EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Dr. Volker Klein
OHB System AG - Munich, Germany

Mr. Maximilian Freudling
OHB System AG - Munich, Germany
Dr. Timo Stuffler
OHB System AG - Munich, Germany
Mr. Gerhard Ehret
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany
Mr. Matthias Alpers
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany
Mr. Markus Bode
Airbus DS GmbH, Germany
Mr. Christian Wührer
Airbus DS GmbH, Germany
Mr. Pierre Flamant
Ecole Polytechnique, France

# THE FRENCH-GERMAN CLIMATE MISSION MERLIN

**Abstract**

Besides carbon dioxide, methane is of major importance for theoretical investigations (numerical modelling) of terrestrial climate conditions. In order to establish a solid data base of methane sources and flux on a global basis, the development of the space borne laser system MERLIN was initiated. MERLIN is a path integrating active remote sensing system (Lidar) for column density monitoring of CH4. This project is a French-German collaboration, where France is supplying the satellite platform (Myriade) and Germany is contributing with the Lidar instrument. On the German side, an industrial consortium, comprising Astrium GmbH and Kayser-Threde GmbH is realizing this instrument, where Astrium is acting as the prime leader and is contributing with the transmitter laser. Kayser-Threde is responsible for the optical receiver system and the signal chain. Research scientists from CNES and DLR are the principle investigators for this mission. This project is currently being studied in Phase-A as preparation for its subsequent realization (launch in 2014). Once in operation, the Lidar instrument onboard the Myriade satellite will perform its measurements from an orbit height of about 500 km (sun synchronous). The transmitter laser is emitting pairs of pulses at a dedicated wavelength at 1645 nm; tuned to CH4 spectral absorption features and close-by for reference. This sounding is performed along track in nadir orientation. A 690 mm diameter receiver telescope is picking up the optical return signals from the Earth surface and is feeding this information to an electrically cooled InGaAs photodiode. In order to compensate for deviations in the laser pulse energy, an internal calibration path is feeding its signal to this detection unit as well. Based on the round trip time of the emitted laser pulses, an exact height determination (satellite above terrain) is carried out for later data evaluation. Based on this height information and an actual map of the global atmospheric pressure distribution, the CH4-induced absorption of the received laser return signal is converted into path-integrated methane abundance along the sub satellite track. By this "Integrated Path Differential Absorption" (IPDA) method, Merlin is finally creating and maintaining a

global grid of data points of CH4 column density with significant weight of the low troposphere close to the sources on ground. These data will be used in extensive numerical models for the prediction of methane sources on the Earth surface and future terrestrial climate conditions.

The MERLIN mission is funded by CNES (France) and DLR (Germany).