
Report Laser scanning

04718

Juupajoki

<i>Document:</i> Report laser scanning Juupajoki	<i>Document</i>	
<i>Client:</i> University of Helsinki	<i>Version:</i> 1.0	<i>Date:</i> 02.09.2004

1.0 General

The document gives an overview of the LIDAR flights and the processing for the Juupajoki project. The BNM AS internal project number is 04718.

2.0 Data Acquisition

2.1 Flights

The flights were carried out from Finland:

Area	Date	GPS day
Juupajoki	5 th of August	218

2.2 Aircraft and crew

Flight carried out with aircraft LN-NPZ. The following BNM crew joined the survey:

Name	Position
Mr Stein Strand	Chief pilot
Mr John Frøybu	ALTM operator

2.3 GPS reference point

A reference point, set up by *U of H*, has been used. The location of this point is:

Lat: 61 50 5.18736
 Long: 2420 13.73439
 Ell height: 154.787

GPS/INS postprocessing report is found in appendix 3.

2.4 Parameters data acquisition

Parameter	Value
Scan frequency	29 Hz
Scan angle	+/- 20 deg
Speed	75 m/s
Altitude	900 m

A plot of the flightplan is found in appendix 1.

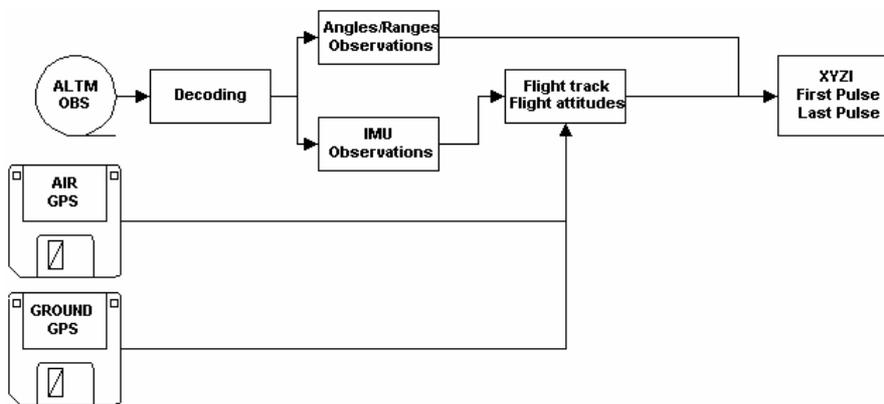
3.0 Processing

The processing chain has 4 major levels :

1. XYZ computations by combining GPS/INS solution with the ALTM observations (range and scan angles)
2. Roll, Pitch and z adjustment
3. Transformations
4. Product output, WGS84 UTM35:
 - o Laser point cloud
 - o ASCII (X, Y, Z, I), one file pr. pulse.

3.1 XYZ processing

Simplified workflow diagram :



The following software has been used :

Name	Product by	Tasks
REALM	Optech	Tape decoding, XYZ processing
POSPAC	Applanix	GPS/INS processing
TerraScan	TerraSolid	Pointdata management
TerraMatch	TerraSolid	Flighline matching

3.2 Attitude adjustment

Terramatch was run to determine and adjust for offsets in roll, pitch and height between flight lines. The report from TerraMatch is included in this document as Appendix 2.

3.3 Transformation and model offset

No transformation was carried out by BNM AS. This means that there can be a model height offset. Normal model offsets are from 4 cm to 15 cm.

3.4 Product generation

The following products has been delivered in WGS84 UTM 35:

- ASCII (X,Y, Z, Intensity) space separated.
- Separate files for first- and last return pulse.

