



MERLIN

MEthane Remote sensing LIdar missioN



Mission Goals:

- Global information on atmospheric methane (CH_4) concentration (methane column density) with an accuracy better than 2% and with a spatial resolution of 50 km along track also under cloudy and variable sun illumination conditions.
- The main data product is column-weighted dry-air mixing ratio of CH_4 .
- Improved knowledge on contribution to the atmospheric methane amount from energy production, wild fires, wetland changes due to climate change such as melting of permafrost soils and ocean sediments (gas hydrates).
- Improved understanding of CH_4 sources and sinks and their interactions with Earth climate.
- Improved data quality concerning anthropogenic and natural methane emissions.
- Significant contribution to climate change prediction

Payload Concept:

- MERLIN is the first space-based Integrated Path Differential Absorption (IPDA) Light Detecting And Ranging (LIDAR) instrument.
- It determines the total methane column density between satellite and Earth surface or cloud top height. The methane amount is calculated from different absorptions at two laser wavelengths, reflected on Earth surface or cloud tops.
- It consists of a frequency stabilized high-power laser (20 Hz double pulse of 9 mJ pulse energy, wavelength around 1.645 μm) as transmitter, and a receiver section consisting of an off-axis telescope (\varnothing 690 mm) and a sensitive signal chain (baseline: InGaAs APD detector).

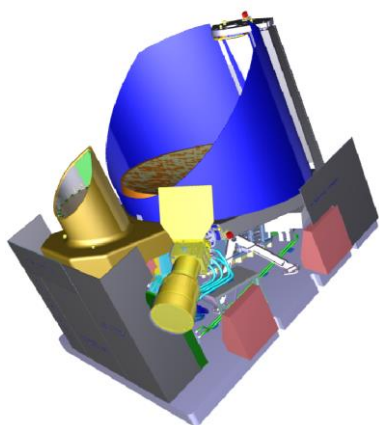
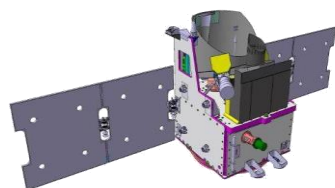
Contributors:

- The MERLIN climate mission is a joint French-German cooperation, performed by the national space agencies, CNES and DLR Space Administration.
- France contributes by its MYRIADE Evolutions satellite platform and its satellite control centre. CNES is mission prime and operates the satellite. The data processing centre is developed and operated in France, with a German contribution for Level 1 processing development.
- Germany contributes by providing the IPDA LIDAR instrument, to be developed by German industry and German research institutes.
- Science activities are led by two Co-Principle-Investigators from the French laboratory from CNRS and the German Institute for Atmospheric Physics from DLR, with additional support of several French and German Research Institutes.
- The satellite is developed by Airbus DS SAS (France) which provides the MYRIADE Evolutions platform and Airbus DS GmbH (Germany) builds the methane IPDA LIDAR instrument. The industries are under contracts by CNES and DLR Space Administration, respectively.



MERLIN

MEthane Remote sensing Lidar mission



MERLIN: MEthane Remote sensing Lidar mission

MERLIN is a dedicated mission of the global methane (CH₄) monitoring.

It is a joint French-German cooperation on the development, launch and operation of a climate monitoring satellite.

The MERLIN mission aims to improve the understanding of the global methane cycle and the exploration of the nature of the processes, which govern the exchange of methane between atmosphere and biosphere.

Observation Method

Differential absorption of gaseous methane at two laser wavelengths reflected from Earth surface or dense clouds.

Mission Duration

Launch 2020
Lifetime 3 years (+1 year)

Mission Orbit

Orbit type Quasi circular sun-synchronous (LTAN = 06:00 or 18:00)
Altitude ≈ 500 km
Inclination ≈ 97.4°
Repeat cycle 28 days
Attitude control 3-axis stabilised - Geocentric
Eclipse phase ≤ 20 min / orbit during winter

Satellite

Dimensions ≈ 1480 x 1220 x 1700 mm³ (solar array stowed)
Dimensions ≈ 1480 x 4580 x 1700 mm³ (solar array deployed)
Mass ≈ 400 kg
Power ≈ 480 W

Platform

Type MYRIADE Evolutions line
Provided by CNES
Contractor Airbus Defence & Space France
Mass ≈ 270 kg
Power ≈ 200 W

Deployable solar array and Battery

AOCS

Star tracker and Reaction wheels

Payload

Type: Integrated Path Differential Absorption (IPDA) LIDAR (Light Detecting And Ranging) for Methane column density measurements

Provided by DLR
Contractor Airbus Defence & Space Germany
Mass ≈ 120 kg
Power ≈ 150 W

Communication link

X-Band downlink ≈ 180 Mbps
S-Band downlink ≈ 1 Mbps
S-Band uplink ≈ 34 kps

Satellite Control Ground Segment

Spacecraft control, monitoring and orbit control exploitation performed by the CNES facilities located in Toulouse (France)

Training Operation and Maintenance Simulator

System numerical simulator developed by CNES with DLR contribution and operated by CNES in Toulouse (France)

Payload Ground Segment

Payload monitoring and control exploitation performed by the DLR facility located in Oberpfaffenhofen and Bochum

Payload data processing exploitation performed by the CNES facility located in Toulouse

Science Product Expertise

Scientific product quality validation exploitation by CNES and DLR

Launch base and vehicle

TBD taking into account the potential co-passenger opportunity

Industry contractor

Satellite developed by Airbus DS SAS (France)
Payload developed by Airbus DS GmbH (Germany)