

“Airborne Laser Scanning monitoring of Ex-MRP area to archive high-resolution topographical Maps of Peatlands in Central Kalimantan, Contract between Kalteng Consultants and UNPAR and Wetlands International”

by

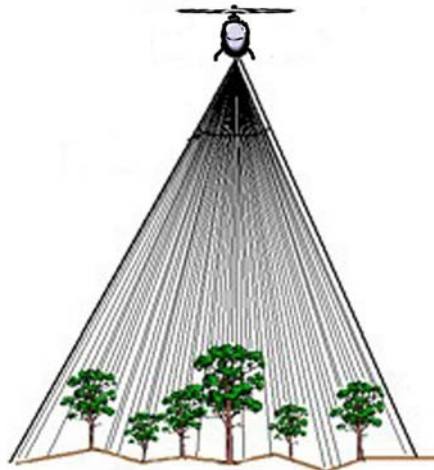
Dr. H.-D. Viktor Boehm

Abstract

With a high-resolution Airborne Laser Scanner (ALS) the topography of peatlands was measured in Aug. 2007 by a helicopter to achieve a 3-dimensional Digital Elevation Model (DEM) for the Central Kalimantan Peatland Project (CKPP). The flight altitude was approx. 500m above ground. Approx. 100,000 Laser pulses / second were sending to the ground. With the received ALS-data DEMs were processed.

DEM's are divided into two types of groups. The Digital Surface Model (DSM) gathers information by Laser Scanner with trees, bridges and house and the Digital Terrain Model (DTM) is filtered using the DSM and shows the topography of landscape without trees, bridges, houses etc.

Airborne Laser Scanner



With this type of information hydrology models of peatland and biomass of Peat Swamp Forest (PSF) have been analysed using this modern technology with an elevation resolution of +/-15cm e.g. in the Ex-Mega Rice Project (Ex-MRP) area of Blocks A, B, C, E and additionally in the Sebangau National Park.

The different ground elevation levels were always calibrated to the Palangkaraya airport reference point with 82ft or approx. 25.0m.

From ALS-track on 7th Aug. 2007 with helicopter flight hours of 2.5 and approx. 280km length we archived tracks 55 – 88 for this project with more than 14,000ha. The Laser pulses were processed to achieve 8.65 GB geo-referenced corrected raw data in ASCII-format for each track 55 to 88, which were processed further to get first the DSMs and than by classification the DTMs in approx. 0.5km x 2km grids geo-coded with a step width of 1mx1m. Track 88 was the ALS calibration flight over the Palangkaraya Tjilik Riwut airport. The DSM- and DTM-data have been visualised either with the SW Surfer or Global Mapper.

