EAGLE-1 and the Path to its Industrialisation

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Key Facts

Location	Backnang, Germany
Core Business	Spacecom Satellite Payloads Equipment & Subsystems
Employees	1,100
Turnover	ca. 300 million Euro
Total area	63,000 m²
Clean room area	17,000 m²

- INDEPENDENT SUPPLIER
- WORLD LEADING PARTS AGENCY
- INNOVATIVE SOLUTIONS
- HIGH RELIABILITY
- AFFORDABLE PRODUCTS
- SERIAL PRODUCTION FACILITIES
- DIN EN ISO 9100 CERTIFIED
- DIN EN ISO/IEC 27001:2017 CERTIFIED

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Consortium

EAGLE-1: A multi-national consortium

- Co-Funded by ESA and the European Commission
- Prime: SES
  - Payload prime: TESAT
- 19 partners, both industrial and academic
- participants from seven nations

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Scope

EAGLE-1 Scope: An E2E QKD system

- » Demonstration of satellite based QKD
- » Complete systems architecture
- » Development, manufacturing and testing of a QKD Payload on a LEO satellite
- » Establishment of a operations control center
- » Two optical ground stations
- » Access for potential end-users

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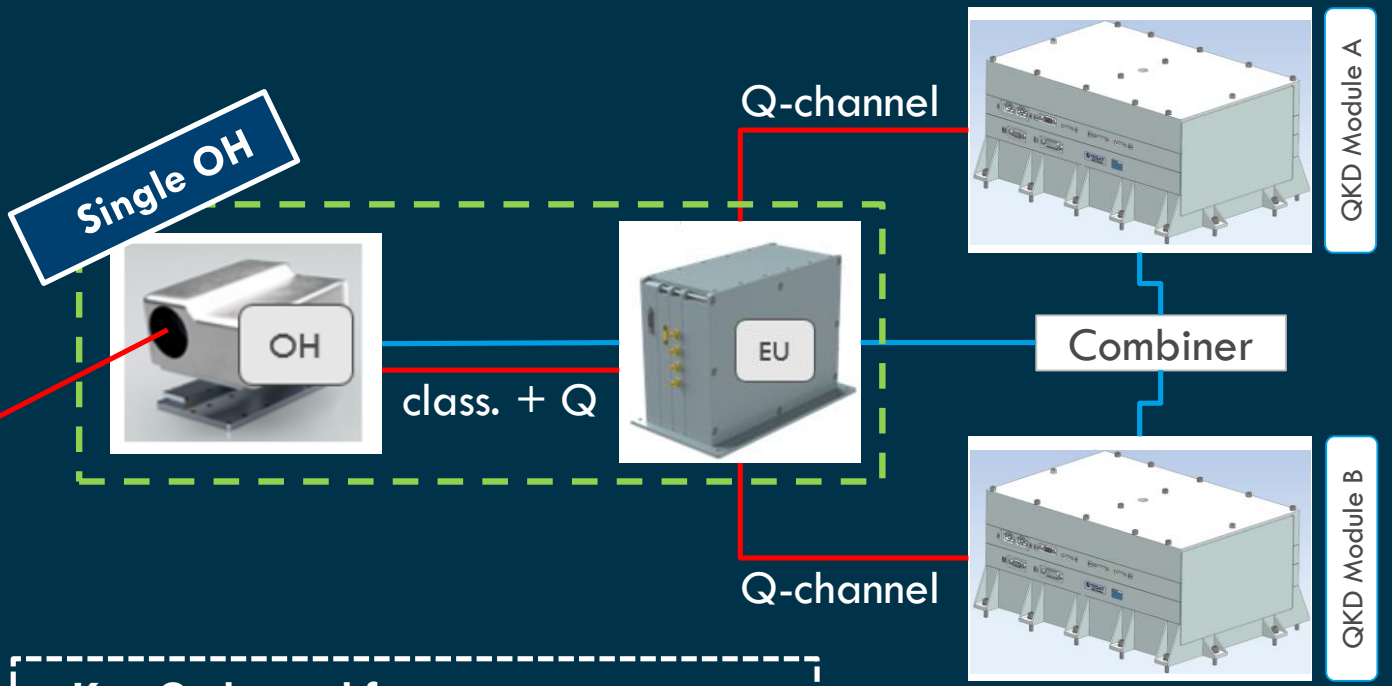
Payload and Optical Ground Station concept

