
# GeReLEO-SMART Project Status

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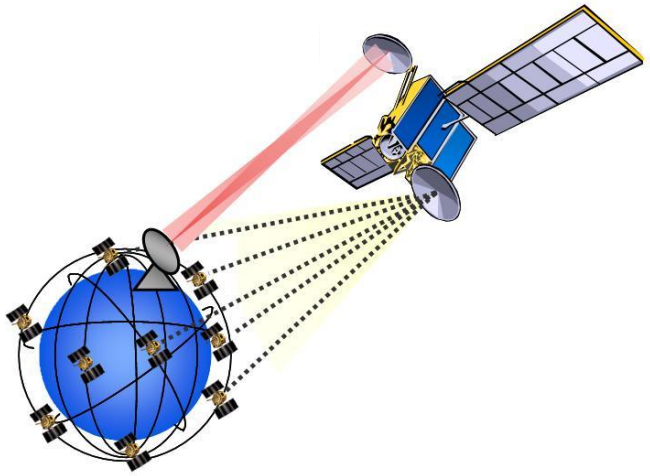
# Main Topics

## Key Questions to be answered:

- What is the purpose of the GeReLEO project?
- How is GeReLEO-SMART related in this context?
- What is the benefit of GeReLEO-SMART?
- Which technical components are included and which function do they fulfill?

# Purpose of the GeReLEO Project

## Geostationary Relay of LEO satellites



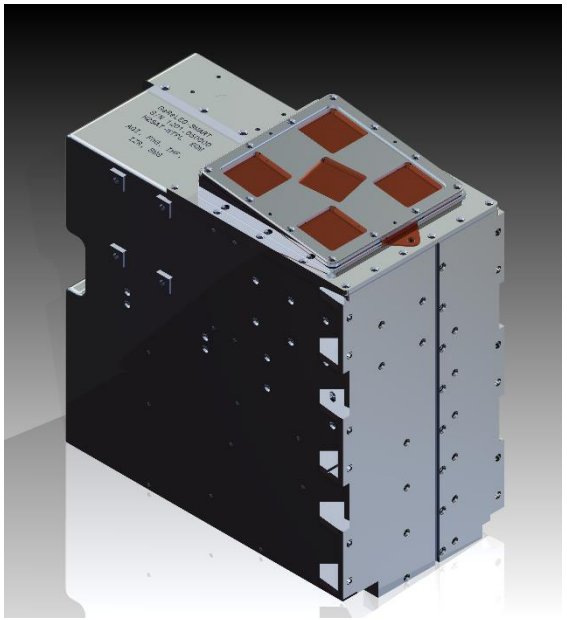
- Standard communication/data link for LEO
  - Contact time LEO → ground is short
  - Low data throughput
  - Several ground stations needed

- Main idea:
  - LEO transmit up to GEO relay
  - Visibility of GEO relay from LEO ~70%
  - GEO relay transmits to ground by fixed high-speed downlink
  - Parallel links to high number of LEO satellites

- Development of key technologies for a GeReLEO System:
  - Multi beam Ka-Band antenna for the GEO relay satellite → GeReLEO-SMART
  - Multi user access for com-link to satellites (LEO Modem) → Project GeReLEO MODULOS

# Description of GeReLEO-SMART

## In-Orbit verification of key technology
## Payload onboard Heinrich-Hertz



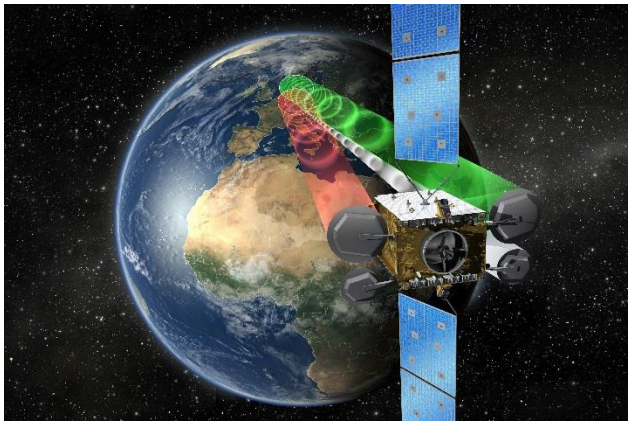
- Multi layer patch antenna with integrated LNA
- Operating frequency Ka band (~ 30 GHz)
- RF MEMS switches to select different antenna  groups
- Filtering and amplification stages
- In-flight reconfigurable FPGA as control logic and TM/TC interface
- Redundant test equipment for new MEMS technology (Airbus, ENAS)

# In-Orbit Verification Experiments

- Communication experiment
  - Ground station simulates LEO satellite uplink
  - GeReLEO-SMART receives signal (different beams selectable) and send it back via H2SAT transponder
  - Demonstration of function
  - Repeated measurement of signal quality and aging effects

