

# Development of an Optical Ground Station (OGS) Network in Germany and Europe

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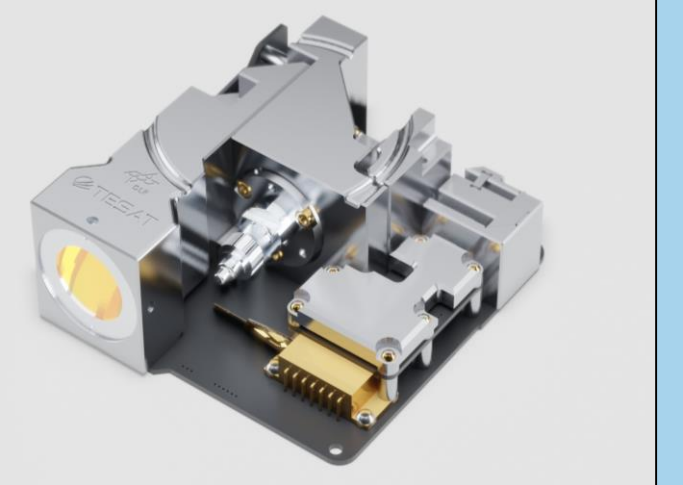
## Advantages of Free-Space Optical (FSO) communication

- No frequency regulation → No licenses necessary
- Large available bandwidth → Data rates up to Terabit/s possible
- Low interference risk and small ground footprint → High level of security on physical layer
- Compact, lightweight, and power efficient optical space terminals → Optimal for small satellites (CubeSats)

