

**ESA/DLR**  
**Complementary De-brief**  
**CCSDS**  
**Optical Communications BOF**

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# Introduction

- Objectives and general briefing by NASA/ESA fully supported
- Complementary ESA/DLR briefing triggered by recent progress and ESA/DLR agreements
- ESA and DLR Optical Space-Space Communications Projects nearing in-orbit demonstration and operational use
  - Related Optical Communications taking the step from DLR 1<sup>st</sup> experimentation (Nfire-TSX; 2007-) towards operational use in an ESA Program (EDRS)
  - ESA/DLR Alphasat/TDP1 launched in 7/2013, IOT in progress and up to now according to plan
  - Alphasat/TDP1 – Sentinels data relay experimentation phase starting 2014
  - EDRS – Sentinels data relay operational services starting 2015
- EDRS at present composed of two GEO /S/C (EDRS-A & - C) and preparing for extension to global coverage. Business case for related Cross Support in related space-space Optical Communication determined
- Agreement between ESA and DLR to make available the air-interface at the core of the Alphasat/TDP1 and EDRS space-space link with Sentinels for interagency cross support
- The Laser Communications Terminal (LCT) Air interface specifications was originally planned to be disclosed to ESA by 2018

# DLR and ESA Optical Communications Experiments and Operations

2012

2013

2014

2015

2016

2017

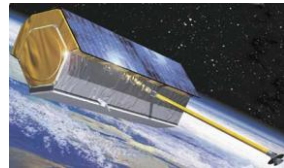
2020

2025

## Technology Demonstrations

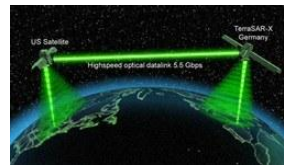
### TerraSar-X (DLR)

- 2009 LEO-ground demo
- 1064 nm, Homodyne BPSK



### TerraSar-X (DLR) to NFIRE (USAF)

- 2008 ISL LEO-LEO demo
- 1064 nm, Homodyne BPSK



### LCT-135/Alphasat (ESA)

- 2013 GEO to Earth demo
- 1064 nm, Homodyne BPSK



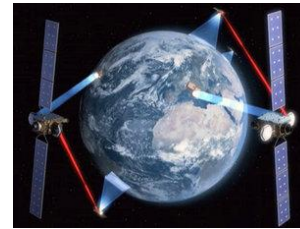
### LCT-135/Alphasat (ESA)- Sentinels

- 2014 ISL, GEO to Earth demo
- 1064 nm, Homodyne BPSK



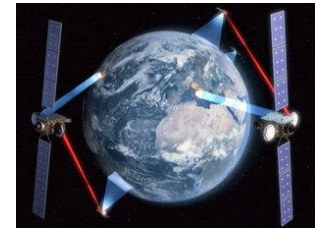
### Sentinel/EDRS (ESA)

- 2014 ISL
- 1064 nm, Homodyne BPSK



### EDRS/GlobeNet (ESA)

- 2020 ISL
- 1064 nm, Homodyne BPSK



LEO-LEO  
LEO-Ground  
Experimentation

GEO-LEO  
GEO-Ground  
Experimentation

GEO-LEO  
Operations

GEO-LEO  
Global  
Operations

# Intersatellite Cross Links

- Intersatellite Cross Links are seen by ESA/DLR at similar level of importance as the already existing concentration of OLSG on space to ground links (As recommended by IOP-3)
- The ESA/DLR system is based on 1064 nm
  - ESA/DLR demonstrations and operations will provide additional data on performance

# New Optical Communication Standards Needed

- In addition to the already identified support to standardization, ESA/DLR would be available to specifically support the
- Blue Book for high signal photon flux optical communications, especially intersatellite crosslinks as well as GEO-Ground

# ESA/DLR Standardization Schedule & Effort Estimate

- Aside from its work on other Books, ESA is available to ensure support of up to 2my for High Photon Flux Blue Book, including prototypes
- Additional support will be ensured by DLR and its industrial partner
- Given the maturity of the existing and emerging in-orbit systems, ESA/DLR propose to start work on the High Photon Blue Book in 2014, incl. use of in-orbit use as CCSDS prototypes

2014                  2015                  2016                  2017                  2018                  2019

**Green Book –  
common link budgets**

Begin —————> Complete

**Blue book – low  
photon flux**

Begin —————> Complete

**Blue book – high  
photon flux**

**Begin** —————> **Complete**

**Blue book –  
meteorological  
data/forecast and  
handover**

Begin —————> Complete

# IOP-3 Communique

**In line with the IOP-3 Communique, ESA/DLR are fully available to jointly work with the other member agencies to prepare for optical communications as the next evolution of space communications; more specifically:**

1. preparing for future cross support space-space optical communications by developing interoperable standards benefiting from the LCT air interface specifications becoming available now
2. seeking collaboration on demonstrations benefiting from results from Alphasat/TDP1 and the Sentinels experimentation
3. sharing the operational experience of EDRS with the Sentinels
4. Assessing the results of the above in-orbit experimentation and operation to verify the feasibility of a common wavelength for a future intersatellite link in the context of a global data relay system in order to facilitate interoperability.
5. Reporting related progress at IOP-4.