Classical optical channel

» TESAT SCOT80

» SDA Compatible

» C-Band



OGS Oberpfaffenhofen

Key Q-channel facts

» BB84 p/m protocol with Decoy-states

» Qubits phase encoded

» Wavelength C-Band

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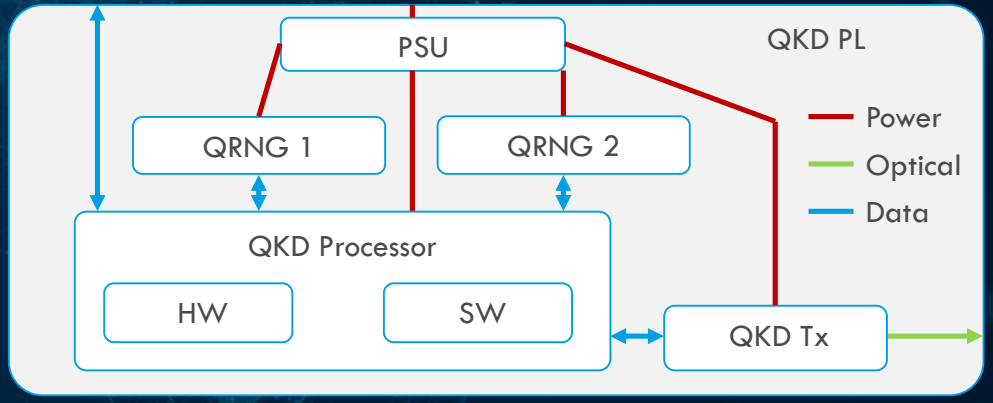
QKD Module

- QKD module consists of several slices each representing a sub-unit
- QKD processor integrates QKD functionalities
  - protocol/algorithm/post processing, KMS, etc.
- Optical link
  - classical bi-directional opt. link, SDA compatible
  - uni-directional quantum coms link (downlink, C-band)
- QKD Tx generates Q-channel (Qubits + Decoy)