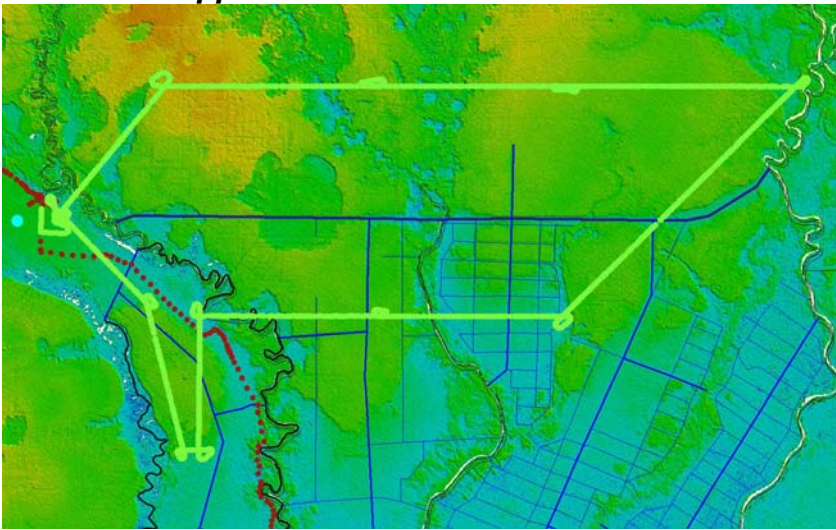


Fig.: GPS-tracks of Helicopter Flight path during 2.5h flight trial on 7. Aug. 2007 from Airport PKY along the Block E passing rivers Kahayan, Mangkatup, Kapuas, Barito basin, crossing Main Channel, in Block A passing rivers Mentangai, Kapuas, in Block B passing again river Kahayan, in Block C over the peat dome, back to the airport Palangkaraya Tjilik Riwut; Tracks are superimposed on SRTM-image taken on 2-2000. Turns are for INS-calibration.

Additional to this KC produced several maps (map of vegetation, map of fire prone area and map of peat thickness) of Block C+B+A.

The equipment was rented by Milan Geoservice GmbH, Germany. The ALS sensor LMS-Q560 from Riegl, the flight management system, the INS, the HC-GPS, the ground DGPS and recorders had no problems during the 2.5 hours. The laser beam in the near infra-red could penetrate the PSF by 3% to 5% with the divergence of 0.5mrad. The highest peat dome was found between rivers Kahayan and Mangkatup with 37.5m at the track approx. 229km south of the equator. Other ALS measurements are available from different areas of Ex-MRP for processing and analysis.

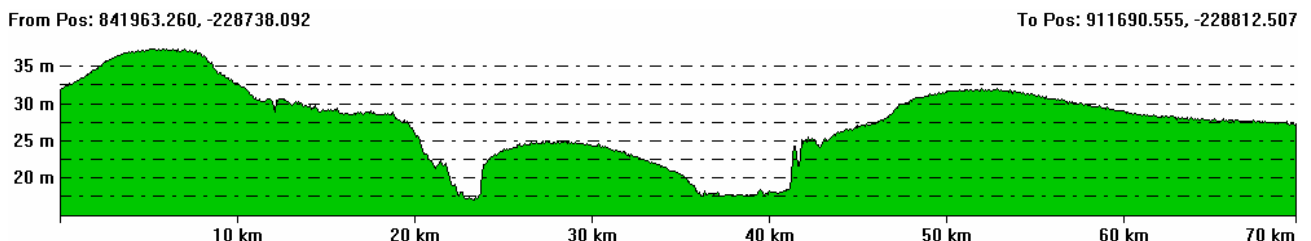


Fig.: ALS-DTM result: Peat Topography, cross-section between Kahayan, Mangkatup, Kapuas and Mawas area, at approx 229km south of equator

The preparation to get all equipment from Germany to Central Kalimantan, Indonesia, and back took several months including the flight permits. The weather condition on the 7th August 2007 was very good. Also the helicopter in conjunction with the equipment worked properly including the qualified ALS-team.

FINDINGS

- Geo-coded ALS raw data (corrected by helicopter movements) taken over peatland and PSF are available from the helicopter flight trials in August 2007.

