Northwest Florida Water Management District (NWFWMD)

Apalachicola River

LIDAR Report

Prepared by:

Merrick & Company

2450 South Peoria Street

Aurora, CO 80014

Phone: (303) 751-0741

Fax: (303) 745-0964

EXECUTIVE SUMMARY

In the Fall of 2006, Merrick & Company was contracted by the Northwest Florida Water Management District via URS Coporation Southern to execute a LIDAR (Light Detection and Ranging) survey along the Apalachicola River of northern Florida. The purpose of the project is to procuce accurate, high-resolution data for planning, analysis, and for use with other data sets. Merrick & Company obtained LiDAR data over approximately 209 square miles covering part of the Apalachicola River drainage in Calhoun, Gadsden, Jackson, and Liberty Counties, Florida. The LiDAR data has been processed to result in a data set that is suitable for the future generation of 2-foot contours.

CONTRACT INFORMATION

Questions regarding this report should be addressed to:

Mr. Doug Jacoby, CMS, GISP
Project Manager
Merrick & Company
2450 South Peoria Street
Aurora, CO 80014
303-353-3903
303-521-6522 Cell
doug.jacoby@merrick.com

Project Completion Report for NWFWMD - Apalachicola River

The contents of this report summarize the methods used to establish the base station network, perform the LIDAR data collection and post-processing as well as the results of these methods for NWFWMD – Apalachicola River.

LIDAR FLIGHT and SYSTEM REPORT

Project Location

The project location for NWFWMD – Apalachicola River is defined by the client provided shapefile "Apalachicola_R_Grid_floodplain_LiDAR.shp".

Duration/Time Period

The LIDAR aircraft, a Cessna 402C, arrived on site on March 16th, 2007 and the LIDAR data collection was accomplished on March 18th, 2007. The Marianna Airport (MAI) was used as the airfield of operations.

Flight Diagram

Refer to Appendix A for the flight diagram for this county.

Mission Parameters

LiDAR Sensor	Leica Geosystems ALS50 Phase 2
Nominal Ground Sample Distance	4 Feet
Average Altitude	7,500 Feet MSL
Airspeed	~124 Knots
Scan Rate	24 Hertz
Scan FOV (scan angle)	30°
Pulse Rate	52,500 Hertz

Mission	Date	Start Time	End Time	PDOP
070318 A	March 18, 2007	14:35 GMT	19:46 GMT	3.4
070318 B	March 18, 2007	21:33 GMT	23:37 GMT	3.1

