OPS-SAT Concept: OSCW 2020

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What is OPS-SAT?

3U cubesat launched by ESA on 18th Dec 2019

First nanosatellite to be directly owned by ESA and controlled by ESA/ESOC

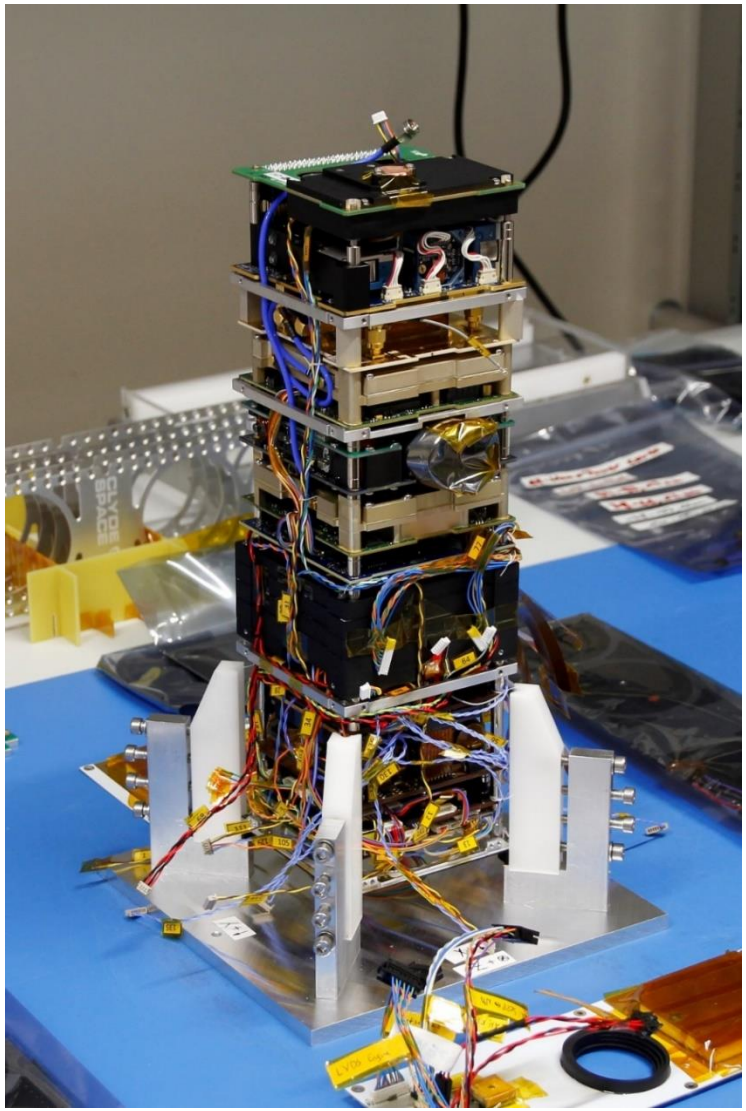
The result of 7 years of development supported by GSTP and ESOC internal investment

A satellite within a satellite. Control can be swapped between the two and they monitor each other – providing the in-built robustness.

Conceived to break the "has not flown, will not fly" cycle - by allowing real experimentation on critical control functions during flight

Fully equipped with

1) a full set of sensors and actuators including a camera, GPS, star tracker and reaction wheels
2) High speed X band and S band communication
3) Laser receiver
4) Software defined radio receiver
5) A 800 MHz processor with a reconfigurable FPGA at its heart



What does ESA get out of OPS-SAT?

