

How LIDAR monitors changes on the ground and under the sea

Light detection and ranging - commonly abbreviated to LIDAR - is a method of remote sensing, a way of obtaining scientific data using sensors mounted on aircraft or satellites. It uses light in the form of laser pulses to measure various distances on and around the Earth.

Lidar equipment consists mainly of a laser, a compatible scanner and a specialised global positioning (GPS) receiver. When used to collect topographic data in the open air, lidar instruments can be mounted on helicopters and aircraft and use infrared lasers to map the land.

When the mounted laser is pointed at a particular location, it emits a beam of light that is reflected from the targeted surface. The sensor records the reflection. The time difference between the light emission and the sensing of the reflection gives a measure of the distance. A detailed picture is built up by combining these times with angles of light emissions and the coordinates of the aircraft route.

These instruments can also be mounted on sea going and subsea vessels to collect bathymetric data on the sea floor. In this case, they use a green light that can penetrate the water to map seafloors or riverbeds.

Civilian applications

The results can be processed to produce a tree-dimensional picture of the area of interest with a high degree of precision. Such <u>lidar mapping</u> has applications in a wide range of fields:

- The monitoring of shoreline changes along coasts. Cliffs and beaches are temporary features and can change dramatically overnight after severe storms. The gathering of lidar data is important for mapping erosion patterns and planning coastal defences.
- Subsea lidar is able to monitor the circulation in oceans and lakes by measuring temperatures, the heights of waves and by tracking the flow of sea ice. This provides information for the understanding of ocean system and the management of marine resources

- Lidar can track the routes of hurricanes, surface fractures and damage to buildings caused by earthquakes, as well as flooding and erosion inland from manmade or natural hazards. It can also be used to gather information about population movements caused by natural disasters or wars. This provides available information to disaster preparedness programmes.
- Lidar is a vital tool in managing natural resources such as mapping wetlands and their seasonal changes. It also charts the movements of wildlife such as the cross-continental migration of many wild animal species. By comparing this data with urban development programmes it can be used as a tool for protecting wildlife and natural resources.

Military application

Lidar is able to monitor terrain to an accuracy of 4 centimetres and penetrate through tree canopies and foliage. This makes it invaluable as a military instrument to monitor troops and weapons. It can follow the deployment of ground to ground or air to ground installations or military engagements.

