

### Contact information

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### Project Name: Dragons Back Ridge, San Andreas Fault - California

#### 1. Survey areas

The survey area is an irregular polygon centered on the San Andreas Fault (approximately 40 square kilometers) southwest of Taft, California. This area was surveyed on May 19, 2005 using an Optech 1233 Airborne Laser Terrain Mapper (<http://www.optech.ca/>) mounted in a twin engine Cessna 337 Skymaster. Figure 1 (below) is an image showing the flight lines, project shape and location.

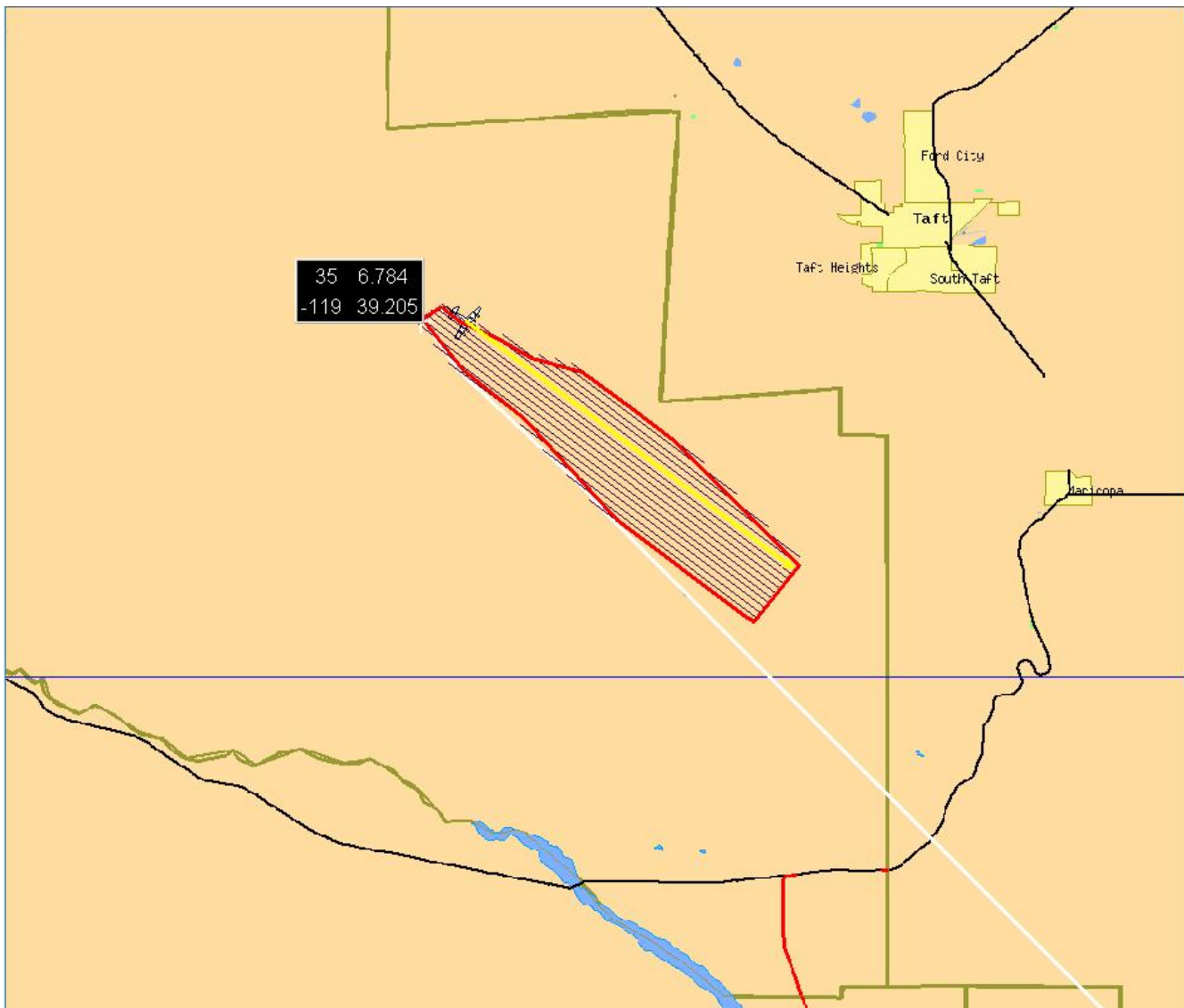


Figure 1 - Project shape and location.

## 2. Survey Parameters

The project area was flown with 17 flight lines oriented northwest-southeast and 2 additional cross lines flown perpendicular to the survey lines for field calibration purposes. The flying height was targeted at 600 meters Above Ground Level (AGL) but varied during the survey. Flying speed was also variable, but targeted at 117 knots. Planned point spacing per swath was approximately 1 meter along-track at nadir, 2.1 meters at the scan edge and 0.73 meters cross-track. Overlap coverage was targeted at approximately 100%, (50% sidelap). Additional parameters are shown below in Figure 2.

**74 Plan Survey Grid**

☒ Lock First Pass to Edge?

**Add New Area** **Remove Area**

**Active Area**

◀ Area **1** of **1** ▶

**Draw Area** **Edit Corners** **Generate Box** **Load from File**

**Pass Orientation**

Optimize ☐ 0 30 60 90 120 150 180 210 240 270 300 330 360

Flight Profile		LIDAR Settings	
Altitude (m AGL)	<b>600</b>	System PRF (kHz)	<b>33.333</b>
Pass Heading (deg)	<b>127</b>	Scan Freq (Hz)	<b>28</b>
Overlap (m)	<b>218.38</b>	Scan Angle +/-	<b>20</b>
Speed (m/s)	<b>60</b>	Desired Res (m)	<b>0.903</b>
Turn Time (min)	<b>8</b>	Cross Track Res	<b>0.734</b>
Passes	<b>17</b>	Down Track Res	<b>1.071</b>
Pass Spacing (m)	<b>218.38</b>	Swath (m)	<b>436.76</b>

**Survey Totals**

Total Passes	<b>17</b>	Swath Area (km <sup>2</sup> )	<b>46.219</b>
Total Length (km)	<b>211.644</b>	AOI Area (km <sup>2</sup> )	<b>40.279</b>
Total Flight Time	<b>03:12:24</b>	Total Laser Time	<b>00:58:47</b>

**Costs**

☐ Use Swath Area **Cost per Acre** **0** **Area Cost** **\$0**

☒ Use AOI Area **Cost per Hour** **0** **Time Cost** **\$0**

**Apply** **Help** **Close**

Figure 2 - Planning parameters.

Table 1 (below) gives the combined laser-on for the project.

