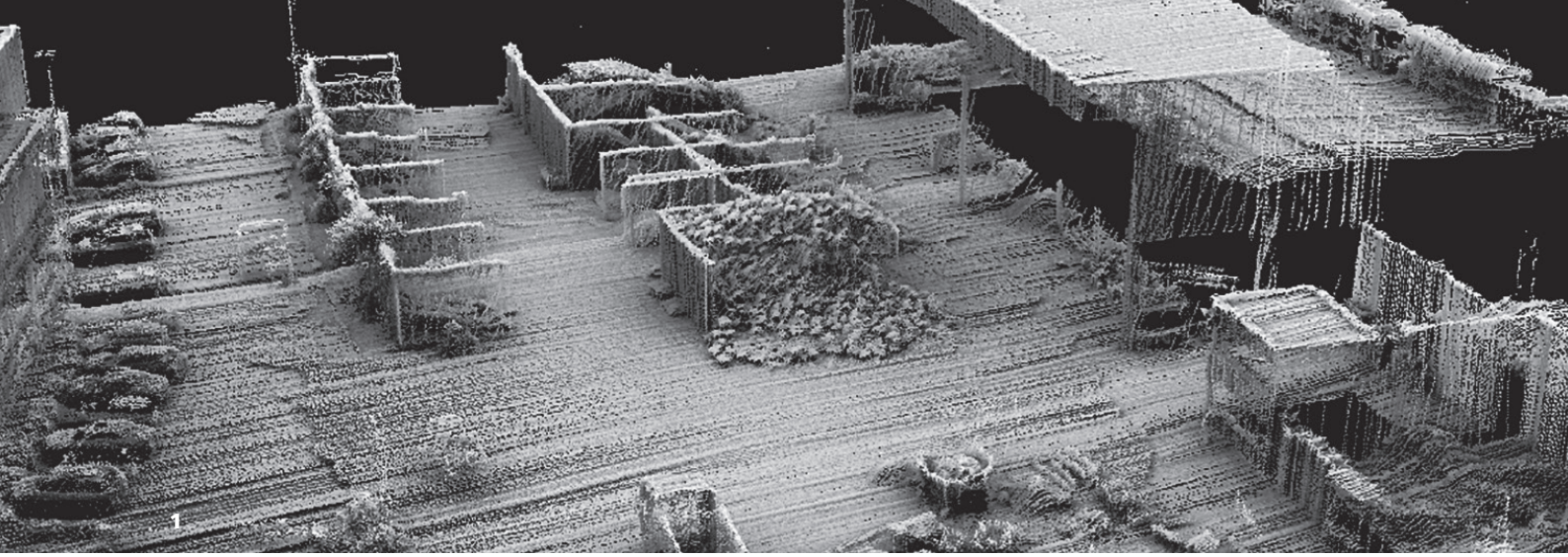

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LASER SCANNING

Collecting data from the air

From impassable terrain to crisis-hit regions, UAVs (unmanned aerial vehicles) are the number one choice for use in locations where it could be dangerous for people to measure infrastructure. Mounted onto small, flying platforms, measurement systems are able to collect data about large areas and complex structures quickly and efficiently. Fraunhofer IPM has developed an innovative measurement system that enables UAVs to gather local geometry data.

Comprising a variety of modular components, the measurement device is able to position and locate itself locally without the need for external referencing systems like a GNSS (global navigation satellite system). This makes the solution particularly suitable for measuring obstructed and complex structures with little or no GNSS reception. It does so by capturing sequences of images very quickly and by using special algorithms. Depending on environmental conditions, the method has a relative accuracy of a few centimeters. The measuring component used in the system is an eye-safe laser scanner with a working range of 250 m. The scanner is combined with a multispectral camera system to form a powerful multi-sensor unit.

Small, lightweight and energy efficient

Above all, measurement solutions for use in UAVs must be lightweight, which places high demands on the system design. The size, weight and power consumption of the sensors, for example, must be kept within a narrow range. Fraunhofer IPM is continuously striving to optimize these sensors.

The scientists at the Institute are currently participating in two projects concerning the use of measurement systems on UAVs. The objective of the »MulDiScan« project is to better predict natural disasters such as floods, landslides and forest fires, making it easier to introduce preventive measures. This requires scientists to gather high-quality measurement data about vast swathes of land that are sometimes difficult to access, yet may indicate changes to the structural landscape. To achieve this aim, researchers from Fraunhofer IPM have joined forces with academics at the Albert Ludwig University of Freiburg to develop new methods of collecting and interpreting data.

As part of the »MonIs« project, which is being funded by the EU's Eurostars funding program, Fraunhofer IPM in collaboration with partners from Germany, Austria and Spain is developing a system for monitoring infrastructure such as railway tracks, roads and buildings. The measurement solution, which comprises a specially adapted UAV and a sensor system, is able to easily collect data at short intervals in challenging locations.

TIME-DELAY MEASUREMENT OF LIGHT

Collecting data from the air requires highly accurate geometrical measurements to be recorded using the time-of-flight method. This process records the time it takes for light waves or light pulses to travel from a sender to an object and back to a detector. The movement of a laser scanner and measurements taken in rapid succession create a large number of measuring points, which produce a 3D model of the surface under investigation.

Measurement systems fitted to UAVs have enormous potential. From rough or even inaccessible terrain to dangerous environments, they can be used to collect important data whenever it is impossible for measurements to be taken from the ground.

1 *Measuring complex structures from the air. A surface area of several 100 m² can be measured, processed and visualized in less than ten minutes.*

2 *A multispectral camera system enables us to determine the vitality of plants, particularly in terms of their water and chlorophyll content. It consists of four cameras that collect data in different spectral ranges.*

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