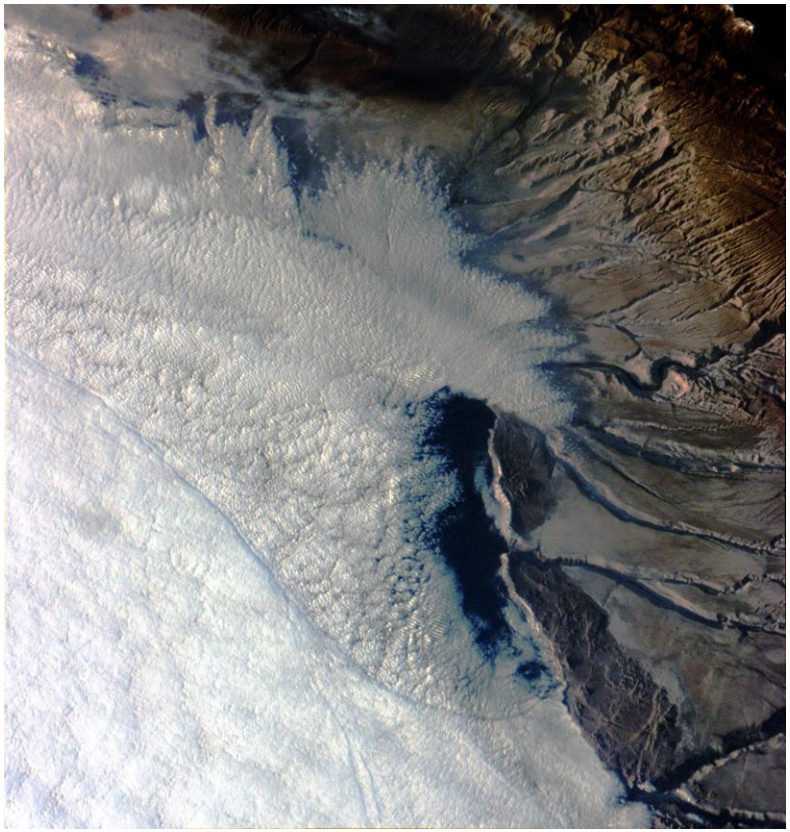
OPS-SAT looks like an advanced ESA spacecraft to the ground. The uplink rate is four times higher than any ESA spacecraft; it employs never before flown communication protocols and implements new ESA patents. So by using many new technologies to control the mission every day **we are preparing for the future.**

At the centre of OPS-SAT is a high performance control processor. This allows "normal" software (Linux, JAVA, Python..) to control the entire satellite: rotate, take pictures, classify them, compress them, send them to the ground etc. **Together with our experimenters, we are exploring how all that processing power and open source software can be exploited in space.**

The processor integrates with a powerful FPGA that allows us to reconfigure its firmware in space. Reconfigurable on-board software caused a revolution in space and this will be just as significant. It is an incredibly powerful technology allowing many algorithms to run in parallel at nanosecond speeds. **Together with our experimenters we are learning how to master this powerful technology safely in flight.**

What does ESA offer on OPS-SAT?

OPS-SAT is unique flying platform that European Industry and Institutions can use to rapidly test their software and firmware experiments in space at no cost* and no bureaucracy.



Experimenters can

- execute repeated "develop, fly, improve" cycles without having to worry about risk
- reconfigure the ground and satellite in ways that up to now have been impossible…
- get their data only a few minutes after it is received at ESOC, command and control their experiment in real-time over the internet..
- join the OPS-SAT community, where experiments and experimenters synergise…

151 experiments are already registered from big primes to start-ups but there are still slots available and we are always open to good ideas!

* ESA has committed to cover the operations cost of OPS-SAT (800K/year) at no cost until Nov 2021. After this date the operations cost will have to be shared between Member States with running experiments or the spacecraft will be switched off.