Hilley	Laser on	Laser off	Line	GPS on	GPS off	Laser on (Hours)			
139 sky	19:05:49	19:09:11	1	414349	414551	0.06			
	19:12:55	19:15:55	2	414775	414955	0.05			
	19:19:12	19:22:16	3	415152	415336	0.05			
	19:26:10	19:30:02	4	415570	415802	0.06			
	19:35:33	19:40:47	5	416133	416447	0.09			
	19:44:35	19:49:43	6	416675	416983	0.09			
	19:53:03	19:58:12	7	417183	417492	0.09			
	20:01:33	20:06:49	8	417693	418009	0.09			
	20:09:57	20:15:29	9	418197	418529	0.09			
	20:18:51	20:24:07	10	418731	419047	0.09			
	20:27:36	20:33:15	11	419256	419595	0.09			
	20:37:03	20:41:42	12	419823	420102	0.08			
	20:44:49	20:49:35	13	420289	420575	0.08			
	20:52:12	20:57:00	14	420732	421020	0.08			
	21:00:38	21:04:20	15	421238	421460	0.06			
	21:07:52	21:10:49	16	421672	421849	0.05			
	21:14:05	21:16:26	17	422045	422186	0.04			
	21:18:28	21:20:02	18 X	422308	422402	0.03			
	21:22:56	21:24:15	19 X	422576	422655	0.02	<b>Total</b>	<b>1.28</b>	<b>Hours</b>

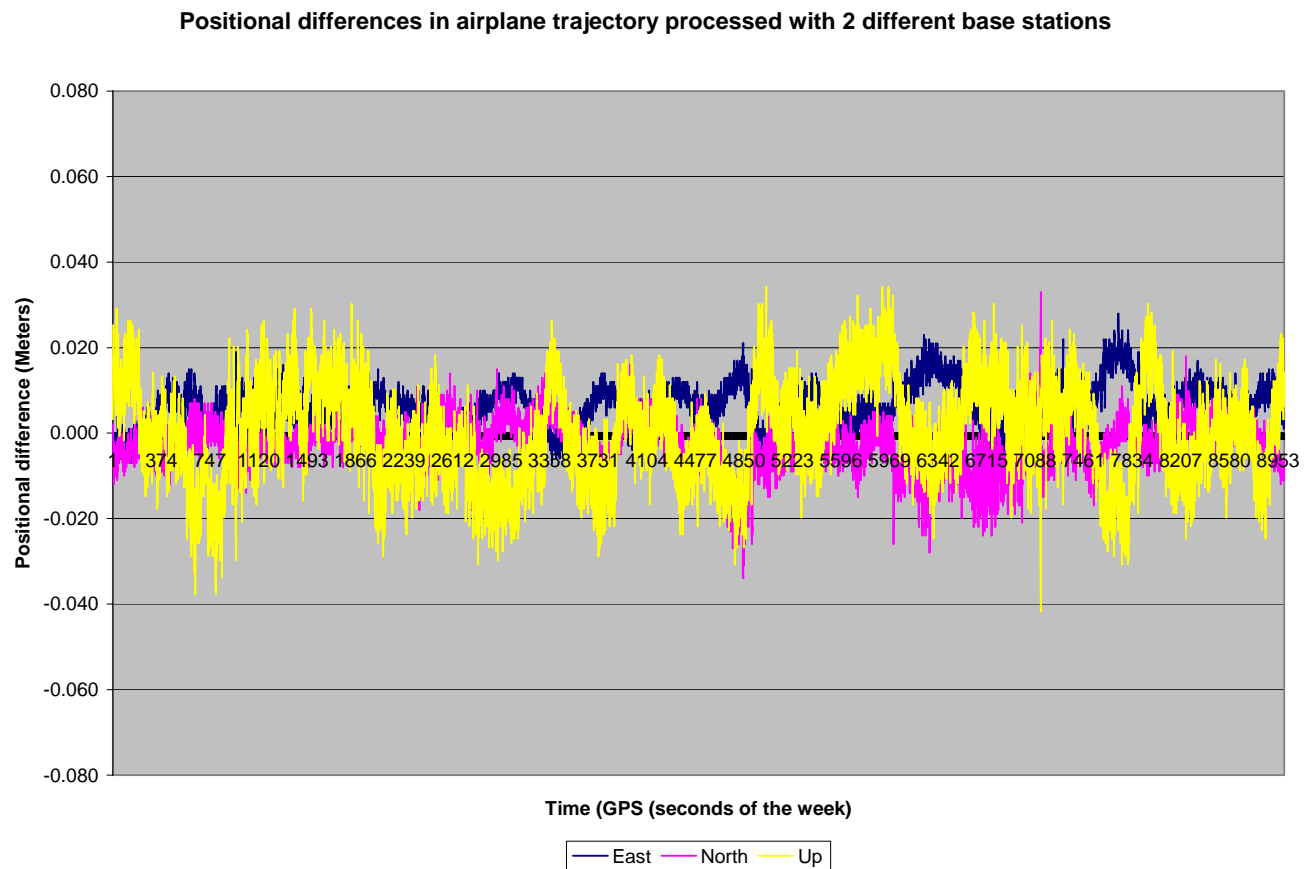
Table 1 - Laser-on time.

### 3. GPS Reference Stations

Two GPS reference station locations were used during the survey. One receiver was placed on a newly set mark (G049) at the southeast end of line 1. This station was observed on May 19 for a total of 7.5 hours. The other receiver was placed on a newly set mark named G050 located in the project area near the northwest end of line 3. G050 was observed for 9 hours on the day of the flight. All GPS observations were logged at a 1-second rate and were submitted to the NGS on-line processor OPUS with solution files included as Appendix A. Final coordinates for the reference stations G049 and G050 were based on these OPUS solutions. For further information on OPUS see <http://www.ngs.noaa.gov/OPUS/> and for more information on the CORS network see <http://www.ngs.noaa.gov/CORS/>. Ground equipment at G049 was an ASHTECH (Thales Navigation) Z-Extreme receiver, with choke ring antenna (Part# 700936.D) mounted on a conventional tripod, and at G050 a TRIMBLE R7 receiver with a choke ring antenna (Part # 29659-00) also mounted on a conventional tripod.

### 4. Navigation Processing

The airplane trajectory was processed using KARS software (Kinematic and Rapid Static) written by Dr. Gerry Madir of the NOAA Research Laboratory. A separate solution was obtained using both ground reference stations G049 and G050 and these solutions were then differenced. A plot of these differences appears below in Figure 3.



**Figure 3 – Positional differences in trajectory positions as processed from 2 base stations**

After GPA processing, the trajectory and the (Inertial Measurement Unit) data collected during the flight were input into APPLANIX software POSPROC which uses a Kalman Filter to produce a final navigation solution (aircraft position and orientation) at 50 Hz.