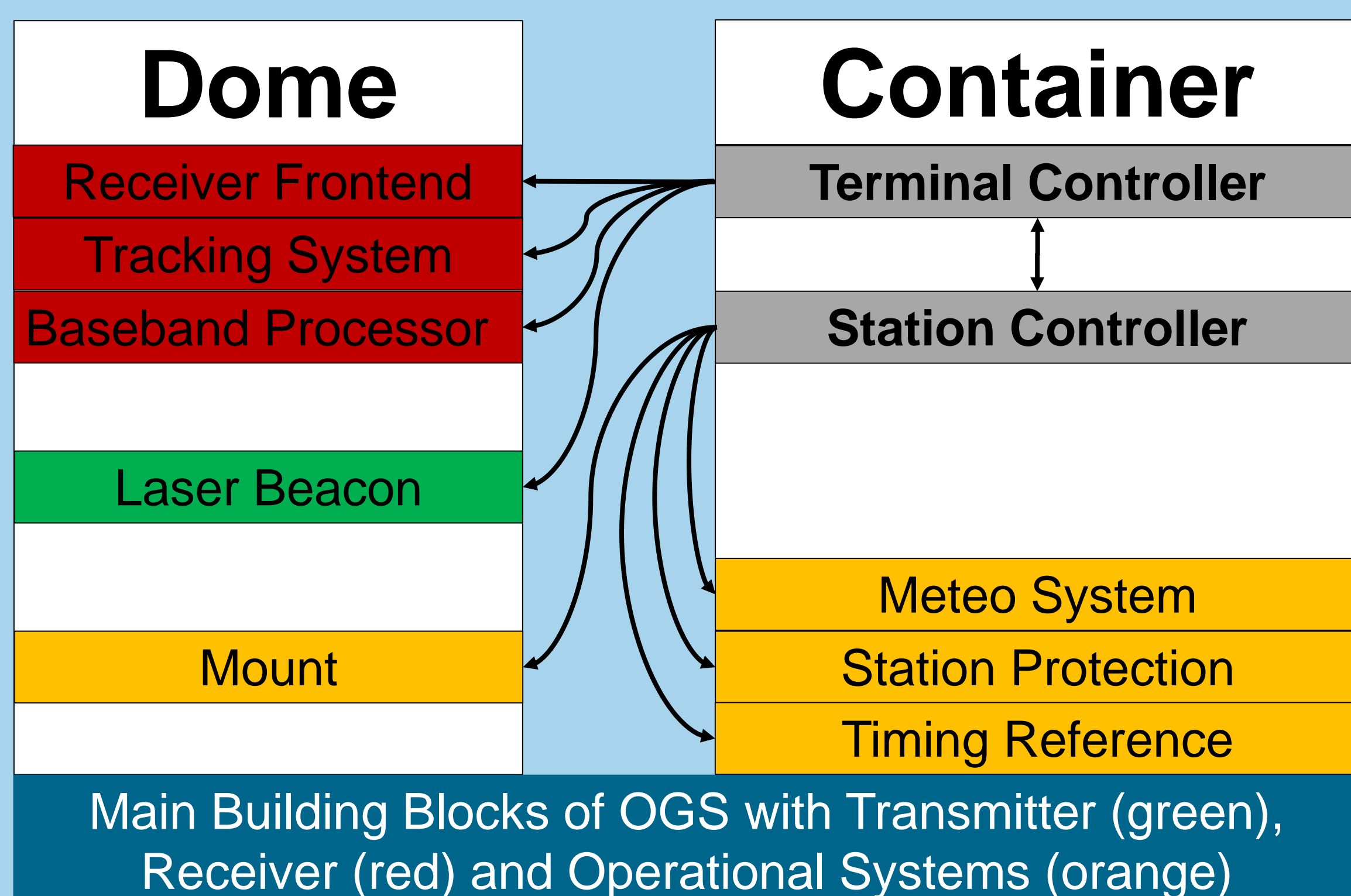
## Challenges and Goals

- Cloud coverage and atmospheric turbulences (scintillations)  
→ Establish a network of Optical Ground Stations (OGSs)

