ALS40 Airborne Laser Scanner

Airborne LIDAR for Professionals

Leica Geosystems

High Performance Laser Scanning

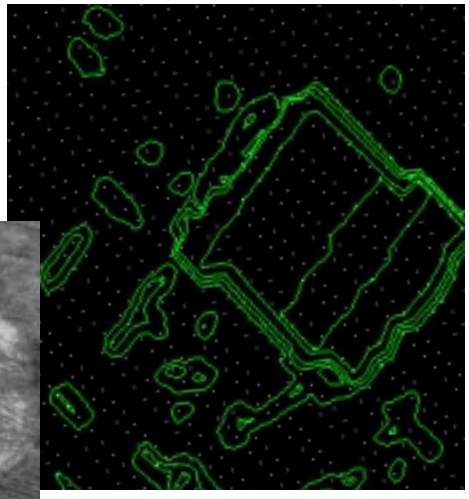
Direct Measurement of Ground Surface from the Air

The ALS40 Airborne Laser Scanner measures the topography of the earth's surface by acquiring large sets of ground surface XYZ coordinate triplets. These are computed using a laser range from the aircraft in combination with position and attitude data derived from airborne GPS and inertial subsystems. The ALS40 falls into the category known as LIDAR (light detection and ranging).

A high performance, robust solution for acquiring geospatial information, the ALS40 provides users with digital surface models for a myriad of applications.

Highlights of the ALS40

- Swath width (or field of view) of up to 75°
- 15-25 kHz laser pulse rate
- Built-in diagnostics
- Easy in-flight operation
- Altitudes to 6100 meters AGL



Applications of LIDAR

- Bare earth digital terrain models (DTMs)
- Generation of orthophotos and mosaics
- Forestry and engineering
- Corridor mapping for utilities
- Coastal and riverine studies
- Flood plain mapping
- Urban modeling
- Disaster response and damage assessment

Benefits of LIDAR

- High density, high accuracy, high productivity
- DTM generation over difficult or inaccessible terrain
- Multi-target discrimination
- Superior vegetation penetration
- Operates at night and under clouds
- Return reflectivity measurement

LIDAR and Imagery

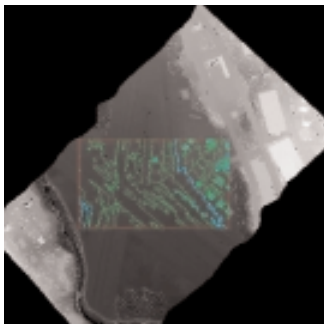
LIDAR is not the same as imagery — it is a high spatial resolution "point cloud" generator. LIDAR can yield details under tree cover, "see" at night and orthorectify photo data (with software).

Because many end users also require imagery to find building corners, edges or other photo-recognizable features, some LIDAR users also run aerial cameras.

In cases where less specialist, top resolution imagery is necessary, a simple digital camera can be mounted on the ALS40 and controlled by the ALS40 graphical user interface. The resulting images give information about the ground over which the mission was flown and are of great value, though not recommended for rigorous photogrammetric post-processing.

