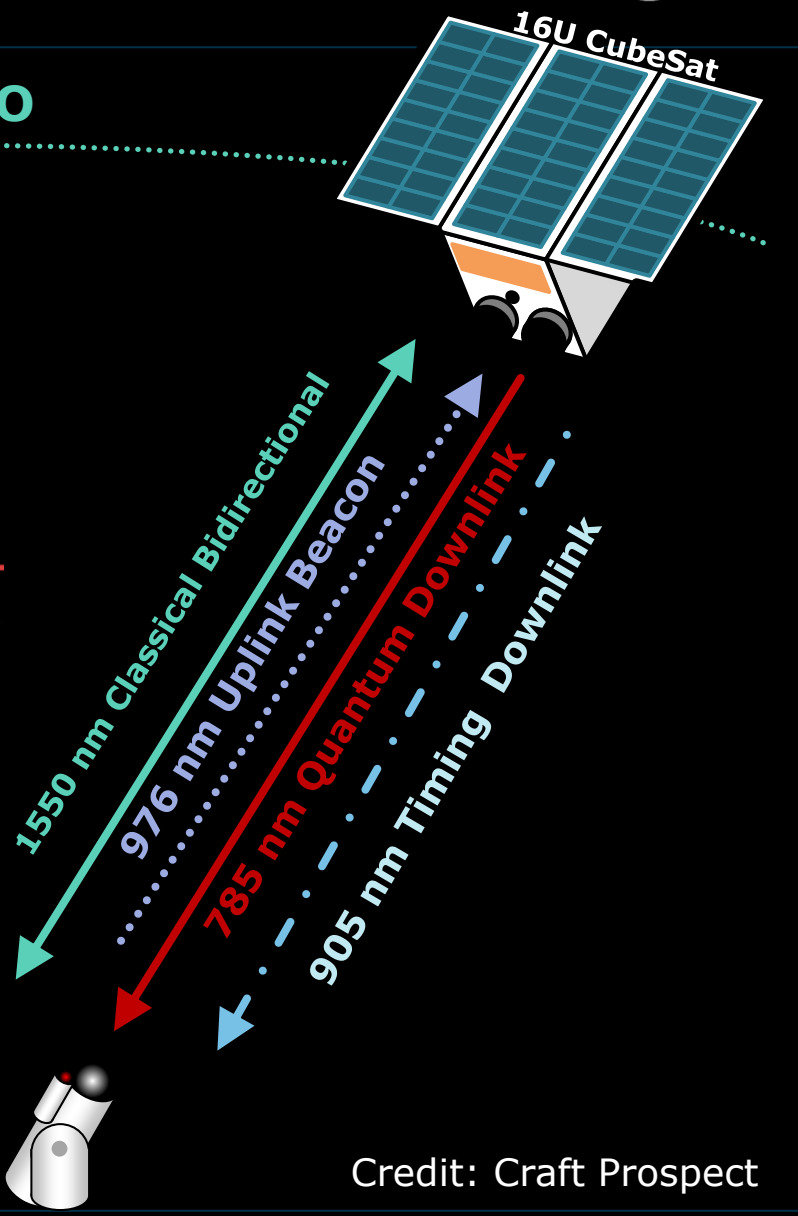
Quantum/Optical Payloads of Opportunity

- Entangled Photon Source

Earth Observation Sensor Package

- 32x Selectable Hyperspectral Imager

CRAFT PROSPECT
a space engineering practice



Credit: Craft Prospect

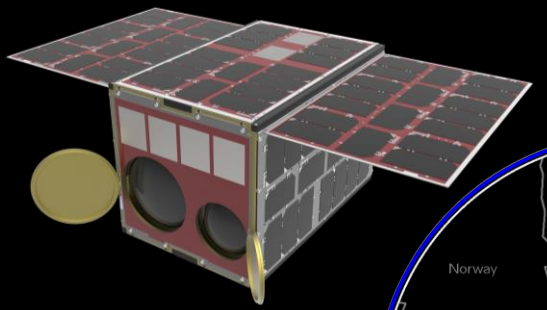
OPS-SAT ORIOLE – 25% OF MISSION FOR SPACE LAB