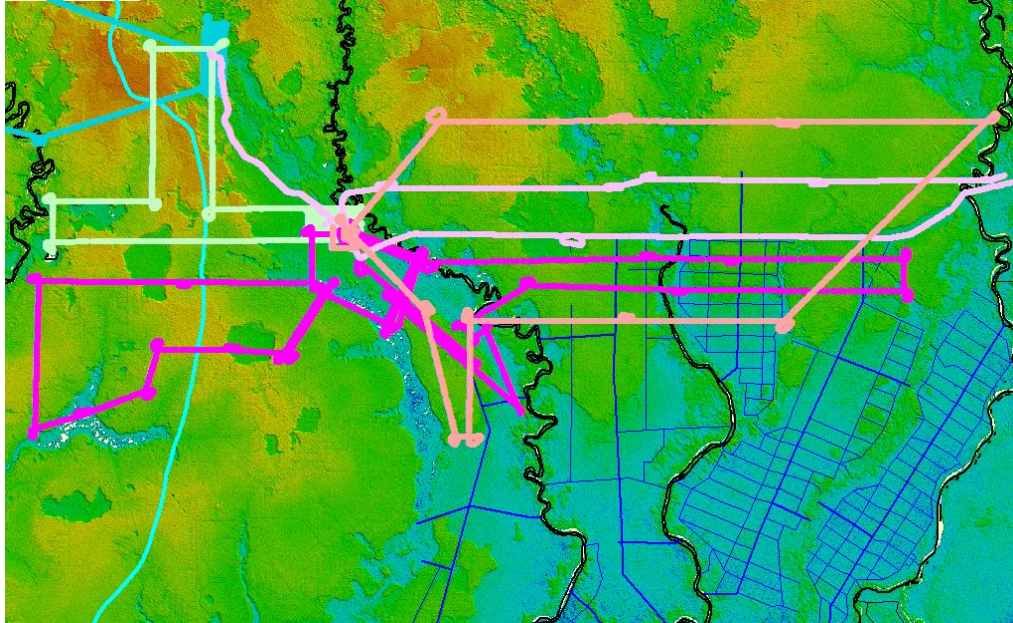


Fig.: ALS-Flight trials over peatland and PSF in Ex-MRP and Sebangau National Park

- Flight path tracks 55 and 87 passed the runway of Palangkaraya airport two times, after 2.5h flight we received the same elevation of 25.0m at the reference point where we installed the DGPS. The calibration flight track 88 confirmed the 25.0m. Even other flights on other days had the same elevation value of 25.0m for PKY
- Precise ALS-data with +/-0.5m resolution in x and y and +/-0.15m in z (elevation) were recorded for analysis's of PSF-bio mass estimation, topographical and hydrological. With the processed DSMs and DTMs the values can be determined very quickly, partly by subtraction. Classification was done automatically and using a manual controls.

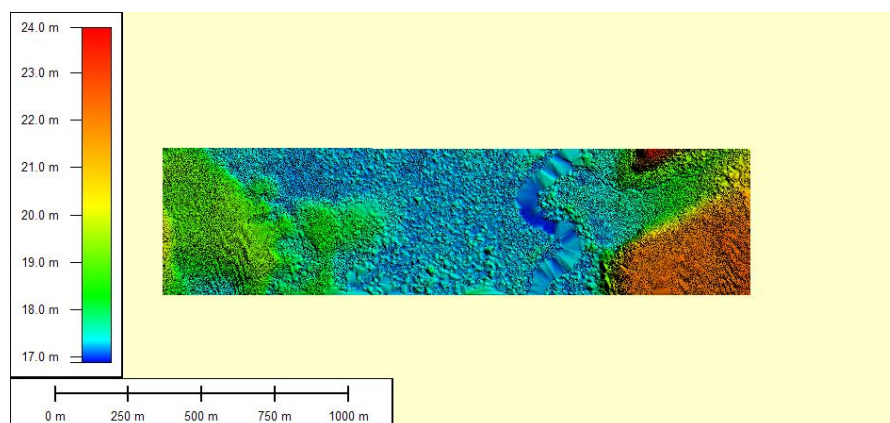


Fig.: ALS-DTM Grid UTM Zone 49 with 864km East, -230 South of equator (2km x 0.5km) of Peat Surface and Mangkatup river with 17.0m surface taken on 7.8.2007

- The ALS is penetrating the PSF with 3% to 5%, which shows the very good results of the DTM for tracks 55 to 88.
- The highest peat dome for tracks 55 to 88 was determined with 37.5m in Block E between rivers Kahayan and Mangkatup at the track 229km south of the equator. Manual analysis of the ALS data show a similar result as the automatic SW-analysis.

