

Turnkey solution for airborne laser scanning

Peter Rieger *, Thomas Gaisecker *, S. Orlandini **

* RIEGL Laser Measurement Systems, GmbH A-3580 Horn Riedenburgerstr. 48 Austria www.riegl.com

** MicroGeo S.r.l. Via Pasolini, 28 50013 Campi Bisenzio Firenze Italy - info@microgeo.it

We present the first commercially available turnkey solution of a completely equipped surveying- and/or surveillance aircraft for airborne laser scanning (Fig.1). As result of the cooperation between the two Austrian companies, **RIEGL Laser Measurement Systems GmbH** and **Diamond Aircraft Industries GmbH**, two different types of modern aircraft, equipped with the latest airborne laser scanning systems are ready to the market. The system combines leading-edge technologies of two fields– aviation and laser range finding. **Diamond's** excellence in designing weight-optimized, highly-integrated carbon-fibre-reinforced-plastics based aircraft, which can be operated at outstanding low costs, establishes an ideally suited platform for airborne laser scanning. The highly-accurate airborne laser scanning system from **RIEGL** offers outstanding point-density and excellent spatial resolution enabled by echo digitization and full waveform analysis techniques. The unique combination of achievements in aerodynamics, avionics, material science, laser ranging technology, and data processing provides an outstanding best-value-for-price system.



Fig.1 RIEGL Airborne Laser Scanner System mounted on an Diamond Aircraft DA42 Multi Purpose Platform

System Description

Successfully carrying out airborne laser scanning missions requires dedicated know-how and expertise in various specialized fields: flight planning, aviation, operating laser scanner equipment and the inertial navigation system, acquiring and post-processing the data, and quality assurance. Integrating a system is a challenging, time-consuming and cost-intensive task. *RIEGL's* turnkey solution puts the service provider in a position to start right off with a state-of-the-art equipment. Fig.2 describes the system integration realized by *RIEGL*.

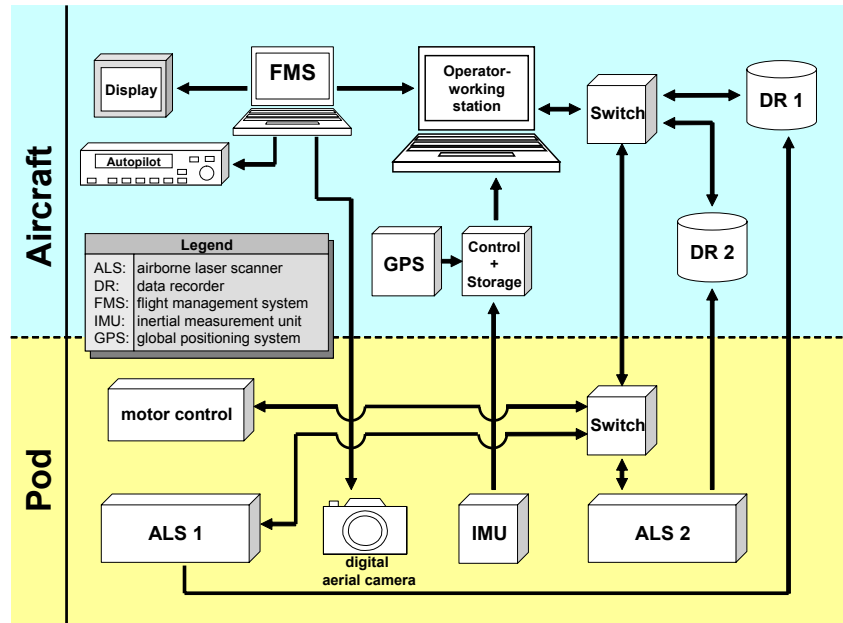


Fig.2 Simplified block diagram of the airborne laser scanner system

The integrated airborne laser measurement system comprises the following main parts (key-features are listed in Tab.1):

