



LASER OPTICS FOR HUMANITARIAN MINE CLEARING

Task

In many former war zones, mines, cluster munitions and unexploded bombs still lie in the ground long after conflicts ended. They constitute a high level of danger to the public and also severely restrict the agricultural use of these areas. Since many of these explosives are partially corroded and in an undefined state, defusing them manually poses a high risk.

Method

Laser radiation can be used to neutralize these explosive devices from a safe distance – without having to contact them. When the explosive sheathing is tapped, the housing can be opened and the charge ignited so that the explosives burn off and the combustion gases can escape without initiating a detonation.

To remotely focus a diffraction-limited laser beam, an optic was designed for the wavelength range around $1 \mu\text{m}$, which can be focused on a spot diameter of less than 2 mm at a distance of 100 m. With this system, holes can be drilled having a few mm in diameter into the housing of anti-personnel mines and unexploded bombs.

1 Laboratory test on a steel plate with a thickness of 1.5 mm.

2 Prototype of the remote focusing optics on a tripod.

Result

In laboratory tests the effect of the laser radiation was examined on housing materials such as Bakelite and steel. Depending on the material and wall thickness, laser powers between about 200 W and 1000 W are required to produce openings having several millimeters in diameter within seconds (Figure 1).

The remote focusing optics was built as a laboratory prototype (Figure 2) and is now being characterized in terms of its optical imaging quality and the allowable laser power. Soon, thus, an optical system for testing of laser-based mine clearance will be ready.

Applications

The laser-based neutralization of mines and explosive devices justifies the effort whenever a manual evacuation is associated with a high risk. Moreover, the laser-assisted defragmenting of explosives can allow access to the ignition device or reduce the amount of detonatable material for the planned explosion.

The work was funded within the context of the EU project »Demining toolbox for humanitarian mine clearing (D-Box)« under the number »FP7-Security No. 284996«.

Contacts

Dr. Martin Wehner
Telephone +49 241 8906-202
martin.wehner@ilt.fraunhofer.de

Dipl.-Ing. Dipl.-Wirt.Ing. Martin Traub
Telephone +49 241 8906-342
martin.traub@ilt.fraunhofer.de