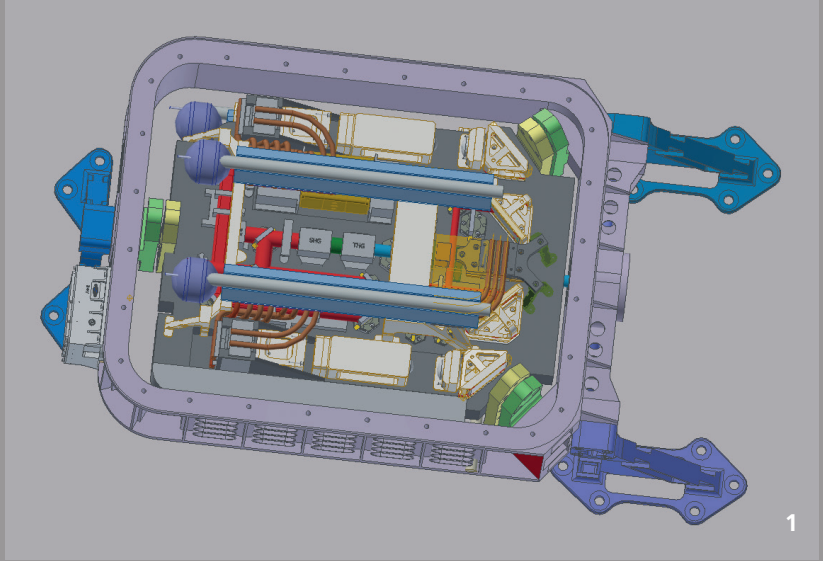

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LASER BEAM SOURCE FOR SATELLITE-BASED WIND MEASUREMENT

Task

As part of the European Space Agency's AEOLUS mission, the global wind distribution in the atmosphere is currently being measured with a satellite-based Doppler lidar instrument. For the follow-up mission AEOLUS Follow-On planned by ESA and the satellite operator EUMETSAT, a more powerful laser beam source is required – which can emit single frequency laser pulses of 150 mJ energy at a pulse repetition rate of 50 Hz and a wavelength of 355 nm. Fraunhofer ILT is currently developing an engineering model (EM) of the laser beam source in cooperation with Airbus Defense and Space.

Method

The laser concept is based on the results of the NIRLI project completed in 2016, in which Fraunhofer ILT built a laser consisting of a Q-switched oscillator and two downstream Nd:YAG INNOSLAB amplifiers based on Nd:YAG. This 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 two LBO crystals. For AEOLUS-Follow-On, space-qualified components are available for the oscillator and the first amplifier stage. For the second INNOSLAB amplifier stage and the frequency converter, the size of the optomechanical components needs to be scaled up. Using the experience gained in the MERLIN project, the institute is developing a thermal system for dissipating the heat loss of about 300 W under space conditions. It is working on the EM design in close collaboration with Airbus Defense and Space and SpaceTech.

Results

A complete preliminary design of the laser beam source was created and accepted by ESA during a preliminary design review (PDR). In the model, the heat dissipation 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.

Applications

The results obtained in the project are primarily of interest for lidar laser beam sources in harsh environments such as satellites, aircraft or helicopters. The setup technology enables stable and maintenance-free operation for many years so that 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 the European Space Agency (ESA) under contract number 4000132323/20/NL/AD.

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1 CAD model of the AEOLUS follow-on transmitter.

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