OSIRIS Laser Communication Terminal for CubeSats



Small Optical Focal Assembly (SOFA) attached to telescope

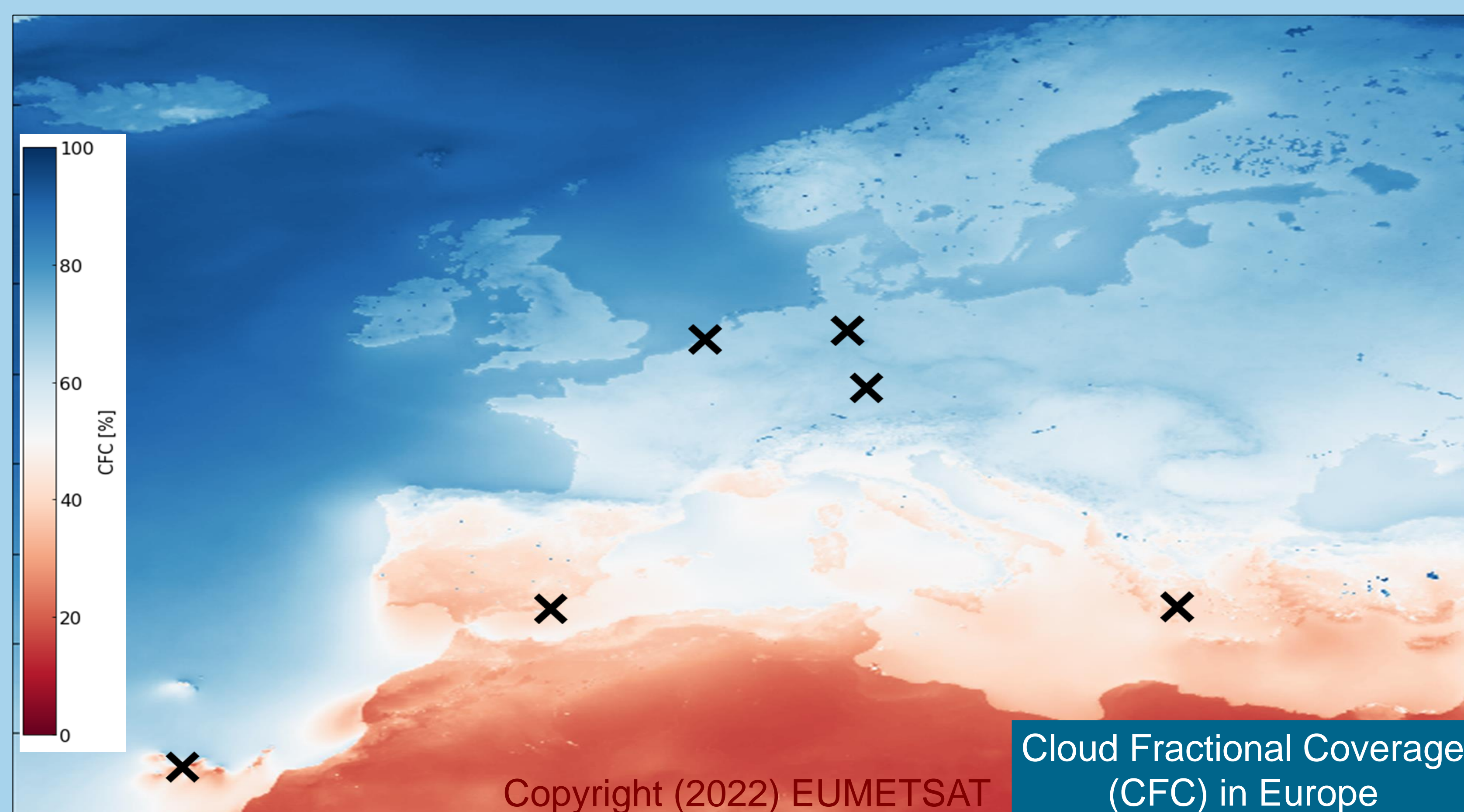


## Laser-Bodenstation Trauen (LaBoT)

- Dome with telescope**
  - 4.5 m dome with 70 cm Ritchey-Chrétien
  - Three exit apertures for optical instruments → e.g. receiver test bench (SOFA)
  - Weather shelter and thermally insulated working platform
  - Laser safety unit and ADS-B receiver for aircraft detection
- Control container**
  - Temporary working space
  - Weather station with AllSky-camera and antennas
  - Deployable station design

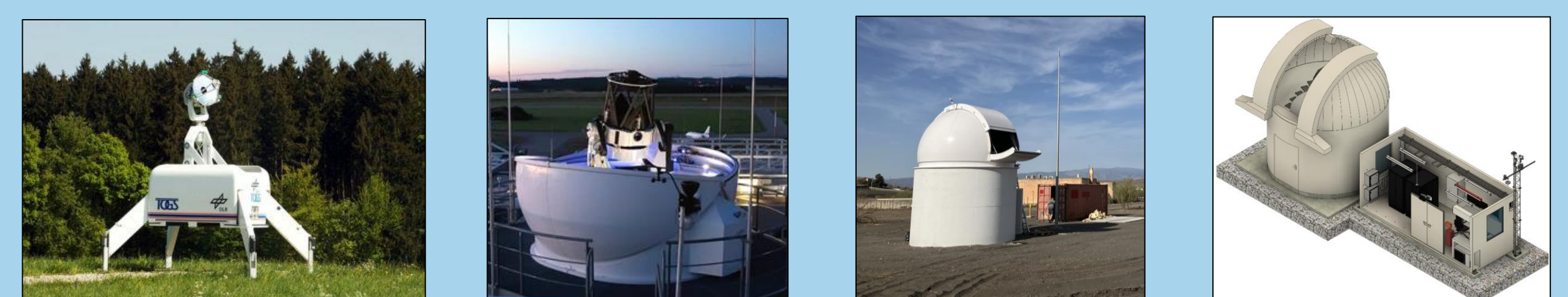
## Optical Ground Station (OGS) Network

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|--|---|
| <b>Germany</b> <ul style="list-style-type: none"> <li>• Oberpfaffenhofen (DLR)</li> <li>• Transportable OGS (DLR)</li> <li>• Trauen (DLR)</li> <li>• Neubiberg (UniBw M, DLR)</li> </ul> | <b>Europe (European Optical Nucleus Network)</b> <ul style="list-style-type: none"> <li>• Almería, Spain (ESA, DLR)</li> <li>• Tenerife, Spain (ESA)</li> <li>• Nemea, Greece (ESA, KSAT)</li> <li>• The Hague, Netherlands (ESA, TNO)</li> </ul> |
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## Outlook

- Consolidate individual stations within OGS network
- Demonstrate interoperability (e.g. link handover)
- Alleviate the impact on optical link availability



### References

- [1] A. Köhler et al.: Setup of the Optical Ground Station in Trauen for Optical Free-Space Communication, 2022.
- [2] R. Schwarz et al.: Optical Ground Station for Free-Space Optical Communication Research and Experimentation, 2023.
- [3] M. Lantschner et al.: An Optical Ground Station for the German Space Operations Center - Status and Outlook, 2019.
- [4] M. Knopp et al.: The Small Optical Ground Stations Focal-Optics Assembly (SOFA), 2022.
- [5] M. Krynitz et al.: The European Optical Nucleus Network, 2021.