FLIGHT CAMPAIGN »CHARM-F«

Task

Within the »CHARM-F« project (CH_4 Airborne Remote Monitoring – Flugzeug), Fraunhofer ILT has developed two Nd:YAG pump lasers as well as their control and supply units for an airborne LIDAR system to measure the greenhouse gases CO_2 and CH_4. The pump lasers are used to drive the optical parametric converters from the Institute of Atmospheric Physics (DLR-IPA). The LIDAR system is designed specifically for use on the research aircraft HALO (High Altitude and Long Range Research Aircraft) to simultaneously measure both trace gases. The »CHARM-F« system can measure the amount of gas in a column between the aircraft and ground.

Method

Both pump sources contain a single-frequency oscillator that supplies double pulse pairs at a repetition rate of 50 Hz, each having a pulse duration of approximately 30 ns and a pulse energy of 8 mJ, at nearly diffraction limited beam quality. In both systems, they are amplified in an INNOSLAB stage to 75 mJ. In the CO_2 system, the pulses are amplified to 150 mJ in a second INNOSLAB stage. A separate rack houses the supply of the pump laser. The project partner DLR-IPA is responsible for the conversion in the measurement wavelength of 1645 nm for the CH_4 and 1572 nm for the CO_2 system as well as for the entire measuring system. Both lasers and rack are designed so that they meet the requirements for equipment for flight operations in the DLR jet.

Result

Under the first test flight campaign in spring 2015, both systems were used successfully to measure both gases over Poland, Italy and Germany in five flights in a total of 22 flight hours.

Applications

The CHARM-F system will be used on different climate research missions in the future. Such measurements are an important step towards a deployment of satellite-based systems, as they are currently being developed in the MERLIN project at Fraunhofer ILT. The technology can also, in principle, be adapted to determine other atmospheric parameters such as wind speed or the distribution of other trace gases. Alongside climate research, such parameters play an important role, for example, in the evaluation of wind farm areas, in industrial gas monitoring or in the measurement of turbines.

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3 Laser and supply rack in the HALO airplane.
4 Measurement flight with a view of the Hambach and Düren strip mines.