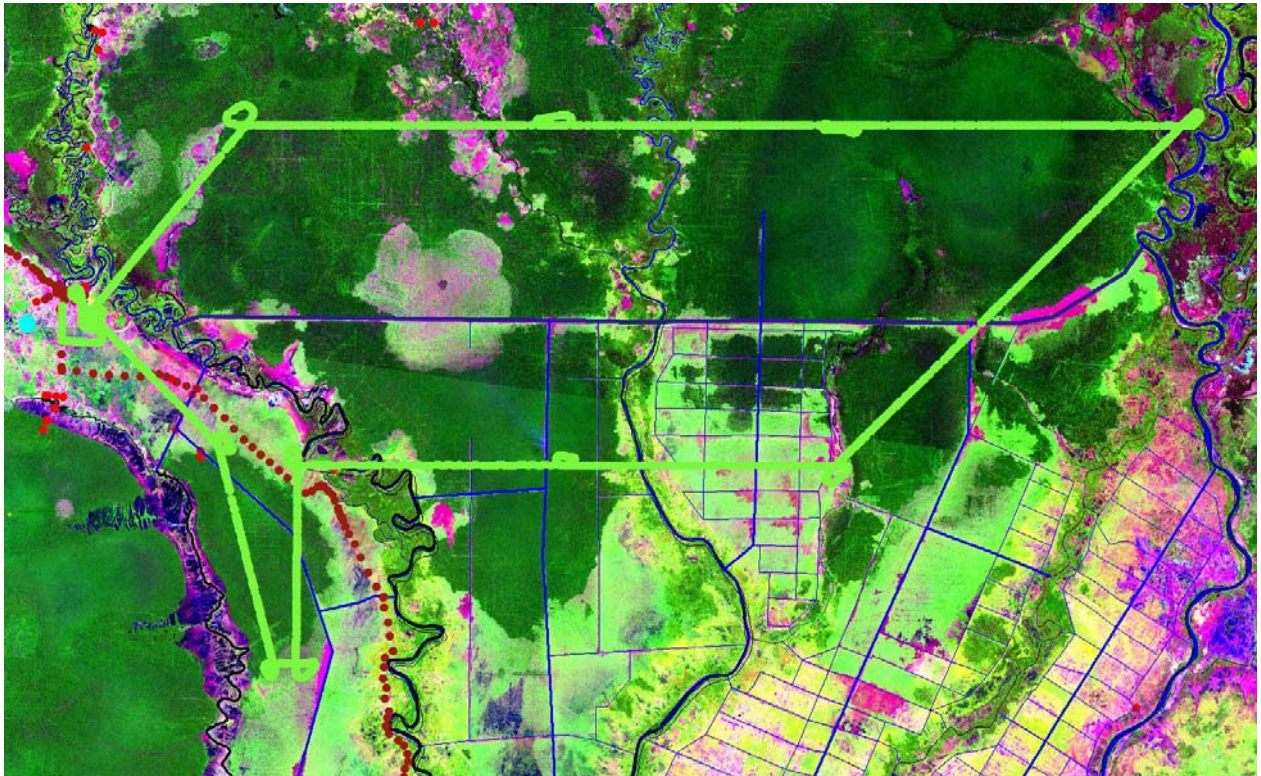


Fig.: GPS-tracks of Helicopter Flight path during 2.5h flight trial on 7. Aug. 2007 from Airport PKY superimposed on Landsat-Image 7-2000

- A lot of carbon is stored in Central Kalimantan.