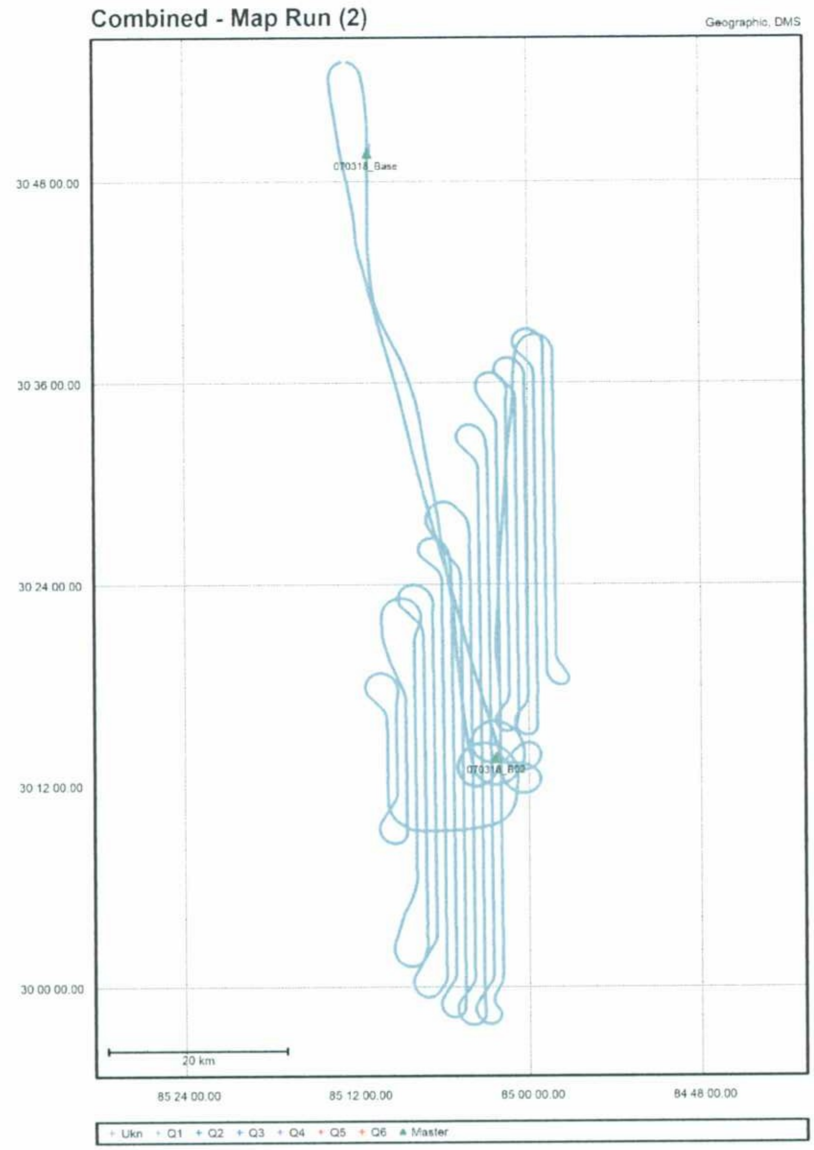
Field Work / Procedures

Two GPS base stations were set up, with one receiver located at the airport, and one secondary GPS receiver placed in the southern half of the project area, near Lewis, FL.

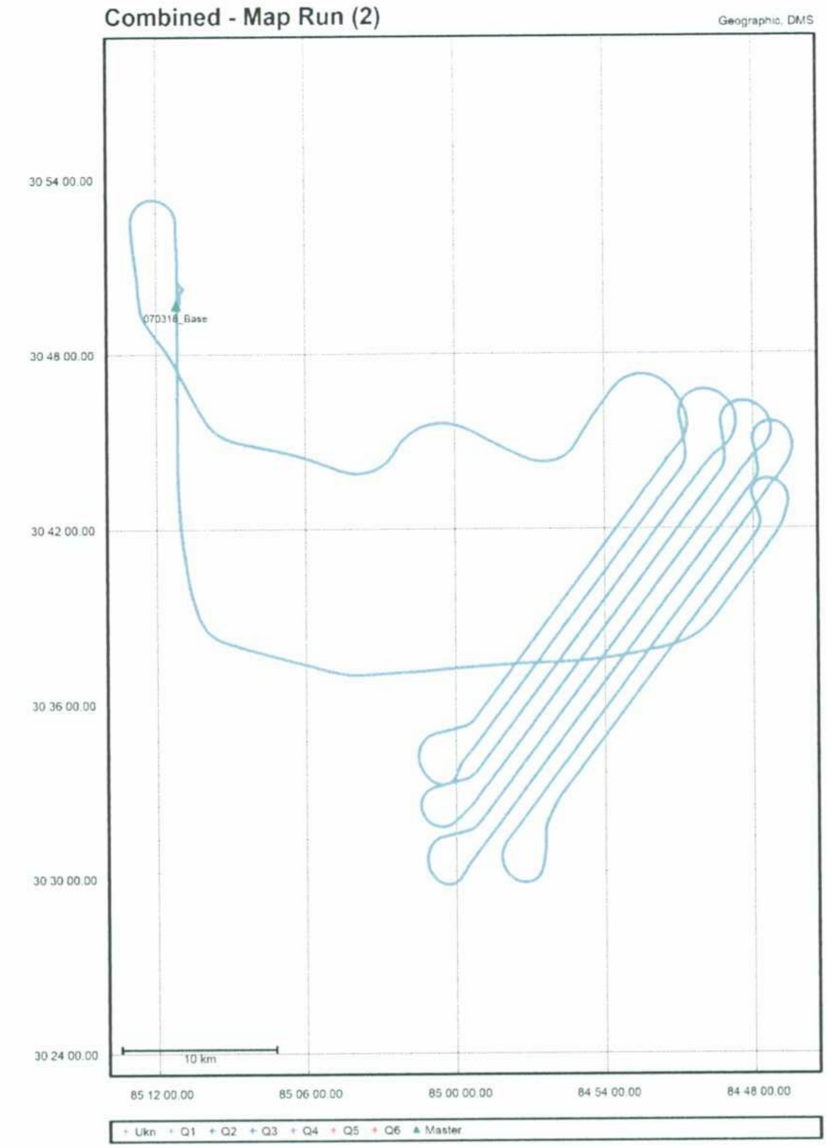
Pre-flight checks such as cleaning the sensor head glass are performed. A five minute INS initilization is conducted on the ground, with the engines running, prior to flight, to establish fine-alignment of the INS. GPS ambiguities are resolved by flying within ten kilometers of the base stations.

