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## MERLIN – CRITICAL DESIGN REVIEW (CDR) COMPLETED

### Task

Fraunhofer ILT is developing and building the Laser Optical Bench as the core element of a laser beam source for the German-French climate mission MERLIN (Methane Remote Sensing LIDAR Mission). This bench constitutes the laser transmitter along with the pressure housing developed by Airbus and the cooling, supply and control units.

The aim of the mission is to measure the greenhouse gas methane in the Earth's atmosphere from a satellite. The laser pulses backscattered from the Earth's surface will provide information about the methane concentration of the overlying atmospheric column. Generating the laser pulses with the required properties is not the only challenge here: The complex and compact laser system must also be insensitive to strong vibration and temperature fluctuations. Since the enclosed system must have a service life of more than three years, it is necessary to do without outgassing materials to avoid contamination.

### Method

Fraunhofer has developed the final detailed design of the Laser Optical Bench and verified the resilience of the system to all environmental loads encountered with an extensive analysis campaign. Likewise, the laser performance was analyzed for all operating conditions and load scenarios occurring on the satellite. In parallel, the institute procured long-lead items.

### Results

In addition to the optical elements, the design includes a passive cooling structure and an electrical harness for signal, high-current and high-voltage transmission for laser operation. Soldering techniques are used to contact electrical components and to mount the optics, ensuring robust, ultra-precise and contamination-free connections for a long service life. The institute has demonstrated that the system is able to resist environmental loads and that it performs as required. After the successful completion of the CDR, the client Airbus Defence and Space GmbH and DLR Space Management confirmed and approved the design. The procurement of components has been largely completed and the first laser baseplate prepared for the integration of the functional components.

### Applications

The model philosophy and the assembly concept can be transferred to other laser beam sources. This applies to both aerospace and industrial applications, where high reliability and robustness are key factors.

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2 Prepared laser base plate.