## **5. Laser Point Processing**

All coordinates were processed with respect to NAD83 and referenced to the national CORS network. The projection is UTM Zone 11, with units in meters. Heights are GRS80 ellipsoid heights.

The most complete output format is nine-column ASCII (space delimited), one file per flight strip.

The nine columns are as follows:

1. GPS time (seconds of week);
2. Easting last stop;
3. Northing last stop;
4. Height last stop;
5. Intensity last stop;
6. Easting first stop;
7. Northing first stop;
8. Height first stop;
9. Intensity first stop.

Note that the UTM zone code (11) is appended to the Easting coordinate in this nine-column format. The UF has utility software to reformat these files, for example to extract last stop elevations and intensities and remove the UTM zone code. These utilities are written in C /C++ programming language and are available for distribution.

During processing, a scan cutoff angle of 3.0 degrees was used to eliminate points at the edge of the scan lines. This was done to improve the overall DEM accuracy (points farthest from the scan nadir are the most affected by small errors in pitch, roll and scanner mirror angle measurements). Points with very low intensity values were also filtered out (intensity values less than 7), because these points also tend to be the least accurate. This is due to the fact that very weak return pulses yield the noisiest range measurements. These points represent a very small percentage of the total number of points, usually in the neighborhood of a few hundredths of one percent. An almost total absence of vegetation makes this project area ideal, because removal of scan edges and very low intensity points does not reduce the point density of bare-earth shots as it might in a heavily canopied project area.

All calibration files as well as all raw observation files (both GPS and ALTM) necessary to reprocess this project in its entirety are archived by UC Berkeley.

Appendix B contains a copy of the range file report – in-depth information of the data file written by the ALTM 1233 during the survey.

## **6. Ground Truth and Calibration**

A relative calibration was performed using the cross lines in TERRASOLID software using modules TERRASCAN and TERRAMATCH ([www.terrasolid.fi](http://www.terrasolid.fi)). This software uses point to point correlations of separate flight strips to solve for heading, roll, pitch and scanner mirror scale calibration values. After obtaining adjustments to calibration values using TERRAMATCH, laser point processing was re-done and the calibration rechecked. Results are shown below in TERRAMATCH output format:

Used loaded points  
Trajectories: C:\\_Work\\_Hilley\139\_sky\  
No known points  
Observe every 1th point  
Intensity not used  
Solution for whole data set

Starting average dz: 0.049  
Final average dz: 0.033

Standard error of unit 0.0150

Execution time: 2165.7 sec  
Number of iterations: 25

Points	4580594		
H shift	-0.0162	Std dev	0.0009
R shift	-0.0058	Std dev	0.0002
P shift	-0.0001	Std dev	0.0007
Scale	+0.00098		

Note that average differences in swath to swath elevation values are less than 5 cm.

No absolute ground calibration was performed on these data, so a bias may be present with respect to ellipsoid heights obtained by GPS during ground surveys. If this bias exists it should be in the range of +/- 0.15 meters.

## 7. Filtering and DEM Production

Terrasolid's TerraScan (<http://terrasolid.fi>) software was used to classify the last return LIDAR points and generate the "bare-earth" dataset.

Two algorithms were run on the entire last return dataset:

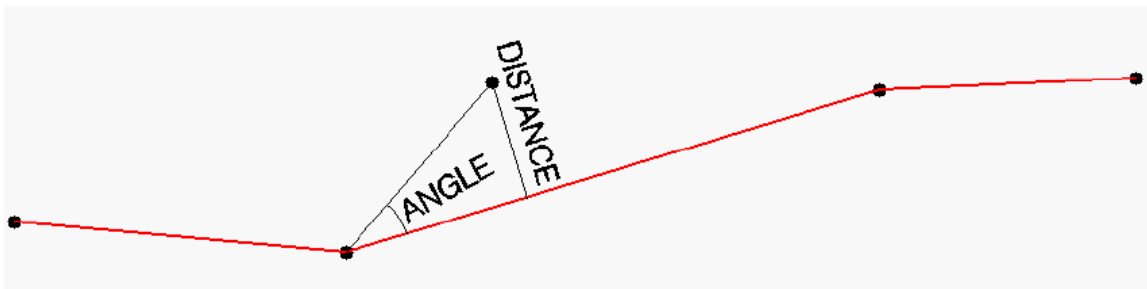
- 1) Removal of "Low Points". This routine was used to search for possible error points which are clearly below the ground surface. The elevation of each point (=center) is compared with every other point within a given neighborhood and if the center point is clearly lower than any other point it will be classified as a "low point". This routine can also search for groups of low points where the whole group is lower than other points in the vicinity. The parameters used on this dataset were:

Search for: Groups of Points  
Max Count (maximum size of a group of low points): 6  
More than (minimum height difference): 0.3 m  
Within (xy search range): 5.0 m

- 2) Ground Classification. This routine classifies ground points by iteratively building a triangulated surface model. The algorithm starts by selecting some local low points assumed as sure hits on the ground, within a specified window size. This makes the algorithm particularly

sensitive to low outliers in the initial dataset, hence the requirement of removing as many erroneous low points as possible in the first step.

The routine builds an initial model from selected low points. Triangles in this initial model are mostly below the ground with only the vertices touching ground. The routine then starts molding the model upwards by iteratively adding new laser points to it. Each added point makes the model follow ground surface more closely. Iteration parameters determine how close a point must be to a triangle plane so that the point can be accepted to the model. **Iteration angle** is the maximum angle between point, its projection on triangle plane and closest triangle vertex. The smaller the Iteration angle, the less eager the routine is to follow changes in the point cloud. **Iteration distance** parameter makes sure that the iteration does not make big jumps upwards when triangles are large. This helps to keep low buildings out of the model. The routine can also help avoiding adding unnecessary point density into the ground model by reducing the eagerness to add new points to ground inside a triangle with all edges shorter than a specified length.



Ground classification parameters used:

Max Building Size (window size): 60.0 m  
Terrain Angle: 66.0  
Iteration Angle: 6.0  
Iteration Distance: 1.4 m

After classification, the ground points were outputted in 2km x 2km overlapping tiles (60m overlap), ASCII format (XYZ).

Using the overlapping tiles, Digital Elevation Models were produced at 1.0 meter spacing using SURFER (Golden Software) ver. 9.01. Interpolation parameters were as follows:

Gridding Algorithm: Kriging  
Variogram: Linear  
Nugget Variance: 0.07 m  
MicroVariance: 0.00 m  
SearchDataPerSector: 10  
SearchMinData: 5  
SearchMaxEmpty: 1  
SearchRadius: 20m

We used overlapping tiles for making sure that the surface obtained from krigging is consistent when transitioning from one tile to the adjacent tiles. The surveyed area is too big to be gridded in one piece with the currently available software.

