# PERSPECTIVES OF USING LASER SCANNERS AND DRONES IN MODERN SURVEYING

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Surveying has been used to establish boundaries and provide construction over the years. It is believed that the ancient Egyptians laid the foundations of the amazing pyramids using pegs, between which they pulled threads. Unsurprisingly, surveying techniques have changed since then, and modern new techniques can be almost as revolutionary.

The greatest breakthrough in the implementation of construction, geodetic and land management were made by the following advanced technologies:

• geodetic laser terrain scanners;

• remotely piloted vehicles, so-called drones.

Geodetic laser scanners are used to scan rooms, buildings and structures, coal mines, subway tunnels, and other complex geometric structures and terrain.

Laser radiation has the following properties that distinguish it from radiation of all other sources:

- high degree of spatial and temporal coherence;

- (as a consequence) a high degree of monochromaticity, i.e. concentrated in a very narrow spectral range (there is no ideal monochromatic source, but the laser is the best approximation to it);

- extreme narrowness (small beam width);

- high spectral power density (power density is the power per unit area, for example, per 1 cm2;

- power spectral density - power density attributed to a single spectral range, for example, up to 1 μm). [1, p. 120]

Geodetic laser scanners have been on the market for about 15 years. Since then, they have been constantly improved.

Today there is no absolutely universal scanner that could be used to solve all problems. They differ in the following main characteristics:

• range of laser scanning;

• speed of measurements;

• the accuracy of a laser scanning single measurement;

• density of laser scanning measurements;

• the size of the laser spot;

• the ability to integrate with other devices (for example, a video camera or GPS-receiver).[2]

Most of the geodetic scanners today can only work in a static mode. In addition, to build a volumetric image of complex surfaces using coordinates (for geodetic tasks), it is necessary to determine the coordinates of the base measurement points using GPS receivers.

Completing the drones with digital photo and video cameras does not provide the necessary accuracy for performing topographic, geodetic and land surveying work and can

only provide an overall picture, visibility of the area. But drones have great potential in the future along with geodetic terrain scanners. The necessary conditions for their use in tandem are:

- improving the technical characteristics of scanners;
- reducing the weight of scanners and drones;
- an increase in the operating time of devices;
- use of the latest technologies for determining coordinates.

Advanced programs will help to get the most complete 3D picture of the terrain, having received the X, Y, Z coordinates of any point, and move them from topographic plans to a digital matrix of space.

Before laser scanning systems came about, certain areas were off-limits to surveyors. But with vehicle-mounted LiDAR systems, organizations can collect point cloud data from even the most inaccessible of areas. For example, drone-mounted LiDAR can survey unsafe sites and structures. [3]

Because laser scanning is a non-contact surveying method, it can also survey sensitive objects or areas, such as vulnerable historic sites.

Laser scanning can also be applied to civil surveying, reverse engineering, mining, and archaeological projects. It plays an important part in most civil engineering related projects and helps governments and private authorities accomplish tasks on time and with 100% accuracy.

**References**

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