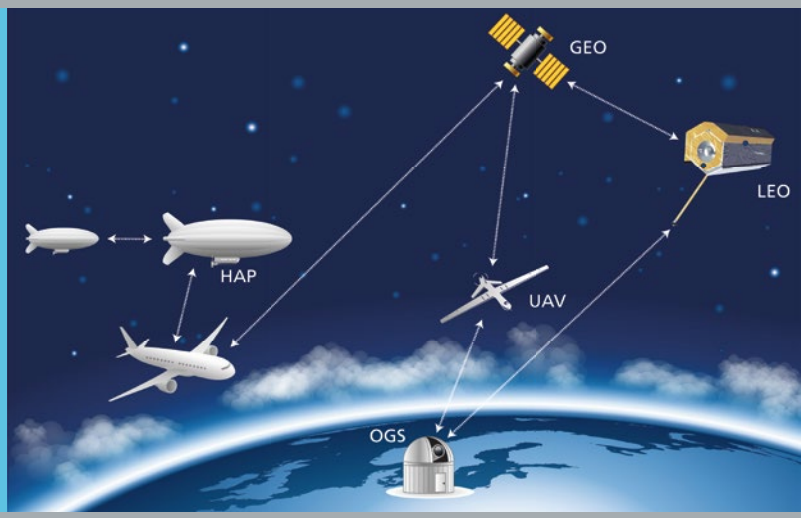
Fraunhofer
Heinrich Hertz Institute

Free-Space Optical Communications

Space and atmospheric optical links



Free-space optical (FSO) links over long distances have been made possible by the development of different key technologies in the near-infrared: high-power lasers, high-speed components, high-sensitivity detectors, cost-efficient optics. In space or through the atmosphere, FSO links increase the capacity (> 1 Gbit/s) and the accessibility (no required license for spectrum usage) of data transmissions. Design issues include atmospheric perturbations, beam tracking and high geometric losses. To face the current FSO challenges, the Fraunhofer Heinrich Hertz Institute (HHI) develops techniques to increase the link reliability and exploits its know-how on fiber-based terrestrial networks.

Challenges

- Mitigation of atmospheric impairments (cloud, turbulence)
- Supply of the very high data rates of fiber communications

Benefits

Advantages compared to radio links

- Larger bandwidth available
- Smaller terminals and lower power consumption
- No spectrum regulation

Compared to fiber links

- Rapid system deployment (e.g. after disasters)
- Communication between mobile terminals

Technical Background

Expertise of Fraunhofer HHI

- Design and fabrication of near-infrared components (1064 nm and 1550 nm)
- Numerical optimization of transmitters and receivers (including optical amplifiers)
- Design of multiplexing techniques (space, wavelength)
- Design of atmospheric mitigation techniques (spatial diversity, adaptive systems)
- Experimental validation of the whole design

Application examples

- Downlinks from Earth-observation satellite
- Feeder link to telecommunication satellite in GEO orbit
- Satellite and aircraft communications
- Quantum key distribution from space

CONTACT

Dr. Nicolas Perlot
Photonic Networks and Systems
Fraunhofer Heinrich Hertz Institute
Einsteinufer 37 | 10587 Berlin | Germany

phone +49 30 31002-782
email nicolas.perlot@hhi.fraunhofer.de
www.hhi.fraunhofer.de/fso