

# [Lidar (light detection and ranging) technology](https://assignbuster.com/lidar-light-detection-and-ranging-technology/)

LIDAR (Light detection and ranging) is a method of determining the topography of the surface using a laser. These pulses generated are recorded which provide precise three-dimensional information about the surface. Today various platform LIDAR is available in the market and those are chosen based on the project requirement. E. g. terrestrial LIDAR, which is fixed in ground, airborne LIDAR, which is placed on a flying platform like an airplane or helicopter and space borne Laser which is fixed on satellite platforms. Two types of LIDAR are available, topographic, and bathymetric. Topographic LIDAR use near infrared laser, whereas bathymetric LIDAR us green light which penetrate the water.

The use of airborne laser (LIDAR) for measuring the depth of near shore coastal waters and lakes from an aircraft is getting more popular in surveying industry. The demand for faster and cheaper coastline survey can be replaced by using airborne LIDAR technology. The Airborne LIDAR bathymetry was successfully tested by US, Canada, and Australia in the early 1970s. The system built by Canadian Hydrographic Service (CHS) in 1986, the LARSEN 500 system was the first operational airborne LIDAR bathymetry system.

Airborne LIDAR bathymetry has proven to be more accurate, cost effective, efficient, and fast method of collecting shallow water bathymetry data than the sonar technology which is less efficient and hard to operate in many cases. The airborne laser bathymetry involves the pulse laser transmitter which emits green and infrared beams. The wave length of green laser is 532 nm which can penetrate coastal water with less attenuation and can be used for coastal bottom detection. The infrared (IR) cannot penetrate the water and can be used for sea surface detection. The bathymetry sensors consist of four major components, the GPS receiver which records the aircraft position, the inertial measurement unit (IMU) which gives the roll, pitch and yaw of the aircraft, the laser scanner which emits the signal and the receiver sensor which read the returning signal. The LIDAR system can record the accurate measurements by knowing the position and orientation of all these components. These sensors can measure thousands of points per seconds

The transmitted laser pulse from the aircraft partially reflected from the water surface and the seabed back to the receiver. By recording the time taken from the laser to reach the surface and back to the receiver and speed of the light in air and in water, the distance to the sea surface and sea bed can be calculated. This information is used to calculate the water depth. The bathymetric LIDAR system also includes RGB cameras which acquire better color photo which is used as a quality check tool in identification of bathymetric features and aids to navigation. Airborne LIDAR bathymetry has various   advantages over other traditional water borne surveying techniques. It has tendency to perform survey quickly, efficiently within small operational window. This can cover a very large area and all those areas where it would be difficult to survey using traditional surveying methods. The ability of the airborne LIDAR to operate from the air gives the surveyor a flexibility that survey vessel surveyors could hardly imagine. The modern airborne LIDAR now comes with oblique digital photography which can be merged with point cloud. These georeferenced images are used during the validation process.

There are numerous limitations of an airborne LIDAR bathymetry system. The maximum depth the laser can penetrate depends on the clarity of water. The maximum surveyable depths depend on several systems used and the environment condition. The green laser penetrates and travel maximum depth if the water is clear water. The maximum surveyable depths ranges from 50 meters in clean water to less than 10 meters in murky water. The use of airborne LIDAR system is not appropriate for small target detection. The spatial resolution obtained from the airborne LIDAR is not as good as for modern high frequency sonar. Small target detection using airborne LIDAR may be possible by significantly increasing the survey density which becomes more expensive. Various environmental factors like rain, fog, clouds, high winds, high waves, etc. can cause problem when carrying airborne LIDAR survey. Surveying in rain cause laser beam to backscatter to the receiver bye raindrops. The backscatter signal by the mist, fog can result in false surface heights.  Airborne survey in high wind can pose a danger when flying near a coastal mountain and cause changes in survey density.

Airborne LIDAR bathymetry technology can be used for many applications like charting, environmental mapping, flood plain and coastal mapping etc.

https://www. gim-international. com/content/article/technology-in-focus-bathymetric-LIDAR-2