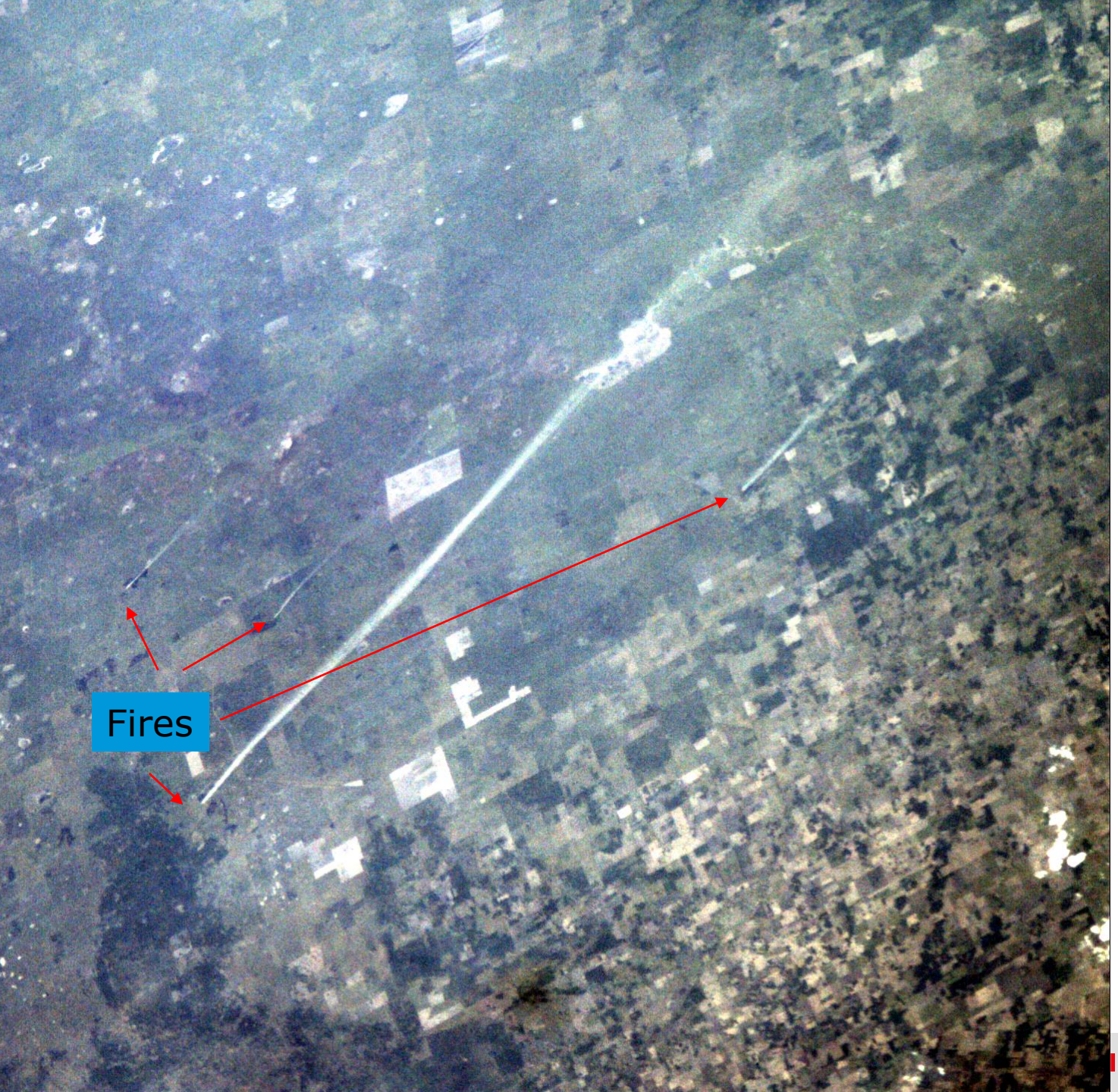
OPS-SAT and OS Software… the story so far

- SATNOGs and saving the mission - a big thank you
- The power of Linux
- Python and managing the experiments
- TensorLite and bringing AI into Space

This could be only the beginning…… for those looking for a challenge that would provide instant value and recognition on the mission. Here is one…

An open source ADCS controller that can achieve nadir mode using magnetorquers as actuators and magnetometers/sun sensor/photodiodes as sensors. It is not as easy as it sounds to implement a solution on a real spacecraft with real problems to solve!

We have not achieved it after one year in orbit – could you do better?



Thank You!