- Mission planning software
- Diamond Aircraft DA42 (optionally DA40)
- Laser Scanner Pod comprising one (optionally two) full waveform *RIEGL* Airborne Laser Scanner Q560i, an inertial measurement unit, and optionally a medium-format digital aerial camera
- GPS antenna/receiver
- *RIEGL* Laser Scanning Control Hardware and Software
- on-line visualization system for planned flight route
- *RIEGL* "RiPROCESS" data post processing software

measurement Range	30 m - 1500 m at target reflectivity of 80% 30 m - 850 m at target reflectivity of 20%
peak measurement rate	up to 200 kHz per laser scanner
ranging accuracy / multi-target resolution	20 mm / up to 0.5 m
scan range	45° (60°), up to 105° with second scanner and tilt mount
aircraft endurance	6 hours (9 hours with long-range tank)
data recorder capacity	500 GB or approx. 6 hours of laser scanning
INS accuracy	pitch, roll ~ 0.004° yaw ~ 0.01° position < 0.1 m height < 0.2m
lowest true airspeed	82 kt (=152 km/h)
point density (Speed=82kt, Altitude=500m)	6 Points/m ²

Tab.1 Main features of the airborne laser scanner system equipped with one laser scanner Q560i

High accuracy and high point density

The system is designed to provide utmost accuracy and high-density, equally-distributed measurement data. With the possibility of using two synchronized *RIEGL* airborne laser scanners Q560i it is possible to gain twice the point density with homogenously-distributed points or to do a whole mission at half the time. For the scanning of complex terrain like mountainous areas, one of the two scanners can be tilted by up to 45° in either direction during the mission flight to enhance sloping-area coverage (Fig. 3 / Fig.4)



Fig.3 Laser Scanner Pod mounted under the DA42-MPP's fuselage

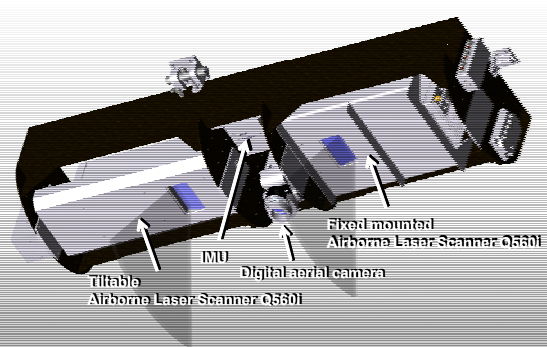


Fig.4 Laser Scanner Pod with cover removed

New dimension in data post processing

Fig.5 describes the seamless workflow from mission planning to a geo-referenced point cloud using *RIEGL*'s software-solution.

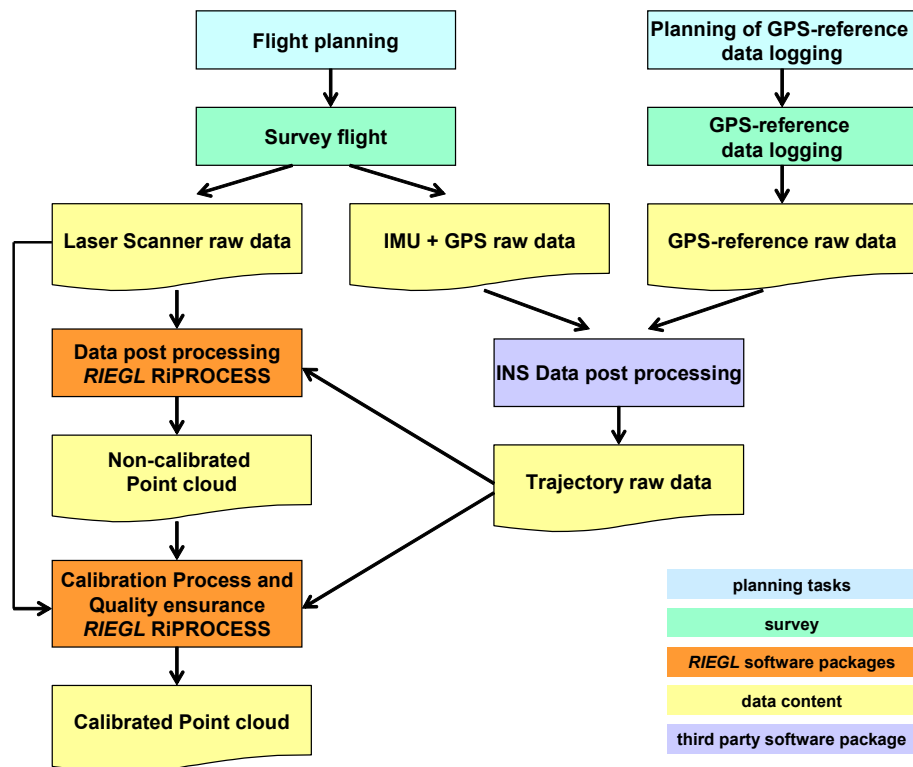


Fig.5 Sketch of work flow starting ranging from mission planning to the geo-referenced point cloud

For scan data post processing *RIEGL* offers the new project-oriented software product “RiPROCESS 560” (Fig.6). The software package enables the user to process the laser scanners full waveform data,

combine it with the INS trajectory data, perform a system calibration and scan line adjustment as well as export scan data. The software is capable of distribute tasks to numerous computers inside a network to speed up processing of large amounts of data. The fast access to scan data even of large projects and the ability to visualize data in 2D and 3D enables the user to assess data quality, scan data alignment and more.