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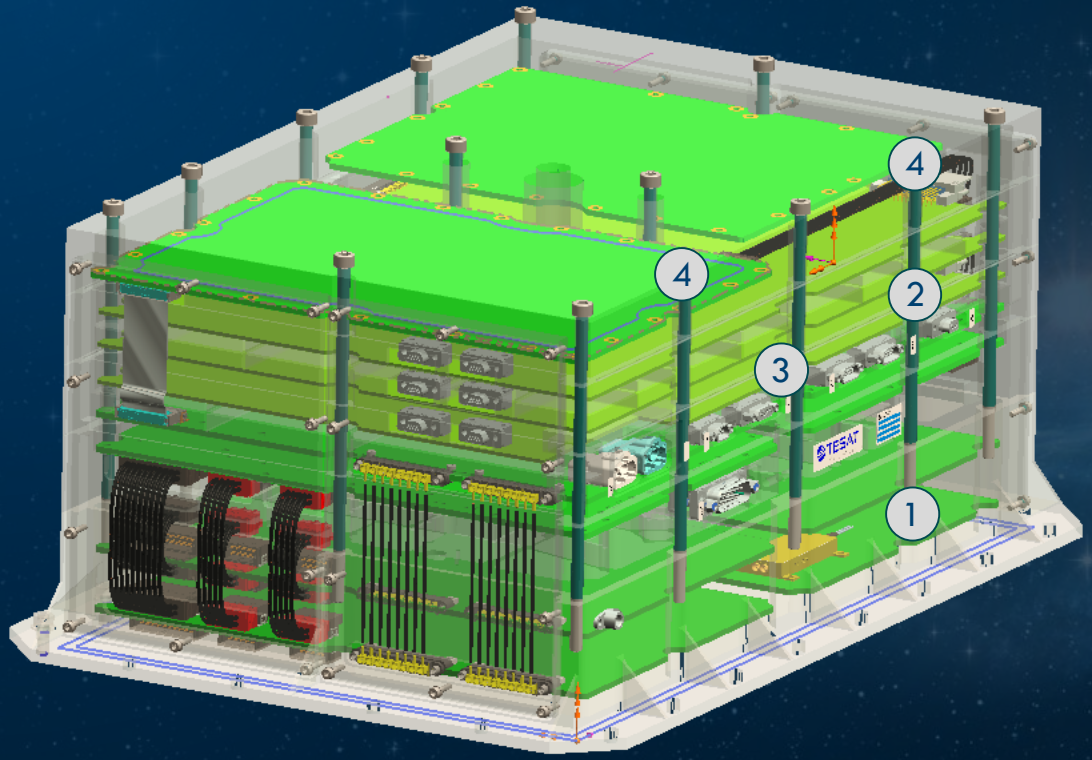
QKD Module



QKD PAYLOAD

1. QKD Transmitter (DLR & TESAT)
2. QKD Processor (TSD)
3. SW Development (TSD, SES, AIT and ESC)
4. 2x QRNG (IDQ & OHB)

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QKD Transmitter

- complex optical architecture
  - challenging fibre network
  - large number of optical components
    - lasers (c-band)
    - SOAs/BOAs
    - modulators (phase, intensity, IQ)
    - photo diodes
    - interferometers
    - …
- needs to be simplified
  - → Photonic Integrated Circuits

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QKD Transmitter

What is required:

- » integration onto as few PICs as possible
  - » agnostic to platform but it must withstand space environment
    - » thermal conditions -40°C to +80°C
    - » radiation tolerant (gamma/ion)
    - » vacuum compatible
    - » shock and vibration resistant to be compliant with launch conditions
- » industrialised manufacturing process
  - » reproducibility is key
- » delivery of components ready for packaging @TESAT

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Summary

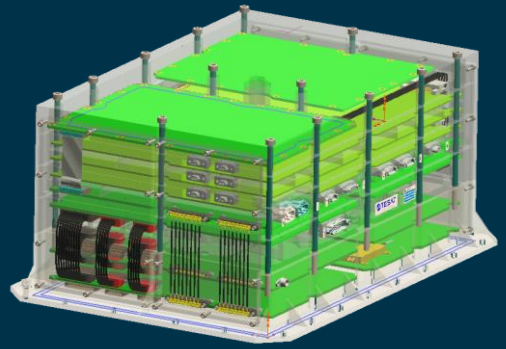
» EAGLE-1 is the first European E2E QKD mission

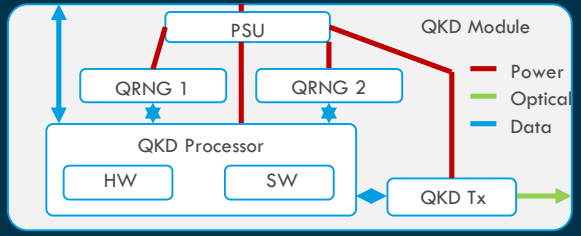
» Major step for QKD technology made in Europe

» Will enable demonstration of satellite-based QKD in real-life scenarios

» Paves the way for commercialization of space-based Quantum Key Distribution

» Ensures European independence with respect to cryptographic Quantum Technologies





