European Large Deployable Reflector Subsystem (LDRS) for Earth Observation, Telecommunication and Science Applications

The LDRS contains:
- Reflector Assembly
- Arm Assembly
- HDRM Assembly
- Thermal Hardware
- Electronics, Harness, EGSE
- Test Methods & related MGSE,

with the following typical mass breakdown (example: 12 m LDRS, total mass: 200 kg)

- Reflector 31 %
- Arm 41 %
- Harness 11 %
- Thermal H/W 5 %
- HDRM 11 %

HPS Germany is Europe’s "turnkey supplier" for large deployable reflector subsystems (LDRS), in conjunction with a range of high class partners like LSS and RUAG. Based on many years of constant development in detail driven by ESA technology-programs, by the end of 2017 the European Commission (EC) gave green light to the project of building the first complete LDR-subsystem within the frame of Horizon 2020’s ambitious program aiming at drastically reducing the dependence of Europe on critical technologies from other continents’ suppliers. HPS and its consortium “WeLEA” (from Germany, Portugal, Denmark, Sweden, France, Spain) was chosen to realize the subsystem. In order to acquire flight heritage, HPS will give the final PFM "LEA" for free to any customer worldwide who would like to take advantage of the gift within the frame of his own space project. Since April 2019, WeLEA, led by HPS Germany and contracted by ESA, is now developing two LDRS to fit the two Copernicus missions CIMR and ROSE-L for earth observation applications.

Main LDRS Parameters
- Frequency: L-band up to Ka-band
- Scalable architecture of reflector and arm
- Reflector diameter: 3 m up to 20 m
- Arm length up to 20 m
- Three mesh types: up to L-band, up to Ku-band, up to Ka-band
- Low mass, high stiffness (e.g. < 200 kg, 0.25 Hz for 12 m LDR)
- Small packaging ratio: e.g. 2.6 m x 1.2 m x 0.6 m for a 5.1 m LDRS
- Low height in stowed configuration: e.g. 3 m for 12 m reflector
- Fully European solution (no ITAR items, MAIT in Europe)

Application Examples
- In Orbit Verification:
  - LEA (5.1 m, X-band)
- Earth Observation:
  - CIMR (7-8 m, L- up to Ka-band)
  - ROSE-L (12 m, L-band)
  - TANDEM-L (15 m, L-band)
- Telecom:
  - 3-5 m reflector diameter
  - C- up to Ka-band
  - Two LDRS per satellite panel

Timeline
- 11/2017: LEA-PFM Kick-off
- 12/2018: TRL5 in general
- 04/2019: LEA-PFM CDR
- 04/2019: LEOB-EM Kick-off
- 12/2019: LEOB-EM MRR
- 12/2019: TRL 5-6 up to Ka-band
- 10/2020: TRL6 for X-band & LEA delivery
- 11/2020: CIMR/ROSE-L EQM Kick-off
- 04/2021: TRL6 up to Ka-band
- 05/2022: CIMR/ROSE-L EQM delivery.
Design & analysis for whole subsystem:

- CIMR: 7-8 m, up to Ka-band, rotation 10 rpm
- ROSE-L (design only): 12 m, L-band

Realisation of an Engineering Model

Tests: vibration, thermal cycling, thermo-elastic distortion, 0-g-deployment, RF-test

Customer: ESA (04/2019 - 04/2021)

Lead: HPS (DE), partners: WeLEA-consortium (DE, PT, SE, DK, SP, FR).

LDRS-Related Project Examples

**SCALABLE - REFLECTOR ASSEMBLY (4.5 m, C-band)**

- 4.5 m aperture diameter
- C-band applications
- 0.7 mm RMS “as manufactured”
- 18.3 kg mass (without interfaces)
- Tests: deployment functionality, surface accuracy, repeatability, stiffness
- Customer: ESA (2013 - 2016)
- Prime: HPS (DE), major partner: LSS (DE).

**MESNET - REFLECTIVE MESH & NETWORK (5.0 m)**

- Mesh & network development for Ku-band
- Mesh out of gold plated tungsten
- Mechanical properties investigations
- Realisation of a 5 m Engineering Model

**ABDS - ARM ASSEMBLY (6.1 m)**

- Deployable arm development including HDRM
- < ± 0.5 mm in-orbit accuracy
- Tests: vibration, thermal cycling, thermo-elastic distortion, 0-g-deployment
- Realisation of a 6.1 m Engineering Model
- Customer: ESA (2016 - 2018)
- Prime: HPS (DE), main partners: RUAG (DE), INVENT (DE), DLR (DE), INEGI (PT).

**LEA - LARGE EUROPEAN ANTENNA (5.1 m, X-band)**

- PFM development of whole subsystem
- 5.1 m reflector (X-band), 5.6 m arm
- 0.4 mm in-orbit RMS, 100 kg subsystem mass
- Tests: vibration, thermal cycling, 0-g-deployment, RF-test
- Ready for flight: 11/2020 (looking for IOV)
- Grant contract by: EC (2017 - 2019)
- Lead: HPS (DE), partners: WeLEA-consortium (DE, PT, SE, DK, SP, FR).

**LEOB - LDRS FOR EARTH OBSERVATION (8 m + 12 m)**

- Design & analysis for whole subsystem:
  - CIMR: 7-8 m, up to Ka-band, rotation 10 rpm
  - ROSE-L (design only): 12 m, L-band
  - Realisation of an Engineering Model
  - Tests: vibration, thermal cycling, thermo-elastic distortion, 0-g-deployment, RF-test
  - Customer: ESA (04/2019 - 04/2021)
  - Lead: HPS (DE), partners: WeLEA-consortium (DE, PT, SE, DK, SP, FR).