AIRBORNE LASER SCANNING FOR THE PURPOSE OF HYDRODYNAMIC MODELLING OF WIDAWA RIVER VALLEY

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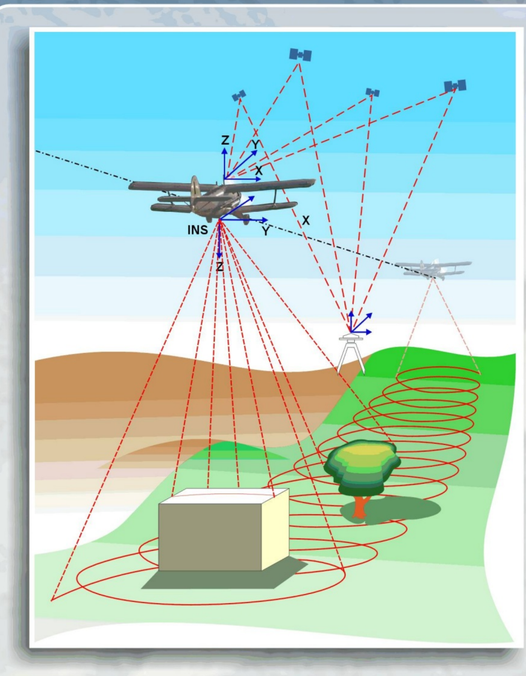
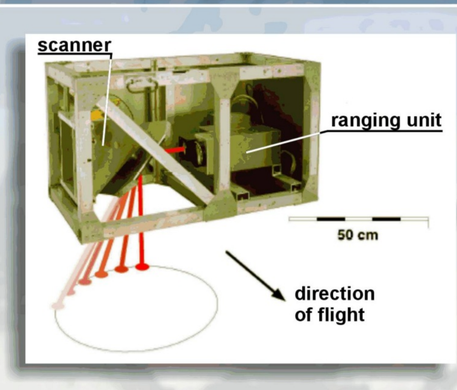
Introduction

Airborne Laser Scanning (ALS) is a new technology for capturing data for a detailed Digital Terrain Model (DTM) determination, especially in scrubbed and wooded areas. This measurement technique enables 3D-reconstruction of the terrain and its topography with the resolution of point per m². ALS was applied for DTM generation of Widawa river valley. This DTM will facilitate hydrodynamic modelling. The measurements were taken in November 2005 by the panel of researchers from Agricultural University of Wrocław in co-operation with the University of Stuttgart. In the project, the prototype of continuous wave laser scanner ScaLARS was used.

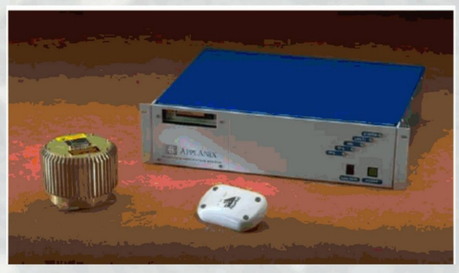
The ALS System





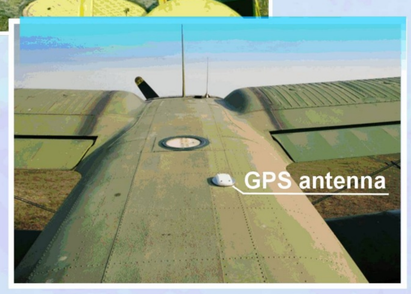
Technical specifications of ScaLars II

Parameter	Value
laser source	CW laser diode InGa(Al)As
laser wavelength	810 nm (IR)
radiated laser power cw	0.55 W
detector	SI avalanche Photodiode
modulation frequency	10 MHz, 1 MHz
max. slant range	~ 750 m
RMS (95%)	0.03 m .. 0.16 m
beam divergence	2.5 mrad
sample rate	20 kHz
rotation rate of mirror	20 Hz
resolution of the intensity	13 bit
FOV	28° or 40°

