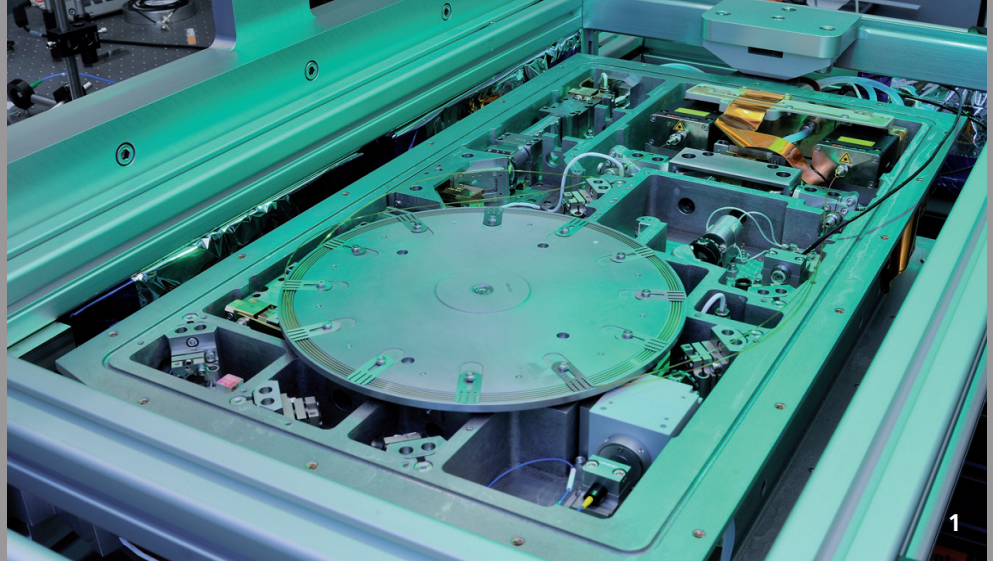

COMPACT LASERS FOR AIRPLANE-SUPPORTED LIDAR SYSTEMS

Task

In climate research, scientists have a long-term goal: to be able to identify, both completely and globally, all the data relevant to the climate with high spatial resolution and then use them as the basis for improving climate models. In the future, these data should be generated using satellite-based LIDAR systems. As technology demonstration models, airplane-supported systems are an important step in that direction.

A beam source to measure wind speed profiles as well as OPO pump sources to conduct density measurements of CO_2 and CH_4 were developed for research projects of the German Aerospace Center (DLR). They fulfil the special requirements upon efficiency, compactness, robustness and security resulting from use in aviation.

Method

The three lasers were conceived as a multi-stage MOPA system with Nd:YAG crystals. The spectral beam characteristics are generated in an oscillator in longitudinal single-mode operation at low pulse energy (~ 10 mJ) and then amplified in an INNOSLAB amplifier stage to 100 – 200 mJ. The target wavelength needed for each application is generated in a down-stream frequency converter stage. The optical components are compactly arranged on both sides of a monolithic carrier structure optimized by means of R&D simulations.

Result

The stable longitudinal single-mode operation of the oscillators was demonstrated at pulse energies of 8 to 10 mJ, a repetition rate of 100 Hz and a pulse duration of 35 ns, and then it was optimized to the special requirements of each of the measuring methods. The pulse energy was scaled to 80 mJ in a first amplifier stage and to 150 mJ in a second stage. The CH_4 system was used successfully to pump an OPO on the customer's premises.

Applications

In the field of climate research, further climatic values can be captured, in addition to the named measurement tasks, by adapting beam parameters, e.g. wavelength. In the industrial sector further applications follow: monitoring industrial plants, conducting leak tests of gas pipelines or surveying wind fields. The system's compact and robust construction technology can be used to develop beam sources spanning many different systems.

Contact

Dr. Jens Löhring
Telephone +49 241 8906-673
jens.loehring@ilt.fraunhofer.de

Dipl.-Phys. Marco Hoefer
Telephone +49 241 8906-128
marco.hoefer@ilt.fraunhofer.de

1 Oscillator and INNOSLAB amplifier of the pump beam source for the CH_4 measurement system.