LIDAR Concept

Accurate Representation Of The Earth's Surface

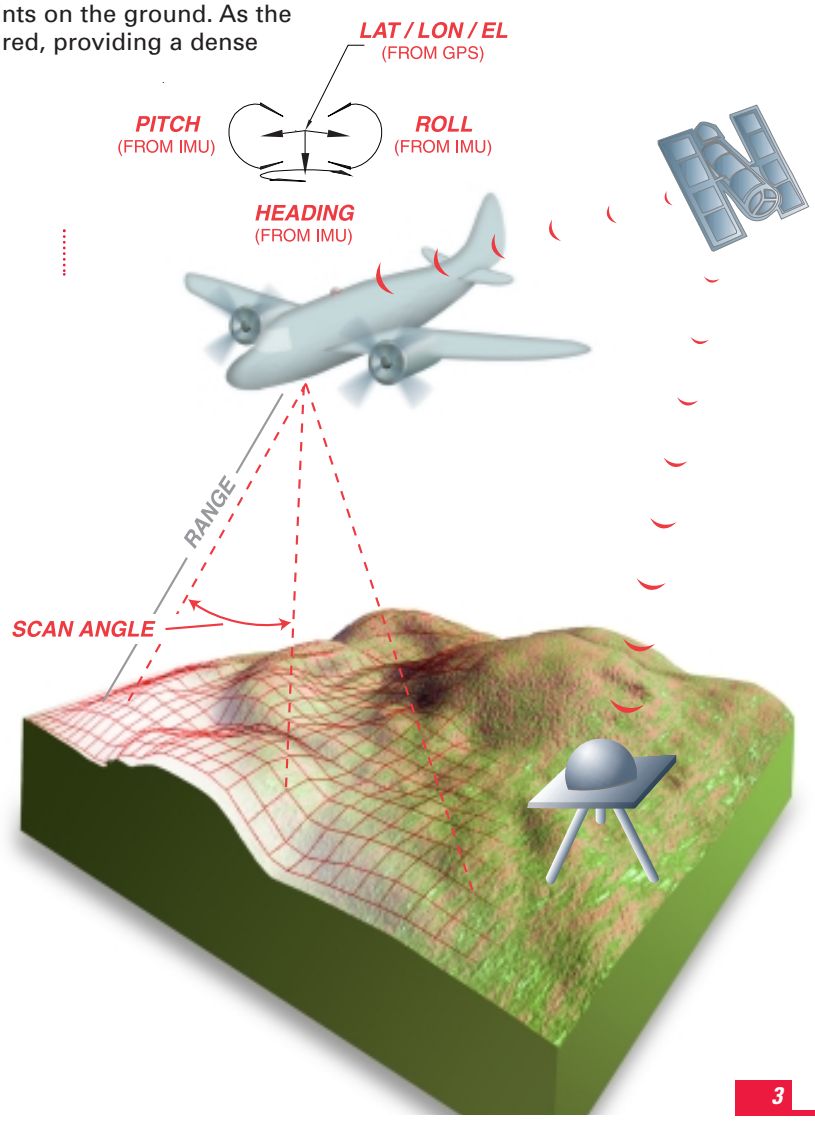


LIDAR Principle

As the aircraft flies across the project area, laser pulses are emitted with high rapidity towards the ground. These are reflected by the ground and/or objects upon it such as trees and buildings.

For each pulse the elapsed time between the emitted and returning signals is measured, which enables a slant distance to be computed. At the same time, the position and attitude of the aircraft are measured with airborne GPS and inertial measurement unit (IMU) sub-systems. A GPS ground reference station is also deployed.

After flight, the ALS40 post-processing software combines this data with information on atmospheric conditions, hardware characteristics and other relevant parameters, to generate a series of XYZ coordinate triplets for points on the ground. As the mission progresses, millions of such points are captured, providing a dense digital terrain model (DTM).



Features

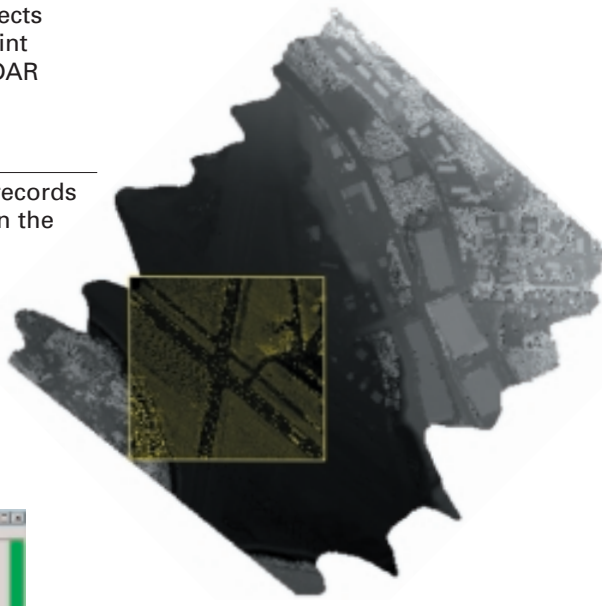
High End Technology, High End Performance