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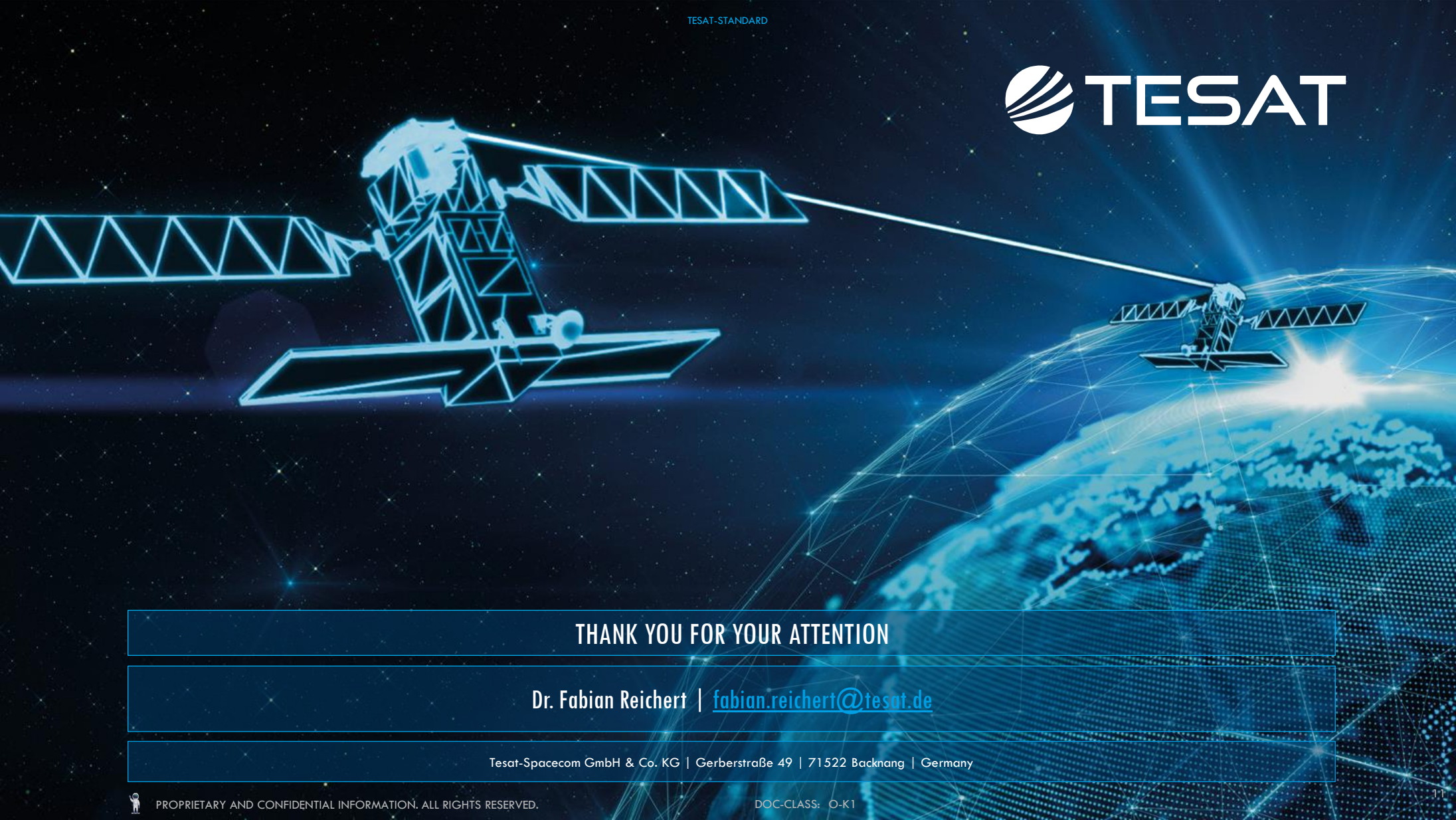

THANK YOU FOR YOUR ATTENTION

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