The first flight mission was 5 hours in duration and the second was 2 hours. During the data collection, the operator recorded information on logsheets which includes weather conditions, LIDAR operation parameters, and flight line statistics. Near the end of the mission, GPS abiguities were again resolved by flying within ten kilometers of the base stations to aid in post-processing. ATC authorities were notified of all flight plans ahead of time and during flight.

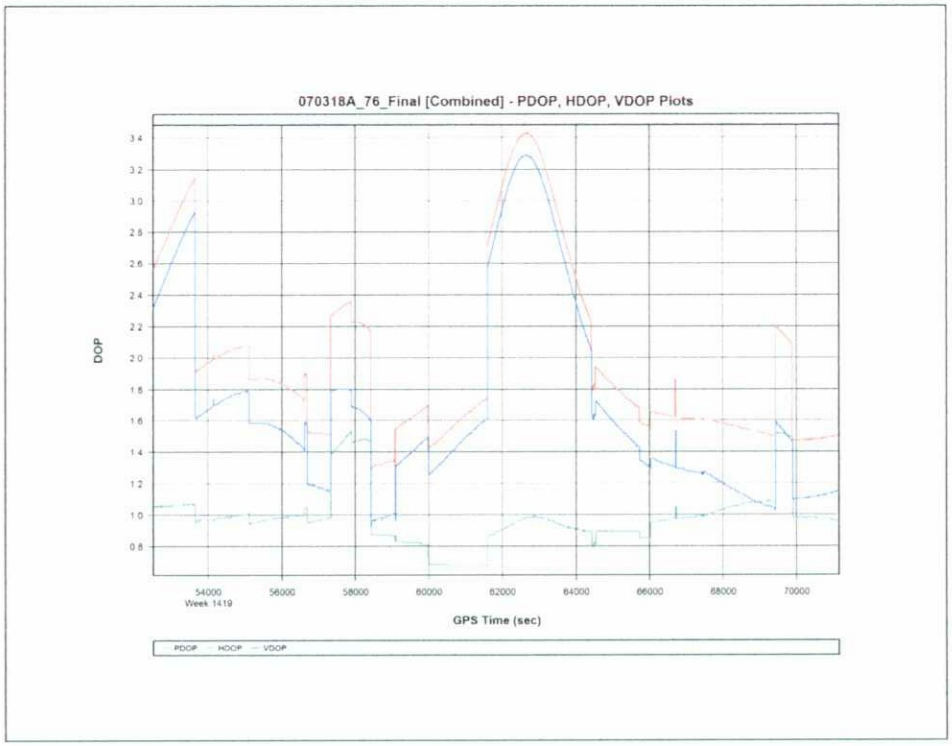
Data was sent back to the main office and preliminary data processing was performed for quality control of GPS data and to ensure sufficient overlap between flight lines. Any problematic data could then be reflown immediately as required. Final data processing was completed in the Aurora, Colorado office.



