The E-SAIL programme

10th IAA Symposium on Small Satellites for Earth Observation

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LuxSpace s.à.r.l – An OHB company

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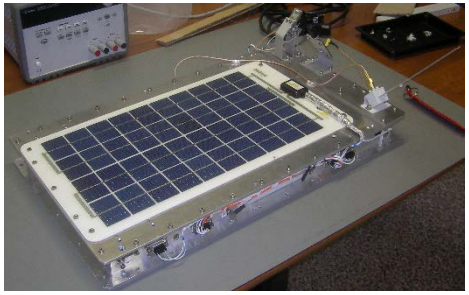
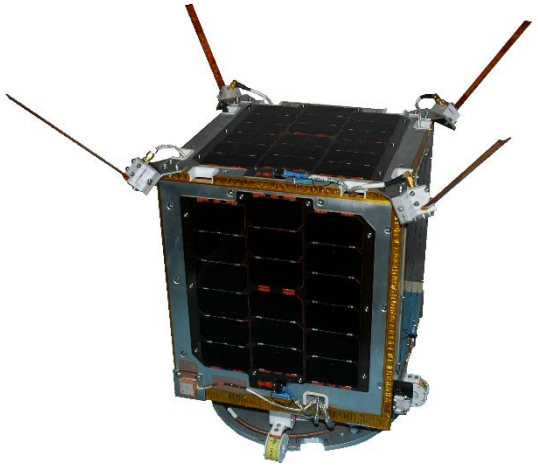
LuxSpace

In a few words:

- Founded end 2004 – daughter company of OHB
- Currently some 45 staff – 13 nationalities
- 4 spacecraft flown:
  - Pathfinder-2 – PSLV attached payload – AIS – 2009
  - Vesselsat-1 and -2 – Commercial AIS – 2010/2011
  - 4M – first private funded Moon mission – Long March attached payload with Chang'e 5-T1 – 2014
  - In addition, AIS Payload flying on other mission





Programme background

- LuxSpace performed various studies on AIS – in-house, Luxembourg funded and under ESA
- ESA ARTES-21 programme running since several years
  - First step: demanding requirements, no cost limit
  - ➢ Billion-€ plus constellation of 100+ satellites
  - Second step: design to cost
  - ➢ At first 100 M€, then 40M€, now some 30M€
  - ➢ Starting with 3 satellites, now 2
  - Commercial customer introduced – PPP setup
  - Phase B1 completed last year, consortium formed to comply with geo-return