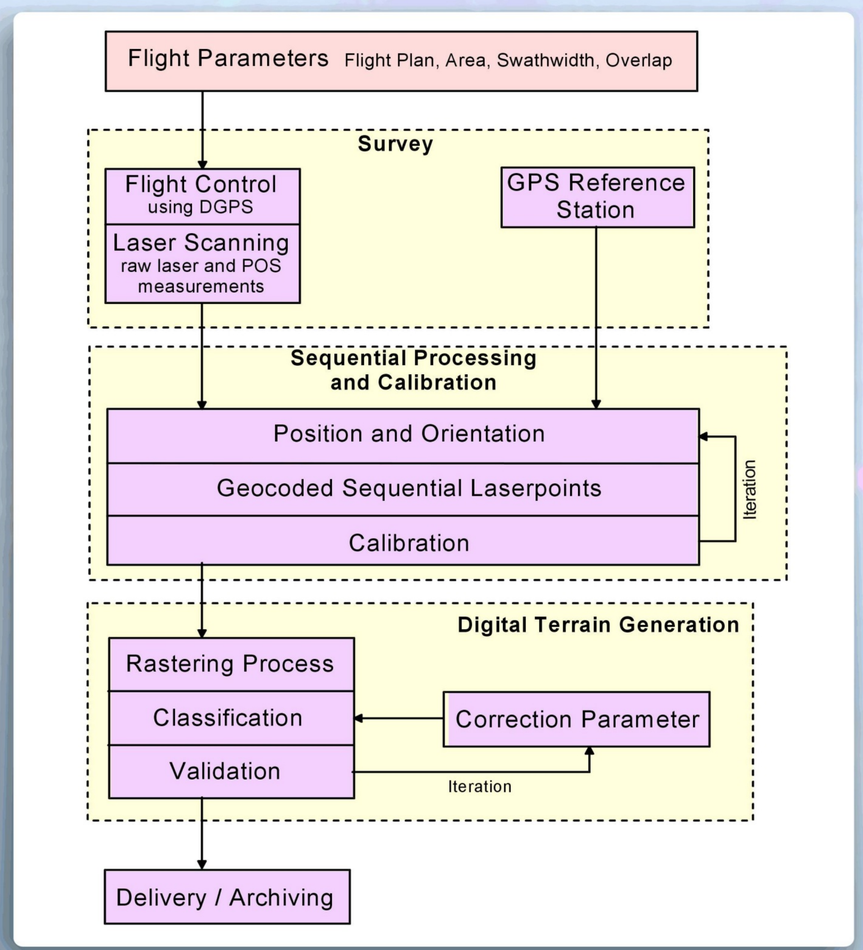


GPS/ IMU System Applanix POS AV 510

AN-2 aircraft and one of GPS reference station

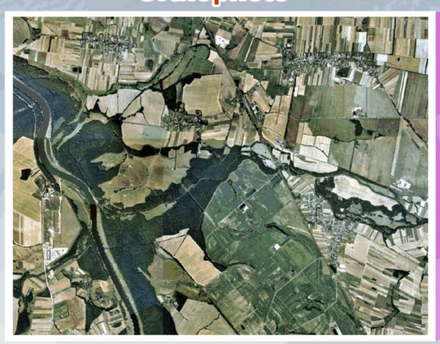


Operational Processing Chain

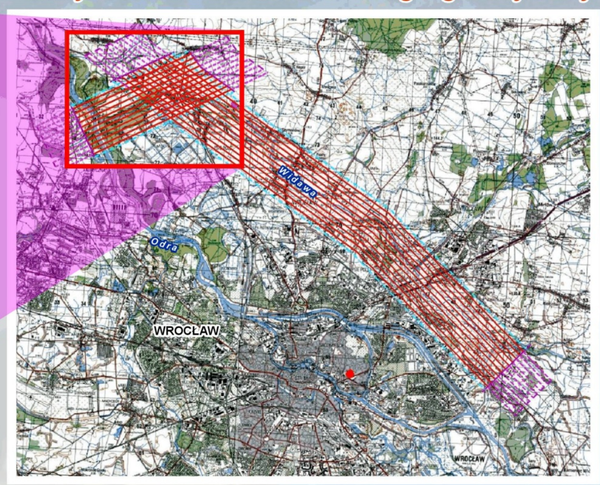


„Widawa" Project

Orthophoto



Mission planning: study area with the laser scanning flight trajectory



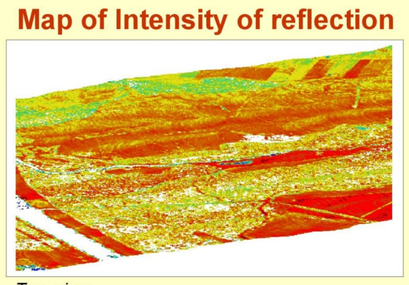
The data of laser scanning flight

Speed flight:	150 km/h
Flying height :	550 m
Swath width:	280 m
Distance betwen scanning flight trajectory (range):	190 m
Width of study area:	2 km
Length of study area :	20 km
Number of strips:	11

Result of survey:

Number of raw points ca:	150 mln
Average density:	3 points/m²
Vertical accuracy:	m_z = ± 0.20 m