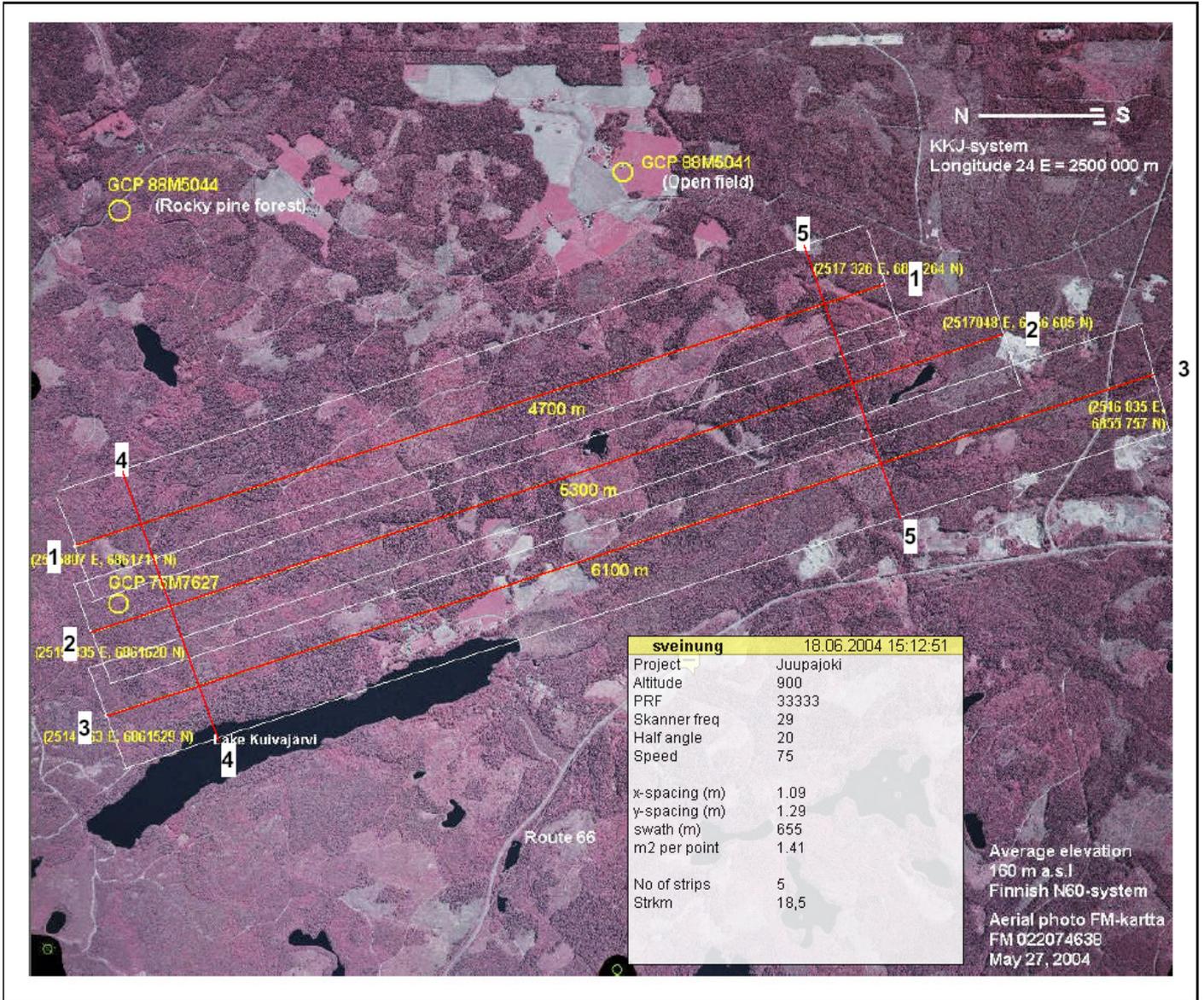
By request from University of Helsinki BNM has delivered raw lidardata, and the post-processed GPS/INS solution. The lidardata are all in ASCII format, and the post-processed GPS/INS solution is delivered as both ASCII and binary.

3.5 Data delivery

The data was delivered by mail to University of Helsinki, Att: Mr. Ilkka Korpela.

Appendix 1.

Flightplan



Appendix 2.

Flightline matching report

No known points
Observe every 5th point
Intensity not used
Solution for individual strips

Starting average dz: 0.0936
Final average dz: 0.0863

Standard error of unit 0.0385

Execution time: 595.5 sec
Number of iterations: 7

Flightline	Points	Z shift	R shift	P shift
4	40867	-0.033	-0.0001	-0.0026
1	88441	-0.060	-0.0041	+0.0024
2	113172	-0.018	+0.0025	+0.0026
3	64011	+0.046	+0.0011	-0.0046
5	47918	+0.066	-0.0008	-0.0033

Standard deviations	Flightline	Points	Z shift	R shift	P shift
	4	40867	0.004	0.0011	0.0014
	1	88441	0.003	0.0007	0.0012
	2	113172	0.003	0.0006	0.0009
	3	64011	0.003	0.0008	0.0013
	5	47918	0.004	0.0011	0.0013

Appendix 3. GPS/INS processing report

Documentation, Lidar survey

Area: Juupajoki
 GPS Day: 218
 Date: 05.08.2004

1. Baseline

Ground station:			Coordinate	ETRS89
GPS antenna:	ASH700718		North	61 50 5.18736
ARP- L1	0.0839		East	24 20 13.73439
ARP - L2	0.0623		Height el.	154.787
ARP- measure p.	0.0636			

Slant distance to measure point (meter): 0.960
 vertical distance to measure point (meter): 0.944
 Vertical distance to ARP (meter): 0.880

Fixed Solution Forward:		386206	Settings	
RMS:	0.029	passed	Elevation mask	13
RMS reliability:	6.300	passed	Omit Satellites	no
Fit / Fix sep:	0.283	passed	Kar	refine
SampeI rate			Frequency:	dual

Omit	Start	end
23	all	
24	387530	600000

Fixed Solution Revers:		387702	Settings	
RMS:	0.024	passed	Elevation mask	13
RMS reliability:	4.700	passed	Omit Satellites	no
Fit / Fix sep:	0.271	passed	Kar	refine
SampeI rate			Frequency:	dual

Combined solution (meter)				
	ground	Height		Min / Max
Seperation:	0.030	0.070	Number of Sat	6 / 7
Position St.Dev			Pdop	2.0 / 2.7

GPS accept : Ivar Oveland 26.08.2004

Solution: gps_proc_21804b.dat 26.08.2004 @ 16:46

GPS / INS integration

Calibration Values from 19.04.2004	X	Y	Z
User to IMU lever arm (mirror to imu)	-0.094	-0.005	-0.109
Use Frame to IMU misalignment	-0.005	-0.015	-1.100
N- GPS lever arm Coordinates	0.530	-0.196	-1.523
Airplan	LN-NPZ	IMU time delay	0.003000 [s]

Flight A_A

Data Control	Done by	Date	Status
Disk Extration	Ivar		ok
Decode Range	Ivar		ok
Extract IMU	Ivar		ok
Decode GPS	Ivar		ok
XYZ calculation			

IMU report:	Start	end
Time intervall	384837	389419
Nr. of interpolation	0	
Nr. of gaps	0	
Correct time types	yes	

Integration Report	Start	End
Time of interest	386780	387695
Processed data	386287	388050
Init. Start process		
Roll Min/maks (grader)		

GPS/INS accept: Ivar Oveland 26.08.2004

Solution: sbet_21804b.out 26.08.2004 @ 16:59