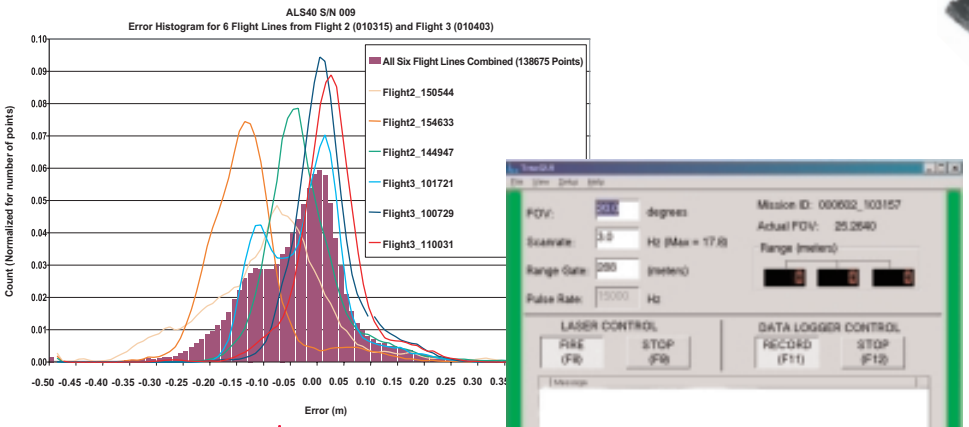
Extensive Coverage

The ALS40 functions at flying heights up to 6100 m, enabling a wide range of projects to be executed. The high pulse and scanning rates of the ALS40 result in dense point spacings for greater detail. The maximum field of view of 75° is exceptional for LIDAR systems, providing swath width similar to an aerial film camera.

Intensity

In addition to recording the round-trip elapsed time of the laser pulse, the ALS40 records the intensity of the incoming beam. This radiometric information can be mapped in the form of a graphical plot, generated by a process similar to that of an orthophoto. The resulting information supplements the XYZ coordinates to increase the value of the mission.





Precise Terrain Data

Sometimes the laser beam encounters more than just the earth's surface and may be reflected by one or two power cables, a tree and the ground itself. The ALS40 is capable of resolving and recording up to five returns for every pulse, generating enormous volumes of information about the area flown during the mission.

Excellent Accuracy

The ALS40 delivers height accuracies in the range 15-50 cm and planimetric accuracies in the range 15-75 cm depending on flying height and position of the point with respect to nadir.

Ease of Use

The ALS40 field of view, scan rate and range gate (for cloud rejection) are chosen by the operator via the user-friendly graphical user interface (GUI) running on the Laptop Control Computer. The touch-screen display allows convenient in-flight access to system settings and recording functions. To ensure the success of the mission, a message window provides feedback on system status

Eye Safety

When operated in accordance with the User's Guide, the ALS40 laser is eyesafe as described in the ANSI Z136.1 specification for single shot exposure when viewed through binoculars at flying heights of 305 m (1000 feet) above ground level.