Map of Intensity of reflection



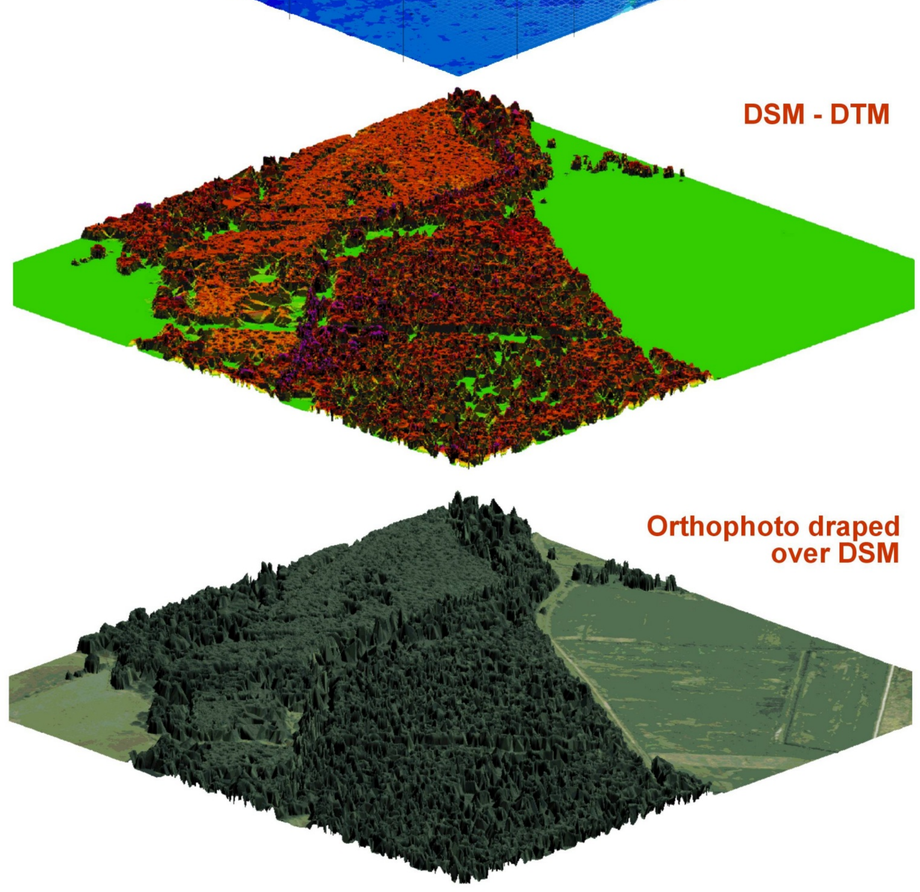
Top view

Calibration parameters

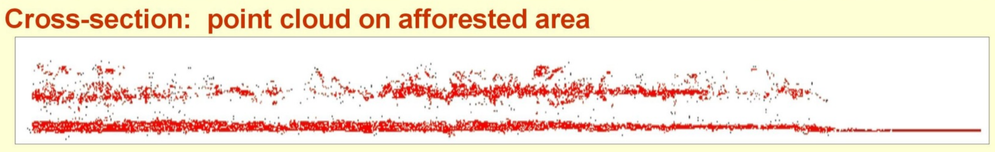
	parameter	values	Standard dev.	Remark
scanner	wobble angle γ_M	6.895 deg	± 0.007 deg	
bore-sight misalignment angels	roll $\delta\omega$	+ 0.636 deg	± 0.010 deg	
	pitch $\delta\varphi$	- 0.476 deg	± 0.010 deg	
	heading $\delta\kappa$	- 0.466 deg	± 0.056 deg	
ranging	slant range offset Add	+ 0.143 m	± 0.048 m	
FOV	across flight direction	27.580 deg	--	calc. with γ_M
	along flight direction	19.306 deg	--	calc. with γ_M

	along flight direction (local frame)	across flight direction (local frame)	vertical
Estimated residuals with respect to control areas	± 0.6 m	± 0.4 m	± 0.15 m
Absolute error (mean value) with respect to GPS control area	0.3 m	0.3 m	0.1 m

Digital Model



Cross-section: point cloud on afforested area



Use of the ALS Data for hydrodynamic modelling

- Differential model (DSM DTM) is applied in resistant factor estimation,
- Reflection intensity image is also applied in resistant factor estimation,
- Laser reflection distribution in vertical cross-sections may be used for wood layers estimation
- DTM is used for flood wave flow modelling.

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