Hybrid Optical telecommunication and Imaging demonstrator

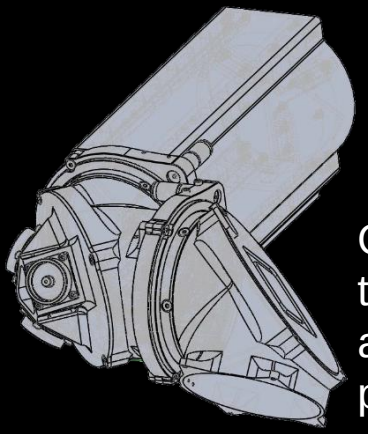
- 1550nm Software Defined Optical Telecommunication Transceiver
- Thermal infrared (8-10um) imaging
- VIS imaging
- Full Dome stabilized pointing capability

Smart Data Link Link management (radio and optical) for low latency data delivery to ground

- Smart ground station switching
- Mix between optical and Radio ground stations globally distributed
- On board platform enabled smart payload management



Satellite platform



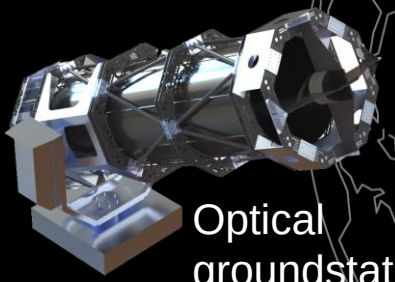
Optical transceiver and Imaging payload

Main imaging targets

UHF/VHF/S GS

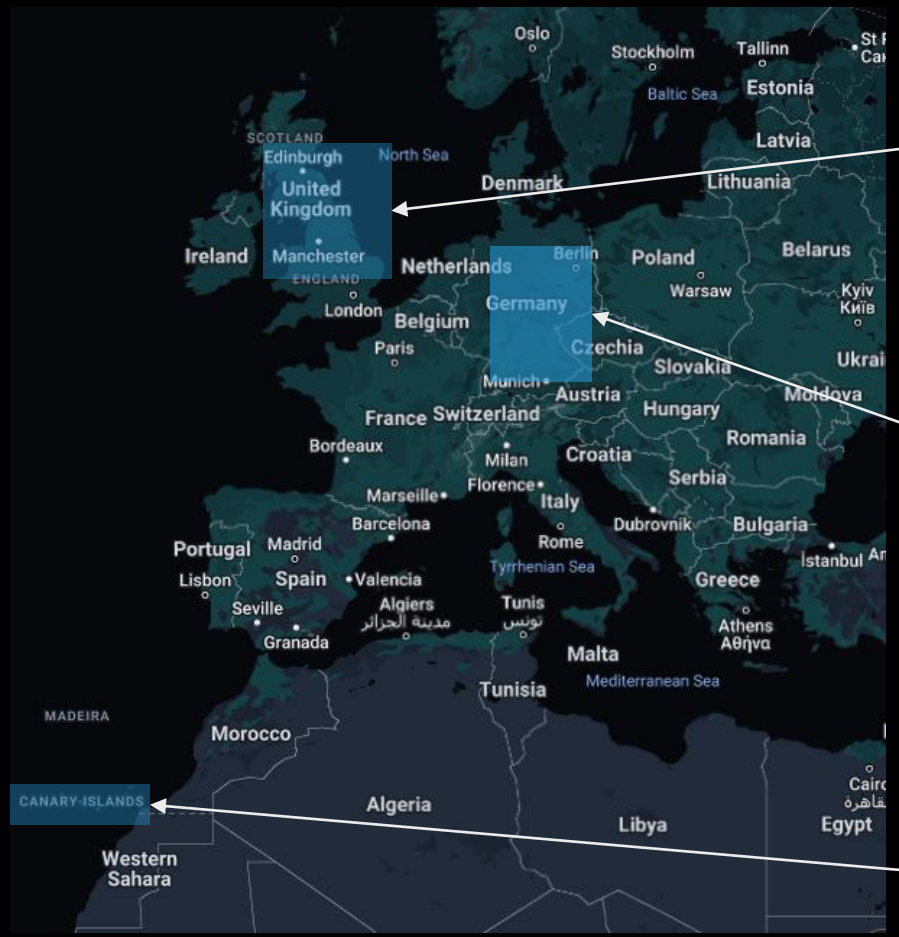
OGS#2

Secozndary imaging targets



Optical groundstation

OPTICAL GROUND STATIONS (ESA SMILE & INDUSTRY)