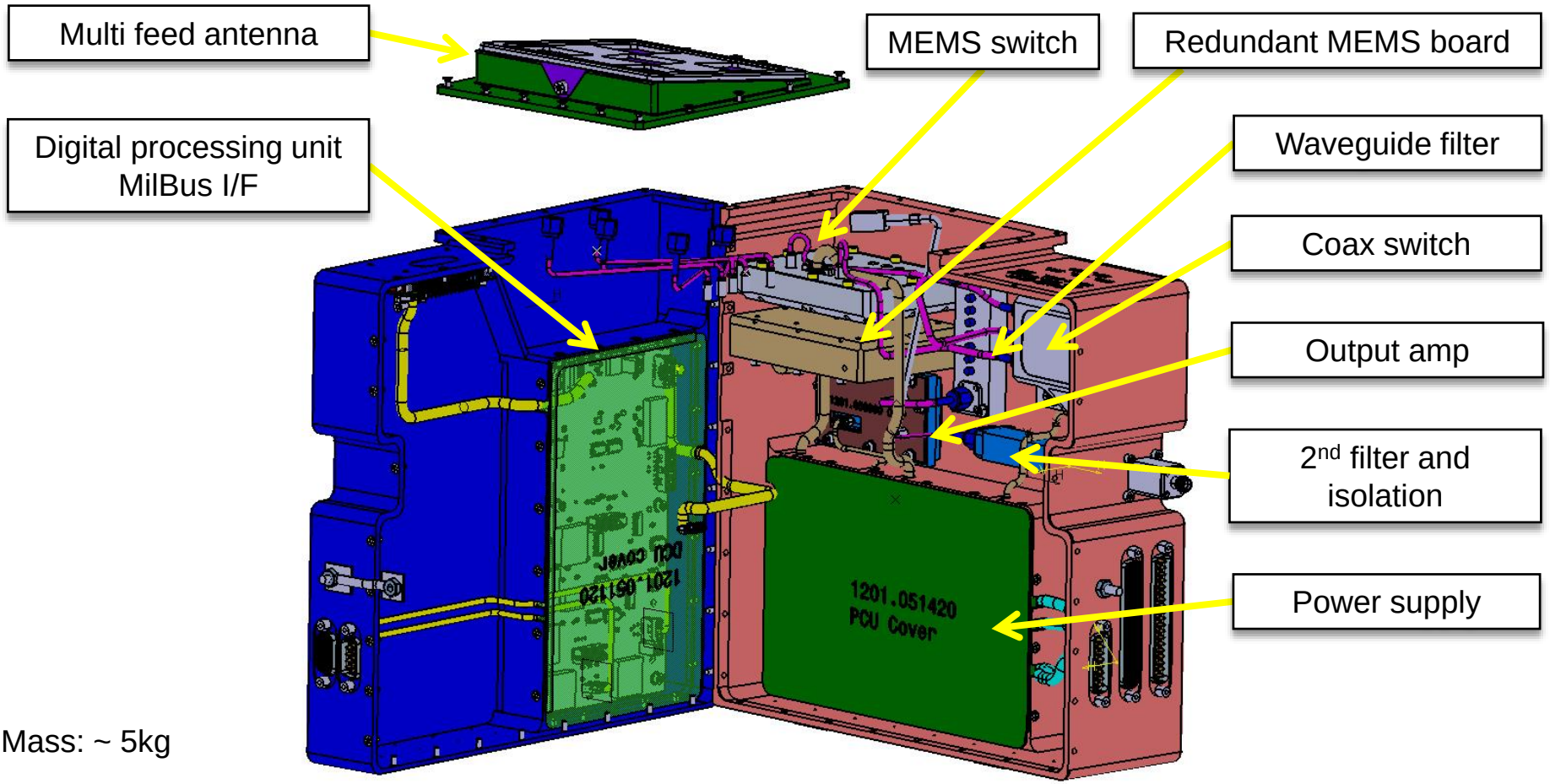
- Reconfiguration of FPGA in-flight via T/C uplink of H2SAT

- Independent MEMS test board
  - Reliability and aging effects of MEMS can be evaluated separately



Source: OHB Systems

# Structural Design of GeReLEO-SMART

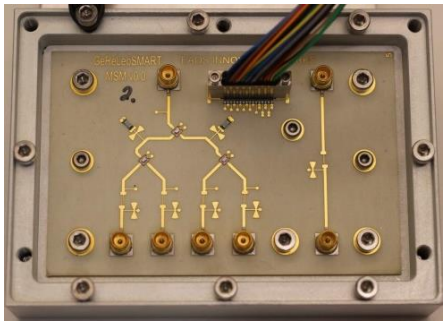



Mass: ~ 5kg

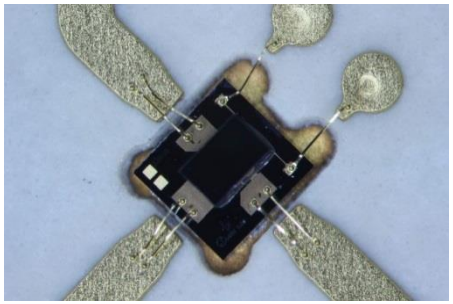
Size: 228 mm x 125 mm x 245 mm

# Completed Tasks

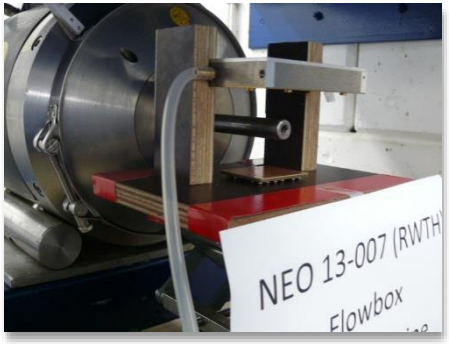
- MEMS switch matrix
  - Improved demonstrator model built and tested
  - Performance requirements are fulfilled
  - Planned improvement: additional LNA stage on board
  - MEMs test board building blocks built and tested