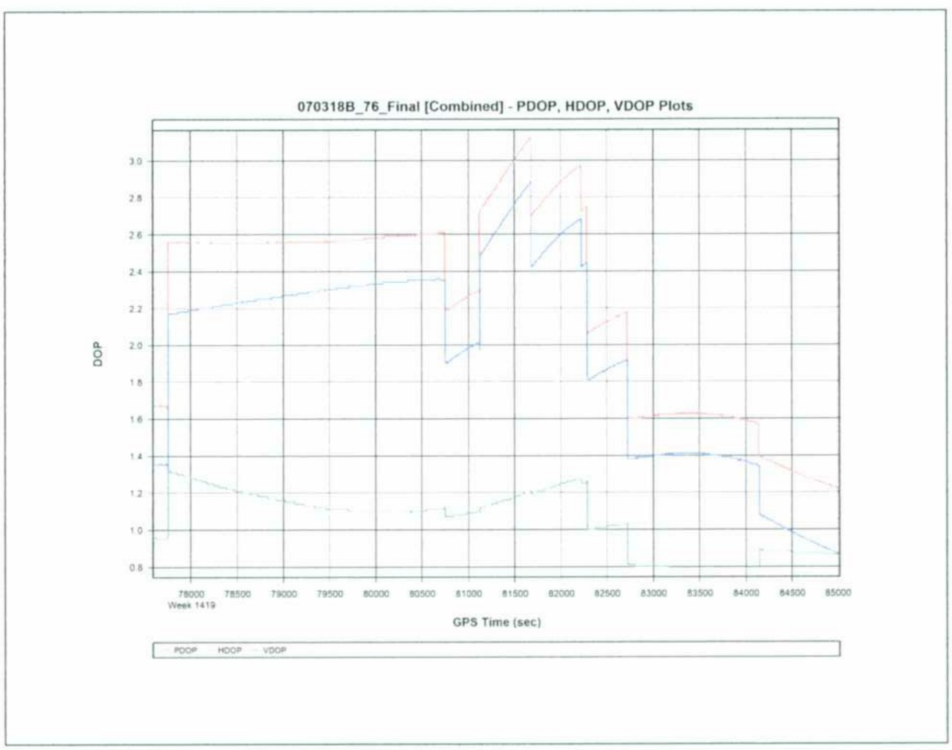
GPS derived flight tracks for mission 070318 A.



GPS derived flight tracks for mission 070318 B.



PDOP chart for mission 070318 A



PDOP chart for mission 070318 B

LIDAR Data Processing

The airborne GPS data was post-processed using Waypoint's GravNAV™ software version 7.6. A fixed-bias carrier phase solution was computed in both the forward and reverse chronological directions. Whenever practical, LIDAR acquisition was limited to periods when the PDOP was less than 4.0.

The GPS trajectory was combined with the raw IMU data and post-processed using Leica's Intertial position and Attitude System (IPAS pro). This results in a two-fold improvement in the attitude accuracies over the real-time INS data. The smoothed best estimated trajectory (SBET) and refined attitude data are then utilized in the ALS Post Processor to compute the laser point-positions – the trajectory is combined with the attitude data and laser range measurements to produce the 3-dimensional coordinates of the mass points. Up to four return values are produced within the ALS Post Processor software for each pulse which ensures the greatest chance of ground returns in a heavily forested area.

Laser point classification was completed using Merrick Advanced Remote Sensing (MARS) LIDAR processing and modeling software. Several algorithms are used when comparing points to determine the best automatic ground solution. Each filter is built based on the projects terrain and land cover to provide a surface that is 90% free of anomolys and artifacts. After the autofilter has been completed the data is then reviewed by an operator utilizing MARS to remove any other anomalies or artifacts not resolved by the automated filter process. During these final steps the operator also verifies that the data set is consistent and complete with no data voids.