United Kingdom

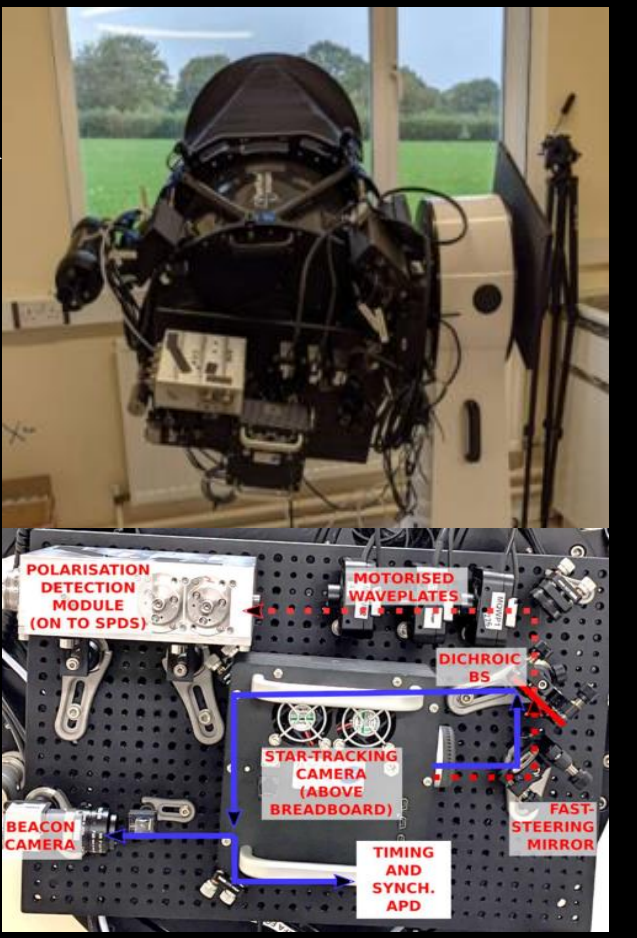
University of Bristol Nomadic OGS
Heriot Watt Errol OGS

Germany-Darmstadt

ESA/ESOC OGS

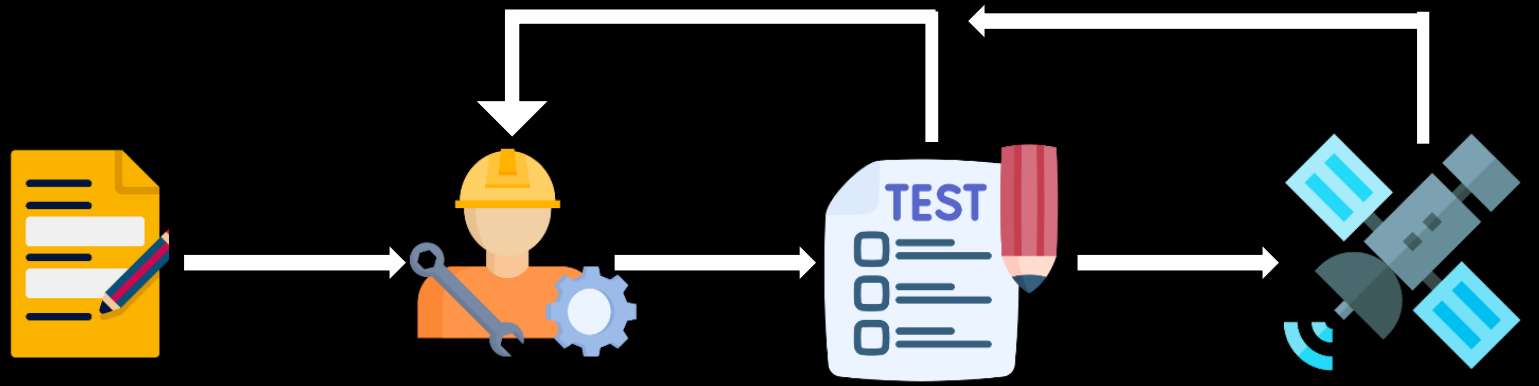
Spain – Tenerife

ESA INZ-1 OGS



Credit: Craft Prospect

OPS-SAT EXPERIMENT PROCESS



Register Make Experiment Test on EM Run on FM

opssat.esa.int

Thank you!