- Multi feed antenna
  - 4 Layer stack containing five times each
    - 2x2 antenna array
    - Integrated preselector bandpass filter
    - Bonded LNA with bias-T
  - Breadboards of different layers built up and tested
  - Radiation test with Co60 for Antenna PCB → passed



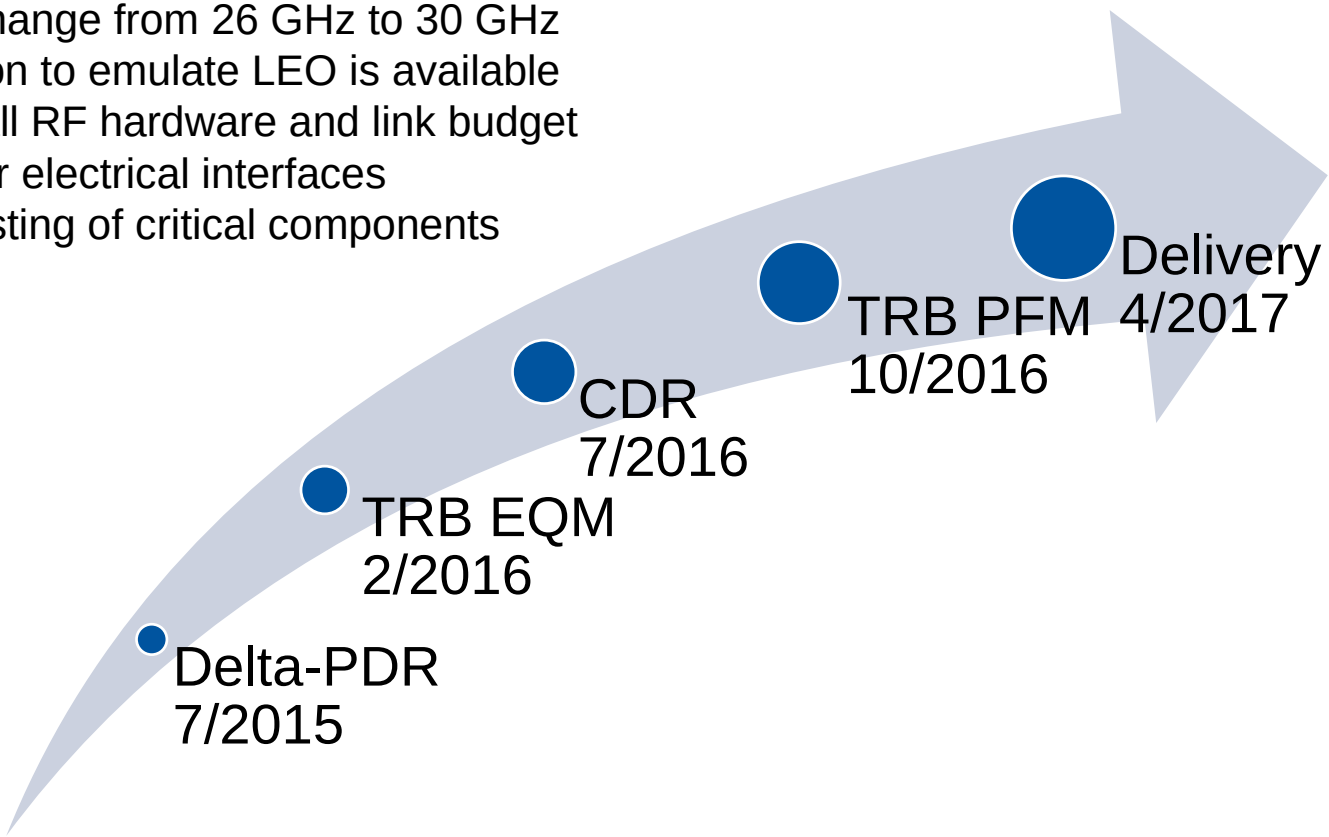
- Digital and analogue control boards designed
  - Power consumption ~15W max.




- Thermal and mechanical design

# Timeline: Project Extension until 7/2017

- Project extension until June 2017
  - Design changes / adaptations
    - Frequency change from 26 GHz to 30 GHz
    - Ground station to emulate LEO is available
    - Adaption of all RF hardware and link budget
    - Scope A/B for electrical interfaces
  - Bread board testing of critical components
  - AIVT of EQM
  - AIVT of PFM



# Thank you
# for your attention

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and our stand in the conference hall