These 1m grids were afterwards imported in ESRI's ArcINFO (ver. 8.3) GIS package, the overlap trimmed and then all grids were merged into one seamless raster dataset.

A similar tiling and krigging process was used to create the unfiltered seamless raster dataset, based on the unfiltered last return point data. The interpolation parameters for the unfiltered grids were as follows:

Gridding Algorithm: Kriging

Variogram: Linear

Nugget Variance: 0.07 m

MicroVariance: 0.00 m

SearchDataPerSector: 10

SearchMinData: 5

SearchMaxEmpty: 1

SearchRadius: 5m



# APPENDIX A.

## GPS Reference Station Coordinates from OPUS

### NGS OPUS SOLUTION REPORT

=====

USER: michael@ufl.edu  
RINEX FILE: g050138r.05o

DATE: June 17, 2005  
TIME: 20:13:54 UTC

SOFTWARE: page5 0411.19 master31.pl  
EPHEMERIS: igs13233.eph [precise]  
NAV FILE: brdc1380.05n  
ANT NAME: TRM29659.00  
ARP HEIGHT: 1.164

START: 2005/05/18 17:50:00  
STOP: 2005/05/19 03:48:00  
OBS USED: 21406 / 21534 : 99%  
# FIXED AMB: 66 / 66 : 100%  
OVERALL RMS: 0.013(m)

REF FRAME: NAD\_83(CORS96)(EPOCH:2002.0000) ITRF00 (EPOCH:2005.3779)

X:	-2581750.324(m)	0.036(m)	-2581751.065(m)	0.036(m)
Y:	-4544093.735(m)	0.040(m)	-4544092.368(m)	0.040(m)
Z:	3644849.953(m)	0.029(m)	3644849.991(m)	0.029(m)

LAT:	35 4 22.38214	0.040(m)	35 4 22.39849	0.040(m)
E LON:	240 23 48.13337	0.037(m)	240 23 48.08129	0.037(m)
W LON:	119 36 11.86663	0.037(m)	119 36 11.91871	0.037(m)
EL HGT:	630.799(m)	0.019(m)	630.147(m)	0.019(m)
ORTHO HGT:	664.358(m)	0.031(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 11)	SPC (0405 CA 5)
Northing (Y) [meters]	3884225.627	675639.911
Easting (X) [meters]	262627.771	1853783.203
Convergence [degrees]	-1.49660003	-0.91389796
Point Scale	1.00029448	0.99993785
Combined Factor	1.00019545	0.99983885

US NATIONAL GRID DESIGNATOR: 11SKU6262884226(NAD 83)

BASE STATIONS USED				
PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
AH8263	VAN1 VANDENBERG AFB 1 CORS ARP	N344935.791	W1203348.573	91870.6
DF7060	CARR CARR HILL SITE 2 CORS ARP	N355318.163	W1202550.898	117591.6
DG4677	BKR1 BAKERSFIELD 1 CORS ARP	N350756.578	W1190634.069	45512.0

NEAREST NGS PUBLISHED CONTROL POINT				
PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
FU3683	TEMBLOR	N350645.983	W1193317.985	6250.8

This position and these vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

# NGS OPUS SOLUTION REPORT

=====

USER: michael@ufl.edu  
RINEX FILE: g049139q.05o

DATE: June 17, 2005  
TIME: 20:12:53 UTC

SOFTWARE: page5 0411.19 master28.pl  
EPHEMERIS: igs13234.eph [precise]  
NAV FILE: brdc1390.05n  
ANT NAME: ASH700936D\_M  
ARP HEIGHT: 1.127

START: 2005/05/19 16:34:00  
STOP: 2005/05/19 23:58:30  
OBS USED: 17454 / 17522 : 100%  
# FIXED AMB: 54 / 54 : 100%  
OVERALL RMS: 0.013(m)

REF FRAME: NAD\_83(CORS96)(EPOCH:2002.0000)

ITRF00 (EPOCH:2005.3804)

X:	-2577780.780(m)	0.010(m)	-2577781.522(m)	0.010(m)
Y:	-4550365.100(m)	0.022(m)	-4550363.733(m)	0.022(m)
Z:	3640136.762(m)	0.029(m)	3640136.797(m)	0.029(m)

LAT:	35 1 12.05018	0.030(m)	35 1 12.06645	0.030(m)
E LON:	240 28 6.44336	0.004(m)	240 28 6.39132	0.004(m)
W LON:	119 31 53.55664	0.004(m)	119 31 53.60868	0.004(m)
EL HGT:	786.358(m)	0.023(m)	785.704(m)	0.023(m)
ORTHO HGT:	819.716(m)	0.034(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 11)	SPC (0405 CA 5)
Northing (Y) [meters]	3878191.924	669673.459
Easting (X) [meters]	269022.861	1860237.005
Convergence [degrees]	-1.45340090	-0.87299802
Point Scale	1.00025757	0.99993311
Combined Factor	1.00013412	0.99980970

US NATIONAL GRID DESIGNATOR: 11SKU6902378192(NAD 83)

## BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
AH8263	VAN1 VANDENBERG AFB 1 CORS ARP	N344935.791	W1203348.573	96710.6
DG4677	BKR1 BAKERSFIELD 1 CORS ARP	N350756.578	W1190634.069	40472.6
DG9737	P562 SOLEDADMTNCS2004 CORS ARP	N345855.661	W1181119.427	122671.0

## NEAREST NGS PUBLISHED CONTROL POINT

FU3645	GLO 12 1926	N350015.912	W1192924.644	4151.7
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This position and these vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