Functionality

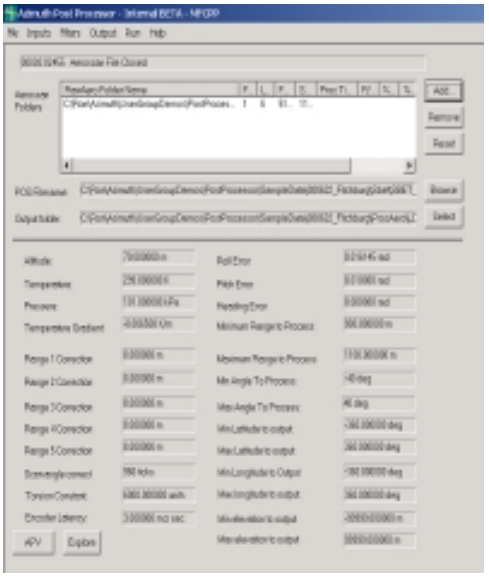
Speed, Flexibility, Convenience

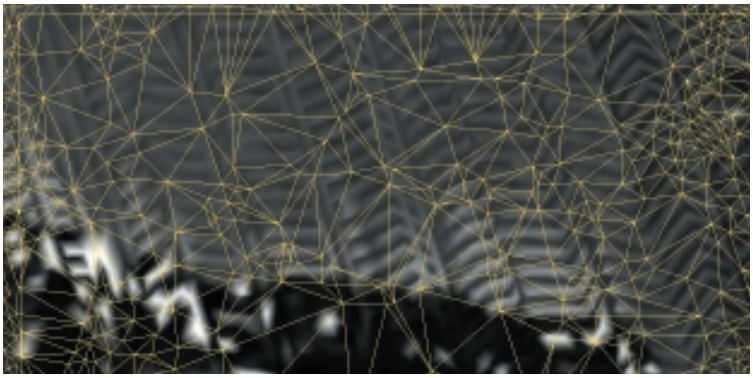
Mission Planning

The ALS40 includes Leica Geosystems' AeroPlan software for flight planning. This straightforward product enables the user to enter the mission parameters and ensure correct coverage, density, accuracy, etc.

Post-Processing

The standard suite of products supplied with the ALS40 includes the Applanix POSPac, POSGPS and POSProc modules to post-process the GPS and IMU data. Leica Geosystems' LIDAR post-processor combines the resulting trajectory and laser scan data to calculate the ground coordinates of the data points and transform, if required, to the projection and datum preferred by the user. The AeroPreview module computes grayscale elevation and intensity images. Utilities are included to output WGS84 data in binary format for archival purposes, to generate graphical images in BMP format or to output computed data in simple ASCII format for export to GIS and other third party systems.





ALS40 and SOCET SET®

The functionality within the digital photogrammetric SOCET SET software for handling ultra-large photogrammetric DTMs is easily applied to LIDAR. Intensity images and their stereomates can be generated from the LIDAR data, allowing the LIDAR "point cloud" to be viewed stereoscopically. SOCET SET facilitates coverage checks and has extensive editing functionality, including automated building/vegetation removal and point thinning.

ALS40 and TerraScan

Leica Geosystems distributes TerraScan, a specialist software package for LIDAR processing. TerraScan operates in Bentley Systems' MicroStation® environment and has a host of functions specially developed for refining airborne LIDAR data. TerraScan includes functions for bare-earth DTM generation, point thinning, point classification and power line catenary generation, among others.

Advantages

Unique Features for Mission Flexibility

- Enormous operational range — flying heights from 500 to 6100 m
- Field of view, scan rate and pulse rate are user-adjustable in flight
- Range gate for cloud rejection
- Multi-position attenuation so user can set laser output level for any altitude
- Drop-in mounting for aircraft currently using standard aerial camera mounts
- Integral mounting for off-the-shelf digital frame camera
- Built-in diagnostics for on-the-fly performance checking
- Low cost per data point
- Facilitating orthorectification of photo products
- Competitive price/performance ratio

Impressive Pedigree

Leica Geosystems entered the LIDAR business through the acquisition in 2001 of Azimuth Corporation, a LIDAR specialist involved in defense and commercial laser ranging systems from as early as 1971. This accumulated expertise enabled the ALS40 system to be brought to market in 1998. In addition to market-leading post-processing software for LIDAR data, ALS40 customers benefit from Leica Geosystems worldwide sales and support network.

User Support

At Leica Geosystems, you find the professionals with whom to discuss your requirements and who can provide the techniques to achieve them: specialists for aerial photography, experienced photogrammetrists, engineers, as well as service and maintenance specialists. Leica Geosystems' skilled personnel advise customers on questions of application techniques, installation, interfaces, accessories, up-grades, maintenance, etc.

Regular user training courses and workshops given at various Leica Geosystems locations help users with the operation and maintenance of Leica Geosystems' products. These courses also give the opportunity to exchange practical experience with other users. In addition, Leica Geosystems organizes specific customer training courses at the customer's site.

Visit our Web site www.gis.leica-geosystems.com for relevant product announcements. If you need more information, contact your local Leica Geosystems office or distributor (see back cover), or contact us by e-mail on info@gis.leica-geosystems.com.

GIS & Mapping
Division

ERDAS
geographic imaging made simple℠

LH Systems

Information subject to change without notice.

Part No. ALS40 cc 8/01

Leica
Geosystems

Leica Geosystems
GIS & Mapping Division
Heinrich-Wild-Strasse
CH-9435 Heerbrugg - Switzerland
Phone +41 71 727 34 10
Fax +41 71 727 46 91
www.gis.leica-geosystems.com