Consortium

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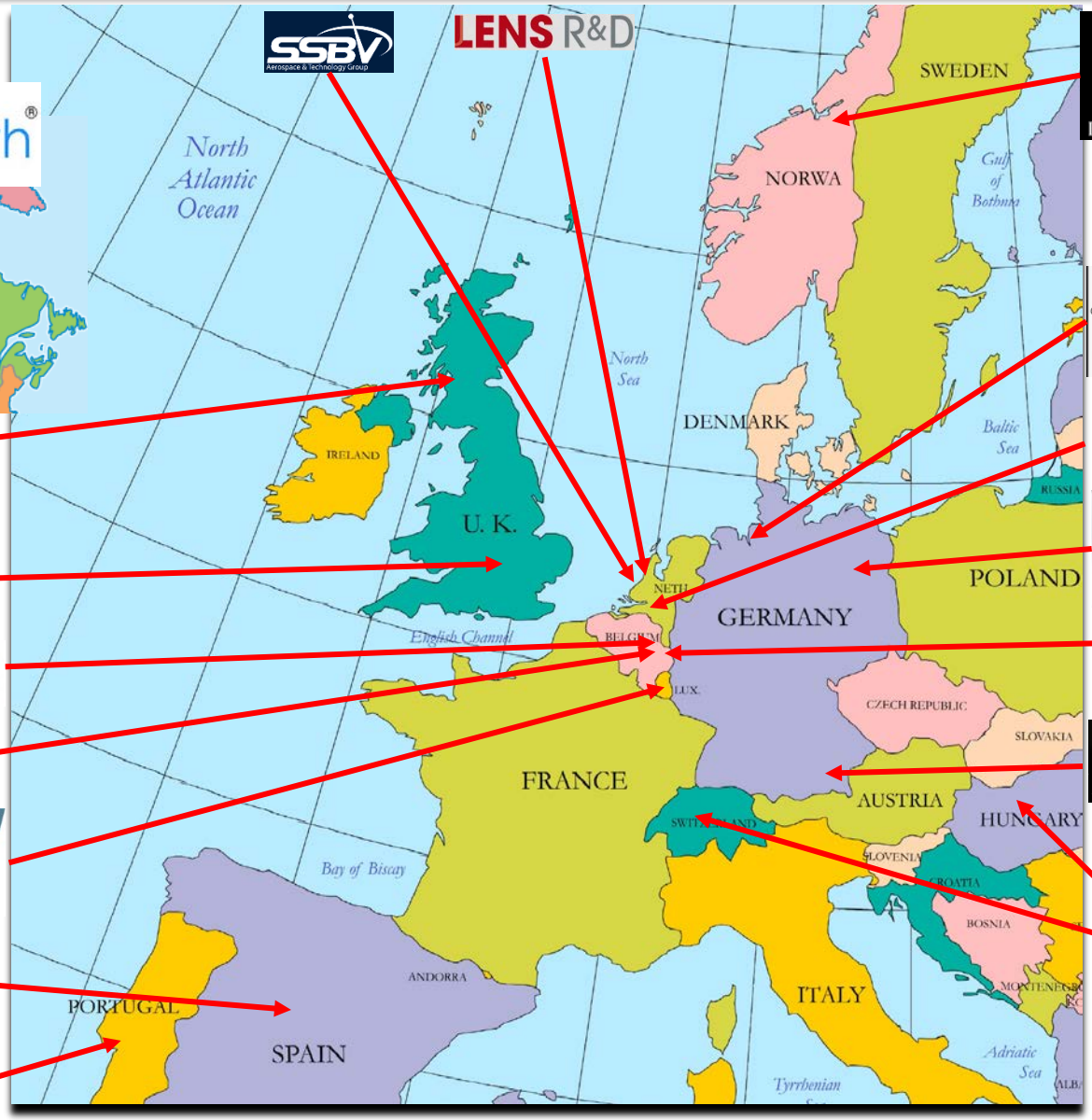
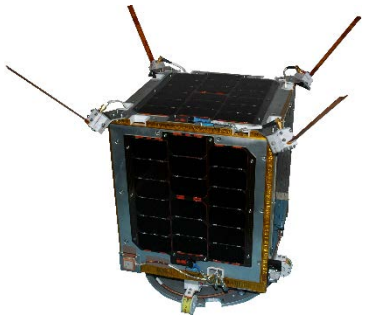
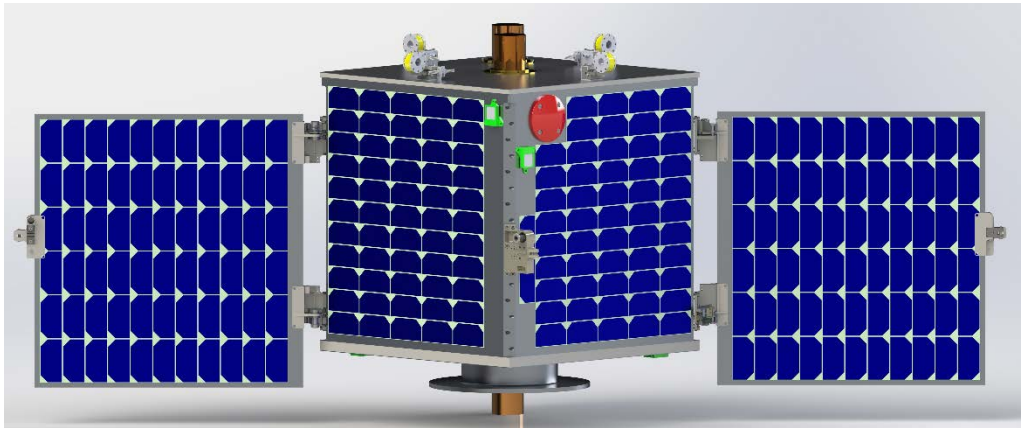


LuxSpace platforms

- Triton-1 platform: Vesselsat-1 & -2
  - Tumbling or limited ACS, 30cm cube, 3 year life
- Triton-2 platform: being developed for E-SAIL
  - Concept based on Triton-1
  - Scaled up to increase power generation, room for subsystems and payloads, added deployable solar panels
  - More redundancy in subsystems, higher grade components, to reach 5 year life

Size comparison:



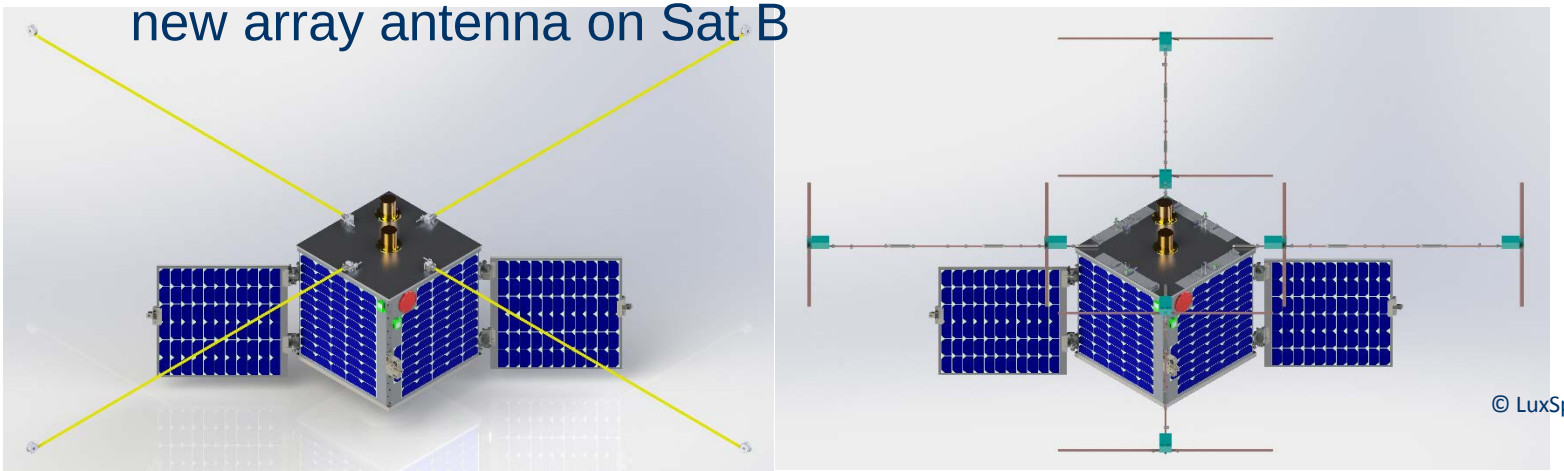


LuxSpace platforms

- Main characteristics of platform
  - Target being able to respond to customer request in ~2 years to launch (for comparison: Vesselsat – 13 months from contract to launch)
  - Low cost
  - Compatible with as many launchers as possible
    - Impose minimum work on launch provider – lean launch site ops, minimized interfaces
    - Limit size of spacecraft
    - ITAR free
  - LuxSpace targets segment between cubesats (1 to 6U) and the 100kg+ microsat class

Spacecraft

- ESAIL spacecraft main subsystems
  - Redundant OBC
  - ASCS: FSS, Magnetometer, Gyro, Wheels & torquers
    - 3-axis ADCS – 1 to 5° (potential for more by including star tracker)
  - TMTC: redundant S-band
  - Payload Data Handling
  - Payload Downlink: C-band (~100Mbps)
  - GPS (red) for time reference & orbit knowledge
  - Payload: AIS receiver, Vesselsat-heritage antennas on Sat A, new array antenna on Sat B



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Critical aspects for AIS mission

- Well-know difficulties of AIS from space
  - Low signal levels
  - Large Field-of-View leading to over-saturation with signals (collisions)
- Counteract with:
  - Antenna system that splits FOV
  - Very sensitive receiver
  - Extremely low platform noise level at AIS frequencies
  - Advanced data processing on ground

  - Vesselsats show very good results by implementing first 3

Mission

- Spacecraft will be launched as passenger
  - exactEarth is responsible for contracting the launch
  - PSLV, Soyuz (from Russia), LM, Falcon-9 and Atlas-V specified
- Asked to be compatible with any orbit
  - 0° to SSO, up to 650km – altitude limited to assure self-decay
- Data timeliness is key for competitiveness
  - Two data downlinks per orbit
  - Customer will put in place large network of ground stations
- Operate largely autonomously
  - One HK download per day
  - One TC batch uplink per week

Programmatic

- Challenge: Tension between
  - Available budget
  - Desire to speed up the programme
    - Have platform available sooner
    - Reduce cost by using less time
  - ESA push for full qualification
  - End up with platform with the right recurrent cost

- Of course, ESA provides a lot of knowledge & advise for free, and a number of tests
- This is an extremely low-cost satellite program by ESA standards – finding the right balance between the possible and the desired is challenging

The end

Questions?

2018: Moon Mission opportunity

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- LuxSpace is preparing its second Moon mission for 2018.
- Low cost, exciting, and using all what we learned from 4M mission. (http://moon.luxspace.lu)
- A true science and engineering endeavour.
- More details to come at IAC 2015.
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