## APPENDIX B.

### Range file information

```
=====
ALTM TapeDeco
-----

TapeDeco Version: 3.1.8

ALTM_1233 Tape being decoded.

Data Source:      C:\_Work\_Hilley\Range\5_19_05sky_c_.range

Tape ID:      139c

Start Time: 10:17:16, 06/20/05
=====
Files Created:
-----
  C:\_Work\_Hilley\Bin\DATA_FL\LT7.lis
  C:\_Work\_Hilley\Bin\DATA_FL\LT2.lsr
  C:\_Work\_Hilley\Bin\DATA_FL\LT5.ins
  C:\_Work\_Hilley\Bin\DATA_FL\LT6.pos
  C:\_Work\_Hilley\Bin\DATA_FL\LT1.lsh
  C:\_Work\_Hilley\Bin\DATA_FL\LT4.tag
  C:\_Work\_Hilley\Bin\DATA_FL\LT3.gps
  C:\_Work\_Hilley\Bin\CTRL_FL\LtTapDec.Rst

=====
Listing Data for Strip Number 3

ALTM 1210 Laser Header Data
-----
Strip:                      3
Flight Date:                2005/05/19, 1323
Strip Start Time:          19:05:56, 414356
Laser Frequency:           33333
TIM 1 Mode:                First Pulse Mode [0]
TIM 2 Mode:                Last Pulse Mode [1]
Scanner Rate:              28
Users Max Scanner Range:   20
Eyesafe Altitude:          0 meters
Laser Power:               100
Beam Set:                  NA
System Serial Number:       98B110
ALTM Customer:              U Of FLA
System Data Format:          SDM5
Airborne Software Version:  rel-6-1-5
Airborne Software Date:     Jan 27 2003
Minimum Allowed Range:      40.00 meters
Maximum Allowed Range:      5000.00 meters
Time Correction:            0.00

RangeIntensityK:            32.000000
```

Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 414359.73, 1323  
End GPS Time, Week: 414552.31, 1323

-----  
Strip Average Temperature: 35 degrees  
TIM1 Clock Frequency Deviation: 6 ppm  
TIM2 Clock Frequency Deviation: -3 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 6419392 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 6419392

Minimum TIM1 Range: 80.88 m  
Maximum TIM1 Range: 704.54 m  
Average TIM1 Range: 637.36 m  
StDev of TIM1 Range: 17.42 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 588.40 m  
Maximum TIM2 Range: 705.00 m  
Average TIM2 Range: 637.79 m  
StDev of TIM2 Range: 17.36 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (215)  
Maximum TIM1 intensity: 992  
Average TIM1 intensity: 84.00  
StDev of TIM1 intensity: 13.38

Minimum TIM2 intensity: 6  
Maximum TIM2 intensity: 992  
Average TIM2 intensity: 84.00  
StDev of TIM2 intensity: 13.35

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.68  
Scanner StDev: 12.19, 1248.63

Number of records in TAG file: 426

Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 21255

Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 4

ALTM 1210 Laser Header Data

-----  
Strip: 4  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:13:02, 414782  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:

Start GPS Time, Week: 518400.00, 1303

End GPS Time, Week: 604799.00, 1355

Strip GPS Times:

Start GPS Time, Week: 414785.79, 1323

End GPS Time, Week: 414956.38, 1323

-----

Strip Average Temperature: 35 degrees

TIM1 Clock Frequency Deviation: 6 ppm

TIM2 Clock Frequency Deviation: -3 ppm

-----

STRIP SUMMARY

-----

Number of good laser records: 5686566 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 5686566

Minimum TIM1 Range: 90.92 m  
Maximum TIM1 Range: 754.68 m  
Average TIM1 Range: 664.62 m  
StDev of TIM1 Range: 34.90 m

TIM1 Errors caused by:

Minimum TIM2 Range: 545.94 m  
Maximum TIM2 Range: 755.11 m  
Average TIM2 Range: 665.05 m  
StDev of TIM2 Range: 34.86 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (195)  
Maximum TIM1 intensity: 224  
Average TIM1 intensity: 80.03  
StDev of TIM1 intensity: 15.38

Minimum TIM2 intensity: 2  
Maximum TIM2 intensity: 180  
Average TIM2 intensity: 80.03  
StDev of TIM2 intensity: 15.36

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.086, 2056.80  
Scanner StDev: 12.19, 1248.63

Number of records in TAG file: 374  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 18720  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 5

ALTM 1210 Laser Header Data

-----  
Strip: 5  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:19:19, 415159  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110

ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 415162.69, 1323  
End GPS Time, Week: 415337.34, 1323

-----  
Strip Average Temperature: 35 degrees  
TIM1 Clock Frequency Deviation: 6 ppm  
TIM2 Clock Frequency Deviation: -3 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 5821668 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 5821668

Minimum TIM1 Range: 80.63 m  
Maximum TIM1 Range: 745.81 m  
Average TIM1 Range: 643.08 m  
StDev of TIM1 Range: 30.37 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 580.05 m  
Maximum TIM2 Range: 746.24 m  
Average TIM2 Range: 643.51 m  
StDev of TIM2 Range: 30.33 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (240)  
Maximum TIM1 intensity: 288  
Average TIM1 intensity: 88.74  
StDev of TIM1 intensity: 19.34

Minimum TIM2 intensity: 6

Maximum TIM2 intensity: 288  
Average TIM2 intensity: 88.75  
StDev of TIM2 intensity: 19.32  
  
Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.72  
Scanner StDev: 12.19, 1248.65  
  
Number of records in TAG file: 417  
Min/Max GPS Time Increment: 1.0000, 1.0000  
  
Number of records in INS file: 20865  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 6

ALTM 1210 Laser Header Data

-----

Strip: 6  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:26:17, 415577  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 415580.75, 1323  
End GPS Time, Week: 415803.30, 1323

-----



Strip Average Temperature: 35 degrees  
TIM1 Clock Frequency Deviation: 6 ppm  
TIM2 Clock Frequency Deviation: -3 ppm

-----  
STRIP SUMMARY  
-----

Number of good laser records: 7418328 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 7418328

Minimum TIM1 Range: 90.05 m  
Maximum TIM1 Range: 775.60 m  
Average TIM1 Range: 643.17 m  
StDev of TIM1 Range: 40.40 m

TIM1 Errors caused by:

Minimum TIM2 Range: 515.45 m  
Maximum TIM2 Range: 776.02 m  
Average TIM2 Range: 643.60 m  
StDev of TIM2 Range: 40.37 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (488)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 87.06  
StDev of TIM1 intensity: 17.53

Minimum TIM2 intensity: 3  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 87.06  
StDev of TIM2 intensity: 17.50

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.70  
Scanner StDev: 12.19, 1248.62

Number of records in TAG file: 566  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 28275  
Min/Max INS Time Increment: 0.0200, 0.0200

=====  
=====  
Listing Data for Strip Number 7

ALTM 1210 Laser Header Data  
-----

Strip: 7  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:35:40, 416140

Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 416143.64, 1323  
End GPS Time, Week: 416448.23, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 10153120 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 10153120

Minimum TIM1 Range: 89.62 m  
Maximum TIM1 Range: 749.14 m  
Average TIM1 Range: 631.74 m  
StDev of TIM1 Range: 40.54 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 539.59 m  
Maximum TIM2 Range: 749.60 m  
Average TIM2 Range: 632.17 m  
StDev of TIM2 Range: 40.50 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (328)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 91.87  
StDev of TIM1 intensity: 20.50

Minimum TIM2 intensity: 6  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 91.87  
StDev of TIM2 intensity: 20.48