Airborne Laser Scanning Technology

Technical Parameter of the Airborne Laser Scanning and RGB-Technology



Aerial-Monitoring Universal Data-Collecting-System with

- Airborne Laser Scanning
- Digital RGB camera
- Inertial Navigation System
- Flight Management System
- GPS-Antenna L1/L2-band
- DGPS-Groundstation
- Several Recorder



Fig.:ALS-Equipment with Bell-Helicopter in hangar PKY



Fig.: RGB-camera, Airborne Laser Scanner (ALS), of Inertial Navigation System (INS)

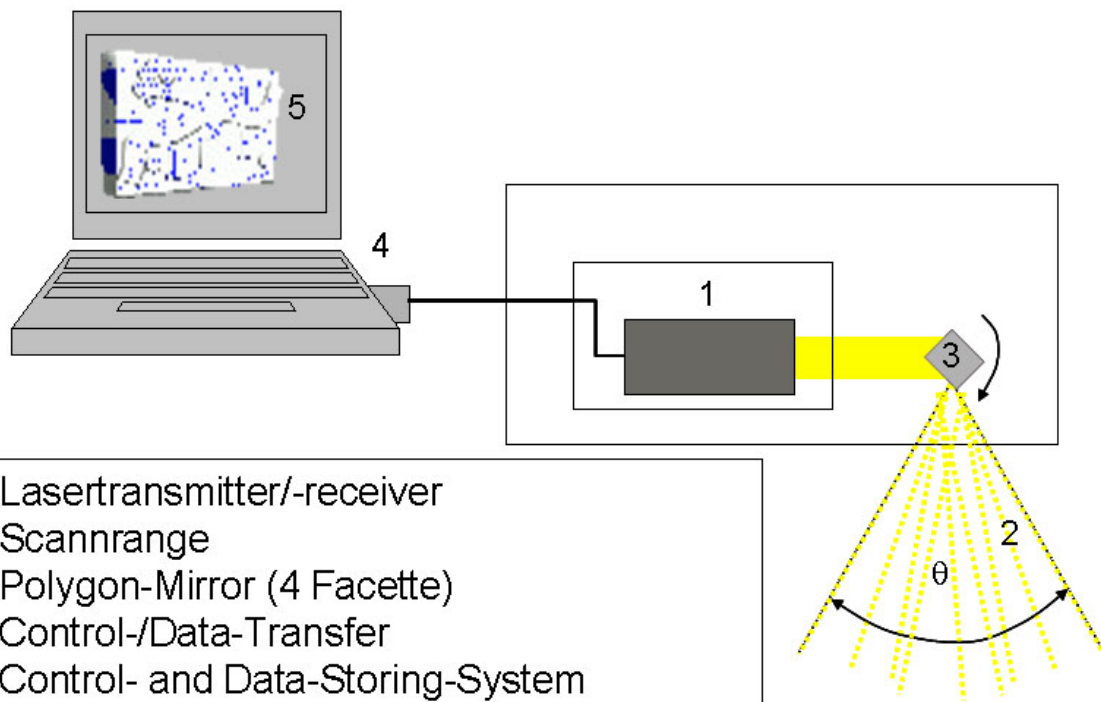
Airborne Laser Scanning Equipment with Riegli Technology

LMS-Q560 Airborne Laser Scanner	
Range	30 - 1500 m
Laser Puls Rate	Up to 100 000 Hz
Laser Wavelength	near Infrared
Beam Divergence	0.5 mrad
Scanner Unit	rot. Polygonmirror
Scanning Type	Parallel Lines
Scanning Speed	5 -160 scans/sec
Measuring Accuracy	±20 mm
Scan angle	± 22.5° and ± 30°
Min. Step Width	0.004° @ 100000 Hz
Wight	20 kg
Power	120 Watt



The Airborne Laser Scanner transmits Laser pulses which will be reflected from the sureface of the earth and received by the Laser Detector.

