

# Laser beam source for satellite-based wind measurement

The AEOLUS mission of the European Space Agency ESA measures, among others, the global wind distribution in the atmosphere with a satellite-based Doppler LIDAR instrument. The follow-up mission AEOLUS-2 planned by ESA and the satellite operator EUMETSAT requires a more powerful laser beam source with longitudinally monofrequency laser pulses of 150 mJ energy at a pulse repetition rate of 50 Hz and a wavelength of 355 nm. In cooperation with Airbus Defence and Space, Fraunhofer ILT is developing an engineering model of the laser beam source for AEOLUS-2.

## Development of a thermal system

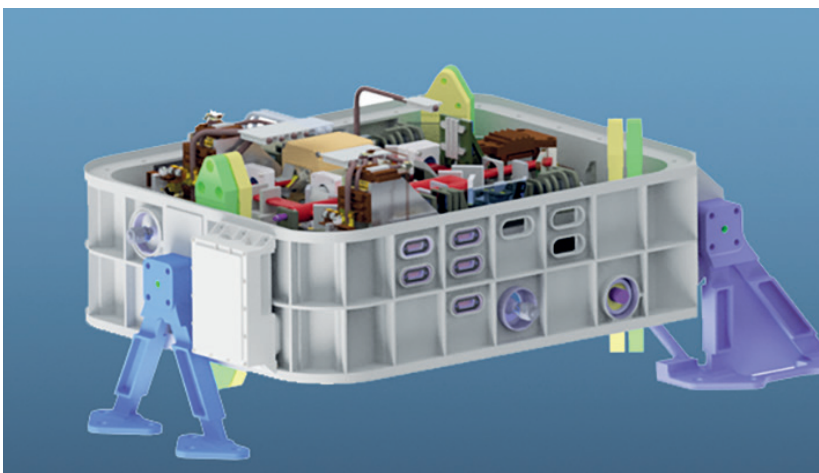
The laser design is based on the results from the NIRLI project completed in 2016, in which the ILT set up a configuration consisting of a Q-switched oscillator and two subsequent Nd:YAG INNOSLAB amplifiers. This system demonstrated more than 500 mJ of pulse energy at a wavelength of 1,064 nm. The frequency is converted to a pulse energy of 150 mJ in the UV with the aid of two LBO crystals. Based on the experience gained in the MERLIN project, Fraunhofer ILT is developing a thermal system to dissipate the heat loss under space conditions. The dissipated heat of about 300 W can vary depending on possible applications and aging effects. Comparatively narrow temperature windows must be maintained in the thermal system during its entire period of use. The development is being carried out in close cooperation with Airbus Defence and Space and SpaceTech.

## Years of stable and maintenance-free operation

A detailed design of the laser beam source was created and accepted by ESA as part of a Detailed Design Review (DDR). In the model, the dissipated heat is efficiently conducted out of the housing by means of heat pipes, so that only a small fraction of the power dissipation couples into the baseplate. This allows stable operation over a wide temperature range. The components are currently being procured, and the baseplate is being manufactured in the ILT's own mechanical workshop. The institute will begin integrating the demonstrator in the next few months. The results obtained are primarily of interest for LIDAR laser beam sources used in harsh environments such as satellites, aircraft or helicopters. Since the setup technology ensures stable and maintenance-free operation for many years, the findings can also be used to develop solid-state lasers suitable for industrial use or small compact beam sources.

The work is being carried out on behalf of ESA under contract numbers 40001323/20/NL/AD and 4000137280/22/NL/IA.

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*CAD model of the AEOLUS-2 – Laser Transmitter-EM.*