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.72  
Scanner StDev: 12.19, 1248.62

Number of records in TAG file: 542  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 27105  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 8

ALTM 1210 Laser Header Data

-----

Strip: 8  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:44:42, 416682  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 416686.09, 1323  
End GPS Time, Week: 416984.30, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

STRIP SUMMARY  
-----

Number of good laser records: 9940232 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 9940232

Minimum TIM1 Range: 89.90 m  
Maximum TIM1 Range: 807.26 m  
Average TIM1 Range: 656.78 m  
StDev of TIM1 Range: 44.06 m

TIM1 Errors caused by:

Minimum TIM2 Range: 568.77 m  
Maximum TIM2 Range: 807.70 m  
Average TIM2 Range: 657.21 m  
StDev of TIM2 Range: 44.03 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (669)  
Maximum TIM1 intensity: 320  
Average TIM1 intensity: 82.97  
StDev of TIM1 intensity: 18.07

Minimum TIM2 intensity: 5  
Maximum TIM2 intensity: 320  
Average TIM2 intensity: 82.98  
StDev of TIM2 intensity: 18.04

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.69  
Scanner StDev: 12.19, 1248.58

Number of records in TAG file: 507  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 25350  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 9

ALTM 1210 Laser Header Data

-----

Strip: 9  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 19:53:09, 417189  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:

Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:

Start GPS Time, Week: 417195.00, 1323  
End GPS Time, Week: 417493.21, 1323

-----

Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm

-----

STRIP SUMMARY

-----

Number of good laser records: 9940232 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 9940232

Minimum TIM1 Range: 76.84 m  
Maximum TIM1 Range: 800.80 m

Average TIM1 Range: 669.32 m  
StDev of TIM1 Range: 39.89 m

TIM1 Errors caused by:

Minimum TIM2 Range: 553.02 m  
Maximum TIM2 Range: 3769.99 m  
Average TIM2 Range: 669.74 m  
StDev of TIM2 Range: 39.86 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (132)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 80.54  
StDev of TIM1 intensity: 20.73

Minimum TIM2 intensity: 2  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 80.54  
StDev of TIM2 intensity: 20.72

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.71  
Scanner StDev: 12.19, 1248.55

Number of records in TAG file: 511  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 25545  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 10

ALTM 1210 Laser Header Data

-----  
Strip: 10  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 20:01:41, 417701  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters

Time Correction: 0.00  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 417703.72, 1323  
End GPS Time, Week: 418010.28, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 10218624 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 10218624

Minimum TIM1 Range: 88.38 m  
Maximum TIM1 Range: 780.43 m  
Average TIM1 Range: 662.32 m  
StDev of TIM1 Range: 32.65 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 581.48 m  
Maximum TIM2 Range: 780.85 m  
Average TIM2 Range: 662.75 m  
StDev of TIM2 Range: 32.61 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (146)  
Maximum TIM1 intensity: 320  
Average TIM1 intensity: 80.75  
StDev of TIM1 intensity: 17.63

Minimum TIM2 intensity: 2  
Maximum TIM2 intensity: 320  
Average TIM2 intensity: 80.75  
StDev of TIM2 intensity: 17.62

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.72

Scanner StDev: 12.19, 1248.54

Number of records in TAG file: 503  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 25155  
Min/Max INS Time Increment: 0.0200, 0.0200

=====  
=====  
Listing Data for Strip Number 11

ALTM 1210 Laser Header Data  
-----

Strip: 11  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 20:10:05, 418205  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000  
  
-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 418208.72, 1323  
End GPS Time, Week: 418530.27, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----



# STRIP SUMMARY

Number of good laser records: 10718092 [100.00 %]  
 Number of bad laser records: 0 [0.00 %]  
 Number total of laser records: 10718092

Minimum TIM1 Range: 88.88 m  
 Maximum TIM1 Range: 796.99 m  
 Average TIM1 Range: 657.07 m  
 StDev of TIM1 Range: 30.95 m

## TIM1 Errors caused by:

Minimum TIM2 Range: 582.05 m  
 Maximum TIM2 Range: 2365.36 m  
 Average TIM2 Range: 657.49 m  
 StDev of TIM2 Range: 30.91 m

## TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (107)  
 Maximum TIM1 intensity: 320  
 Average TIM1 intensity: 81.66  
 StDev of TIM1 intensity: 16.49

Minimum TIM2 intensity: 6  
 Maximum TIM2 intensity: 320  
 Average TIM2 intensity: 81.66  
 StDev of TIM2 intensity: 16.49

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
 Scanner average: 0.085, 2056.73  
 Scanner StDev: 12.19, 1248.52

Number of records in TAG file: 534  
 Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 26715  
 Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

## Listing Data for Strip Number 12

### ALTM 1210 Laser Header Data

-----  
 Strip: 12  
 Flight Date: 2005/05/19, 1323  
 Strip Start Time: 20:18:57, 418737  
 Laser Frequency: 33333  
 TIM 1 Mode: First Pulse Mode [0]  
 TIM 2 Mode: Last Pulse Mode [1]  
 Scanner Rate: 28  
 Users Max Scanner Range: 20  
 Eyesafe Altitude: 0 meters

Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
    Start GPS Time, Week: 518400.00, 1303  
    End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
    Start GPS Time, Week: 418742.40, 1323  
    End GPS Time, Week: 419048.22, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 10189964 [99.96 %]  
Number of bad laser records: 4096 [0.04 %]  
Number total of laser records: 10194060

Timestamps rejected:  
    ALTM Timestamp errors: 4096

Minimum TIM1 Range: 80.77 m  
Maximum TIM1 Range: 763.66 m  
Average TIM1 Range: 658.77 m  
StDev of TIM1 Range: 34.77 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 585.17 m  
Maximum TIM2 Range: 764.11 m  
Average TIM2 Range: 659.20 m  
StDev of TIM2 Range: 34.72 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (120)  
Maximum TIM1 intensity: 320  
Average TIM1 intensity: 78.64  
StDev of TIM1 intensity: 16.43  
  
Minimum TIM2 intensity: 3  
Maximum TIM2 intensity: 320  
Average TIM2 intensity: 78.65  
StDev of TIM2 intensity: 16.42  
  
Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.73  
Scanner StDev: 12.19, 1248.55

Number of records in TAG file: 527  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 26325  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 13

#### ALTM 1210 Laser Header Data

-----  
Strip: 13  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 20:27:43, 419263  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000  
  
-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 419267.77, 1323  
End GPS Time, Week: 419596.19, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

STRIP SUMMARY  
-----

Number of good laser records: 10947356 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 10947356