Table: Parameter of Airborne Laser Scanning System, Hasselblad RGB-camera has 22 MB pixel. Courtesy by Milan Geoservice GmbH



Principle of Airborne Laser Scanning System

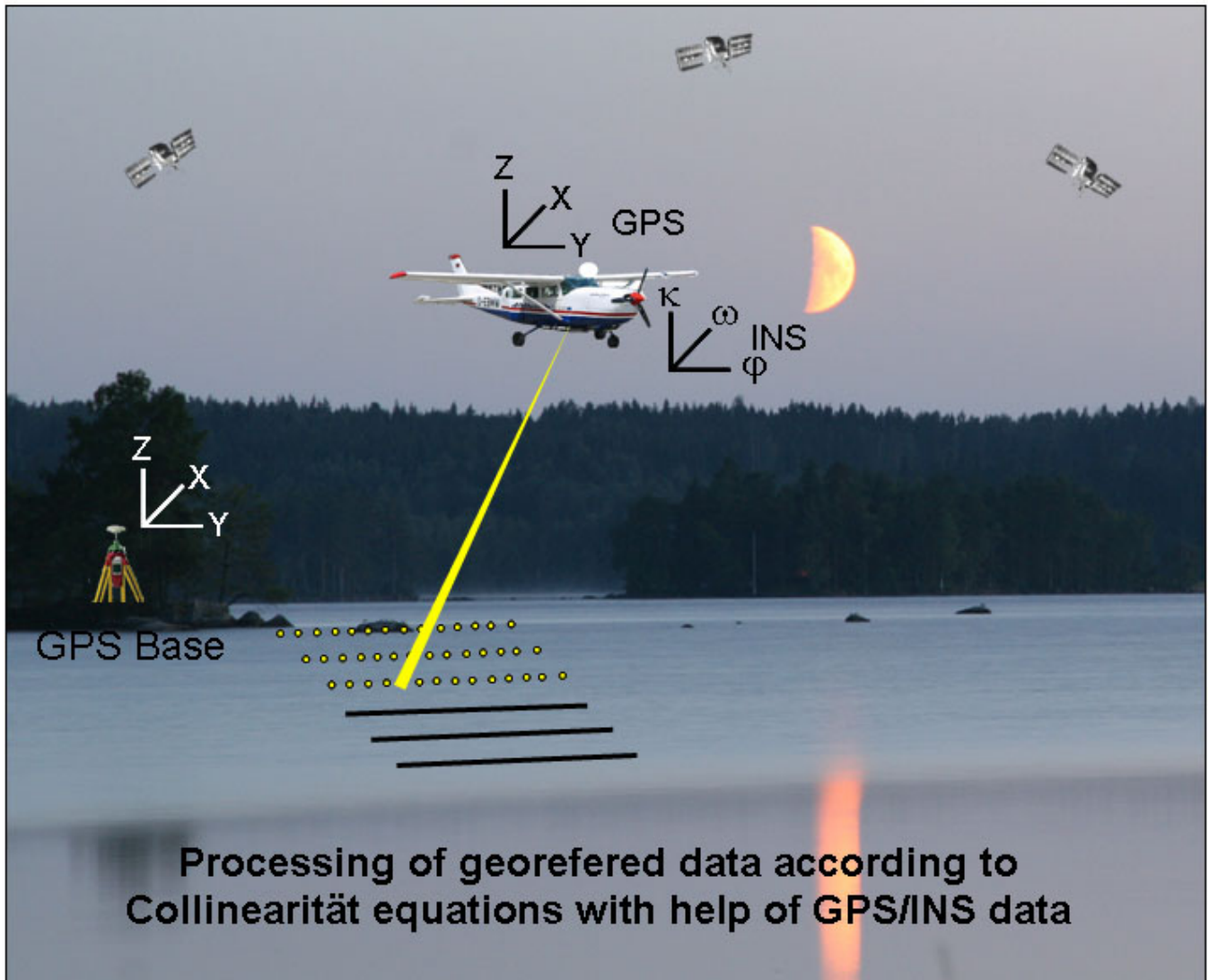


Fig.: The flight altitude was approx. 500m with a swath-width of approx. 500m (at 60° scan angle). For several scans an overlap of approx. 35% is necessary for mosaic the flight paths; We used during this flight a track, which lead approx 280km around the Ex-MRP; Courtesy by Milan Geoservice GmbH