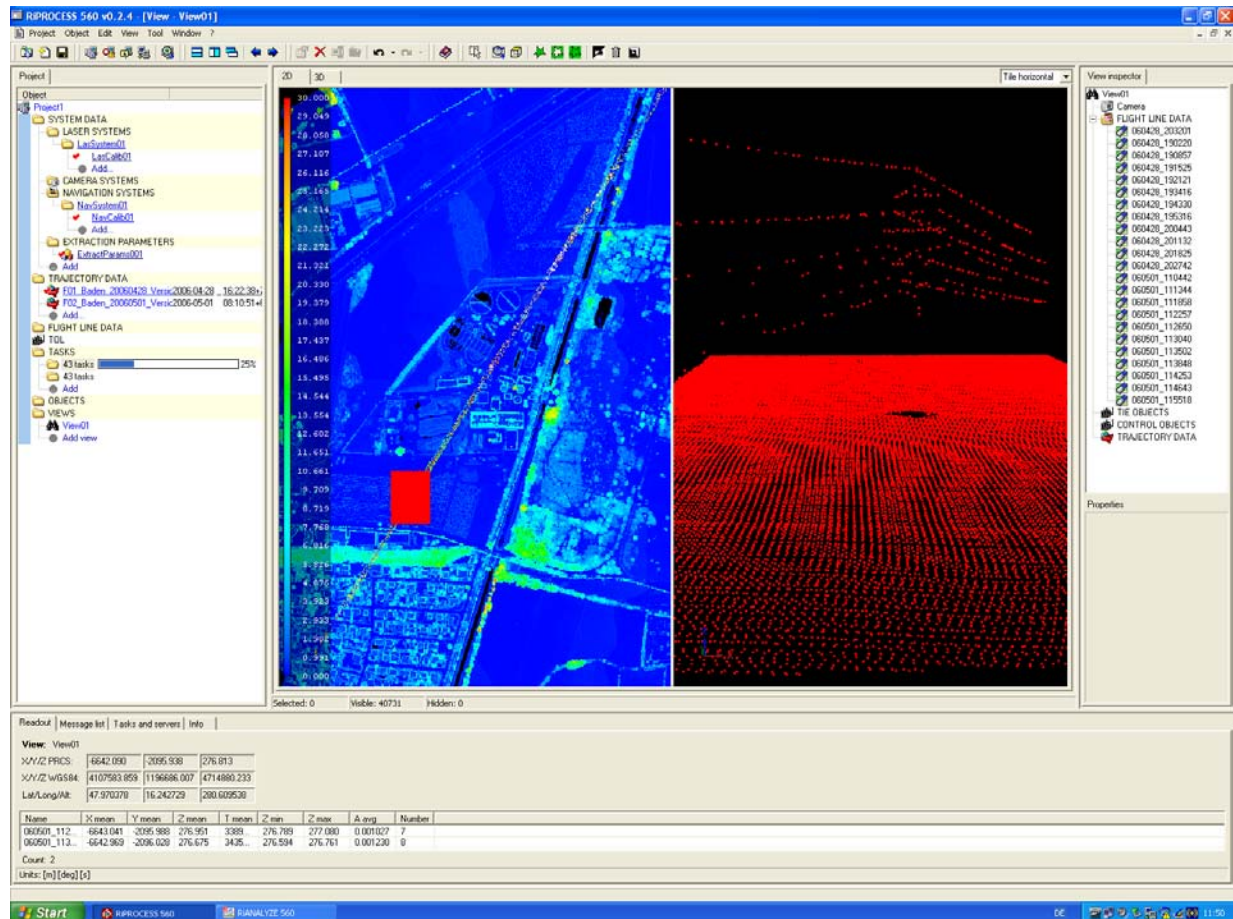


Fig.6 Screenshot of the new *RIEGL*'s post-processing software RiPROCESS 560