Minimum TIM1 Range: 88.39 m  
Maximum TIM1 Range: 780.90 m  
Average TIM1 Range: 654.06 m  
StDev of TIM1 Range: 42.17 m

TIM1 Errors caused by:

Minimum TIM2 Range: 534.60 m  
Maximum TIM2 Range: 781.36 m  
Average TIM2 Range: 654.49 m  
StDev of TIM2 Range: 42.14 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (103)  
Maximum TIM1 intensity: 384  
Average TIM1 intensity: 81.61  
StDev of TIM1 intensity: 20.79

Minimum TIM2 intensity: 2  
Maximum TIM2 intensity: 384  
Average TIM2 intensity: 81.61  
StDev of TIM2 intensity: 20.79

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.73  
Scanner StDev: 12.19, 1248.50

Number of records in TAG file: 565  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 28275  
Min/Max INS Time Increment: 0.0200, 0.0200

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=====

Listing Data for Strip Number 14

ALTM 1210 Laser Header Data

-----  
Strip: 14  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 20:37:11, 419831  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDMS  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000  
  
-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 419835.72, 1323  
End GPS Time, Week: 420103.10, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
  
-----

STRIP SUMMARY

-----  
Number of good laser records: 8912638 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 8912638

Minimum TIM1 Range: 75.27 m  
Maximum TIM1 Range: 758.69 m  
Average TIM1 Range: 636.82 m  
StDev of TIM1 Range: 33.48 m

TIM1 Errors caused by:

Minimum TIM2 Range:	570.17 m
Maximum TIM2 Range:	759.14 m
Average TIM2 Range:	637.25 m
StDev of TIM2 Range:	33.44 m

TIM2 Errors caused by:

Minimum TIM1 intensity:	0 (76)
Maximum TIM1 intensity:	194
Average TIM1 intensity:	82.39
StDev of TIM1 intensity:	15.86

Minimum TIM2 intensity:	3
Maximum TIM2 intensity:	194
Average TIM2 intensity:	82.40
StDev of TIM2 intensity:	15.85

Scanner range (angle, counts):	-20.00 ~ 20.00, 0 ~ 4095
Scanner average:	0.085, 2056.75
Scanner StDev:	12.19, 1248.54

Number of records in TAG file: 468  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 23400  
Min/Max INS Time Increment: 0.0200, 0.0200

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Listing Data for Strip Number 15

ALTM 1210 Laser Header Data

-----

Strip:	15
Flight Date:	2005/05/19, 1323
Strip Start Time:	20:44:56, 420296
Laser Frequency:	33333
TIM 1 Mode:	First Pulse Mode [0]
TIM 2 Mode:	Last Pulse Mode [1]
Scanner Rate:	28
Users Max Scanner Range:	20
Eyesafe Altitude:	0 meters
Laser Power:	100
Beam Set:	NA
System Serial Number:	98B110
ALTM Customer:	U Of FLA
System Data Format:	SDM5
Airborne Software Version:	rel-6-1-5
Airborne Software Date:	Jan 27 2003
Minimum Allowed Range:	40.00 meters
Maximum Allowed Range:	5000.00 meters
Time Correction:	0.00

RangeIntensityK: 32.000000

Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 420299.47, 1323  
End GPS Time, Week: 420576.07, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 9219688 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 9219688

Minimum TIM1 Range: 89.75 m  
Maximum TIM1 Range: 775.61 m  
Average TIM1 Range: 656.73 m  
StDev of TIM1 Range: 34.57 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 588.48 m  
Maximum TIM2 Range: 1349.34 m  
Average TIM2 Range: 657.15 m  
StDev of TIM2 Range: 34.54 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (59)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 79.35  
StDev of TIM1 intensity: 17.37

Minimum TIM2 intensity: 3  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 79.35  
StDev of TIM2 intensity: 17.36

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.70  
Scanner StDev: 12.19, 1248.53

Number of records in TAG file: 441

Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 22035

Min/Max INS Time Increment: 0.0200, 0.0200

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=====

Listing Data for Strip Number 16

ALTM 1210 Laser Header Data

-----  
Strip: 16  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 20:52:19, 420739  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000  
  
-----

User Selected GPS Times:

Start GPS Time, Week: 518400.00, 1303

End GPS Time, Week: 604799.00, 1355

Strip GPS Times:

Start GPS Time, Week: 420743.14, 1323

End GPS Time, Week: 421021.08, 1323

-----

Strip Average Temperature: 36 degrees

TIM1 Clock Frequency Deviation: 5 ppm

TIM2 Clock Frequency Deviation: -4 ppm

-----

STRIP SUMMARY

-----



Number of good laser records: 9260626 [99.96 %]  
Number of bad laser records: 4096 [0.04 %]  
Number total of laser records: 9264722

Timestamps rejected:  
ALTM Timestamp errors: 4096

Minimum TIM1 Range: 88.10 m  
Maximum TIM1 Range: 787.96 m  
Average TIM1 Range: 631.66 m  
StDev of TIM1 Range: 36.01 m

TIM1 Errors caused by:

Minimum TIM2 Range: 471.94 m  
Maximum TIM2 Range: 788.43 m  
Average TIM2 Range: 632.09 m  
StDev of TIM2 Range: 35.98 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (37)  
Maximum TIM1 intensity: 384  
Average TIM1 intensity: 83.29  
StDev of TIM1 intensity: 18.03

Minimum TIM2 intensity: 7  
Maximum TIM2 intensity: 384  
Average TIM2 intensity: 83.29  
StDev of TIM2 intensity: 18.02

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.71  
Scanner StDev: 12.19, 1248.53

Number of records in TAG file: 507  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 25350  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 17

ALTM 1210 Laser Header Data

-----  
Strip: 17  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 21:00:44, 421244  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters

Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
    Start GPS Time, Week: 518400.00, 1303  
    End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
    Start GPS Time, Week: 421248.93, 1323  
    End GPS Time, Week: 421461.04, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 7070338 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 7070338

Minimum TIM1 Range: 82.44 m  
Maximum TIM1 Range: 751.54 m  
Average TIM1 Range: 656.19 m  
StDev of TIM1 Range: 33.51 m

#### TIM1 Errors caused by:

Minimum TIM2 Range: 588.60 m  
Maximum TIM2 Range: 752.03 m  
Average TIM2 Range: 656.62 m  
StDev of TIM2 Range: 33.48 m

#### TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (11)  
Maximum TIM1 intensity: 193  
Average TIM1 intensity: 80.56

StDev of TIM1 intensity: 16.80  
Minimum TIM2 intensity: 10  
Maximum TIM2 intensity: 193  
Average TIM2 intensity: 80.56  
StDev of TIM2 intensity: 16.79  
  
Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.084, 2056.64  
Scanner StDev: 12.19, 1248.53  
  
Number of records in TAG file: 433  
Min/Max GPS Time Increment: 1.0000, 1.0000  
  
Number of records in INS file: 21645  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 18

ALTM 1210 Laser Header Data

-----  
Strip: 18  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 21:07:59, 421679  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 421682.76, 1323

End GPS Time, Week: 421850.04, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

STRIP SUMMARY  
-----

Number of good laser records: 5576028 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 5576028

Minimum TIM1 Range: 93.58 m  
Maximum TIM1 Range: 693.67 m  
Average TIM1 Range: 621.52 m  
StDev of TIM1 Range: 25.18 m

TIM1 Errors caused by:

Minimum TIM2 Range: 552.62 m  
Maximum TIM2 Range: 694.14 m  
Average TIM2 Range: 621.94 m  
StDev of TIM2 Range: 25.16 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (25)  
Maximum TIM1 intensity: 384  
Average TIM1 intensity: 90.54  
StDev of TIM1 intensity: 16.69

Minimum TIM2 intensity: 3  
Maximum TIM2 intensity: 384  
Average TIM2 intensity: 90.55  
StDev of TIM2 intensity: 16.68

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.085, 2056.72  
Scanner StDev: 12.19, 1248.55

Number of records in TAG file: 374  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 18720  
Min/Max INS Time Increment: 0.0200, 0.0200

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=====  
Listing Data for Strip Number 19

ALTM 1210 Laser Header Data  
-----

Strip: 19  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 21:14:11, 422051  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00  
  
RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----  
User Selected GPS Times:  
Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:  
Start GPS Time, Week: 422056.51, 1323  
End GPS Time, Week: 422188.05, 1323

-----  
Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm  
-----

#### STRIP SUMMARY

-----

Number of good laser records: 4384674 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 4384674

Minimum TIM1 Range: 92.57 m  
Maximum TIM1 Range: 703.81 m  
Average TIM1 Range: 632.34 m  
StDev of TIM1 Range: 26.32 m

TIM1 Errors caused by:

Minimum TIM2 Range: 550.60 m

Maximum TIM2 Range: 704.23 m  
Average TIM2 Range: 632.77 m  
StDev of TIM2 Range: 26.29 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (17)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 87.63  
StDev of TIM1 intensity: 15.21

Minimum TIM2 intensity: 4  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 87.63  
StDev of TIM2 intensity: 15.20

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.086, 2056.76  
Scanner StDev: 12.19, 1248.56

Number of records in TAG file: 261  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 13065  
Min/Max INS Time Increment: 0.0200, 0.0200

=====

=====

Listing Data for Strip Number 20

ALTM 1210 Laser Header Data

-----

Strip: 20  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 21:18:34, 422314  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:

Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:

Start GPS Time, Week: 422318.56, 1323  
End GPS Time, Week: 422403.06, 1323

-----

Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm

-----

STRIP SUMMARY

-----

Number of good laser records: 2816672 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 2816672

Minimum TIM1 Range: 91.87 m  
Maximum TIM1 Range: 701.59 m  
Average TIM1 Range: 604.60 m  
StDev of TIM1 Range: 40.70 m

TIM1 Errors caused by:

Minimum TIM2 Range: 522.88 m  
Maximum TIM2 Range: 702.04 m  
Average TIM2 Range: 605.03 m  
StDev of TIM2 Range: 40.69 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (125)  
Maximum TIM1 intensity: 352  
Average TIM1 intensity: 94.18  
StDev of TIM1 intensity: 23.99

Minimum TIM2 intensity: 7  
Maximum TIM2 intensity: 352  
Average TIM2 intensity: 94.20  
StDev of TIM2 intensity: 23.95

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.087, 2056.87  
Scanner StDev: 12.19, 1248.55

Number of records in TAG file: 269  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 13455

Min/Max INS Time Increment: 0.0200, 0.0200

=====

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Listing Data for Strip Number 21

ALTM 1210 Laser Header Data

-----

Strip: 21  
Flight Date: 2005/05/19, 1323  
Strip Start Time: 21:23:02, 422582  
Laser Frequency: 33333  
TIM 1 Mode: First Pulse Mode [0]  
TIM 2 Mode: Last Pulse Mode [1]  
Scanner Rate: 28  
Users Max Scanner Range: 20  
Eyesafe Altitude: 0 meters  
Laser Power: 100  
Beam Set: NA  
System Serial Number: 98B110  
ALTM Customer: U Of FLA  
System Data Format: SDM5  
Airborne Software Version: rel-6-1-5  
Airborne Software Date: Jan 27 2003  
Minimum Allowed Range: 40.00 meters  
Maximum Allowed Range: 5000.00 meters  
Time Correction: 0.00

RangeIntensityK: 32.000000  
Last\_pulse\_constant: 390192  
Scanner Counts: 4096  
Scanner Range [Max Angle]: 40.000000

-----

User Selected GPS Times:

Start GPS Time, Week: 518400.00, 1303  
End GPS Time, Week: 604799.00, 1355

Strip GPS Times:

Start GPS Time, Week: 422586.70, 1323  
End GPS Time, Week: 422655.97, 1323

-----

Strip Average Temperature: 36 degrees  
TIM1 Clock Frequency Deviation: 5 ppm  
TIM2 Clock Frequency Deviation: -4 ppm

-----

STRIP SUMMARY

-----

Number of good laser records: 2309016 [100.00 %]  
Number of bad laser records: 0 [0.00 %]  
Number total of laser records: 2309016



Minimum TIM1 Range: 90.55 m  
Maximum TIM1 Range: 761.58 m  
Average TIM1 Range: 646.11 m  
StDev of TIM1 Range: 47.64 m

TIM1 Errors caused by:

Minimum TIM2 Range: 556.42 m  
Maximum TIM2 Range: 762.02 m  
Average TIM2 Range: 646.54 m  
StDev of TIM2 Range: 47.62 m

TIM2 Errors caused by:

Minimum TIM1 intensity: 0 (43)  
Maximum TIM1 intensity: 384  
Average TIM1 intensity: 86.87  
StDev of TIM1 intensity: 20.54

Minimum TIM2 intensity: 1  
Maximum TIM2 intensity: 384  
Average TIM2 intensity: 86.87  
StDev of TIM2 intensity: 20.53

Scanner range (angle, counts): -20.00 ~ 20.00, 0 ~ 4095  
Scanner average: 0.087, 2056.89  
Scanner StDev: 12.19, 1248.53

Number of records in TAG file: 1903  
Min/Max GPS Time Increment: 1.0000, 1.0000

Number of records in INS file: 95160  
Min/Max INS Time Increment: 0.0200, 0.0200