GROUND CONTROL REPORT / CHECK POINT SURVEY AND RESULTS

GPS Controls

Two GPS base stations were set up, with one receiver located at the airport, and one secondary GPS receiver placed in the southern half of the project area, near Bristol, FL.

The main airborne base station was NGS (National Geodetic Survey) point MARIPORT, located at the Marianna Airport, Marianna, FL.

Ground Control Parameters

Horizontal Datum

The horizontal datum for the project is the North American Datum of 1983 (NAD83); adjusted in 1999 (NAD 83/99).

Vertical Datum

The vertical datum for the project is NAVD88.

Coordinate System / Units

The project coordinate system is UTM Zone 16 North (16N).
Horizontal units are in meters, vertical units are in U.S. Survey Feet.

Geiod Model

Geoid03

Ellipsoid Model

WGS84

Ground Control Report

Refer to Appendix B for the full Network Survey Report. This Report reflects the primary survey network developed by Merrick & Company.

Refer to Appendix C for the check point survey and the results of the check point validation.

LIDAR CALIBRATION

Introduction

A LIDAR calibration or 'boresight' is performed on every mission to determine and eliminate systemic biases that occur within the hardware of the Leica ALS50 laser scanning system, the inertial measurement unit (IMU), and because of environmental conditions which affect the refraction of light. The systemic biases that are corrected for include roll, pitch, and heading.

Calibration Procedures

In order to correct the error in the data, misalignments of features in the overlap areas of the lidar flightlines must be detected and measured. At some point within the mission, a specfic flight pattern must be flown which shows all the misalignments that can be present. Typically, Merrick flies a pattern of at least three opposing direction and overlapping lines, three of which provide all the information required to calibrate the system.

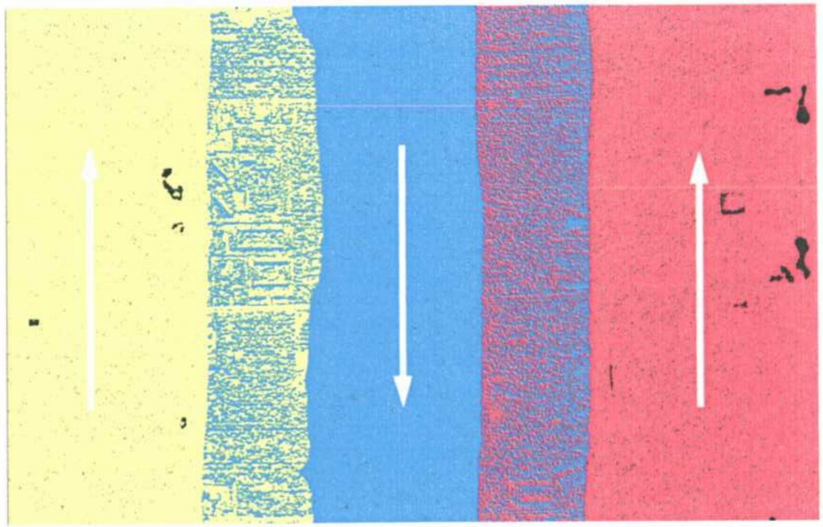


Figure 1: Flight pattern required for calibration

Correcting for Pitch and Heading Biases

There are many settings in the ALS40/50 post processor that can be used to manipulate the data; six are used for boresighting. They are roll, pitch, heading, torsion, range and atmospheric correction. The order in which each is evaluated is not very important and may be left to the discretion of the operator. For this discussion, pitch and heading will be evaluated first. It is important to remember that combinations of error can be very confusing, and this is especially true with pitch and heading. They affect the data in similar ways, so error attributed to pitch may be better blamed on heading and vice versa. To see a pitch/heading error, one must use the profile tool to cut along the flight path at a pitched roof or any elevation feature that is perpendicular to the flight path. View the data by elevation to locate these scenarios.

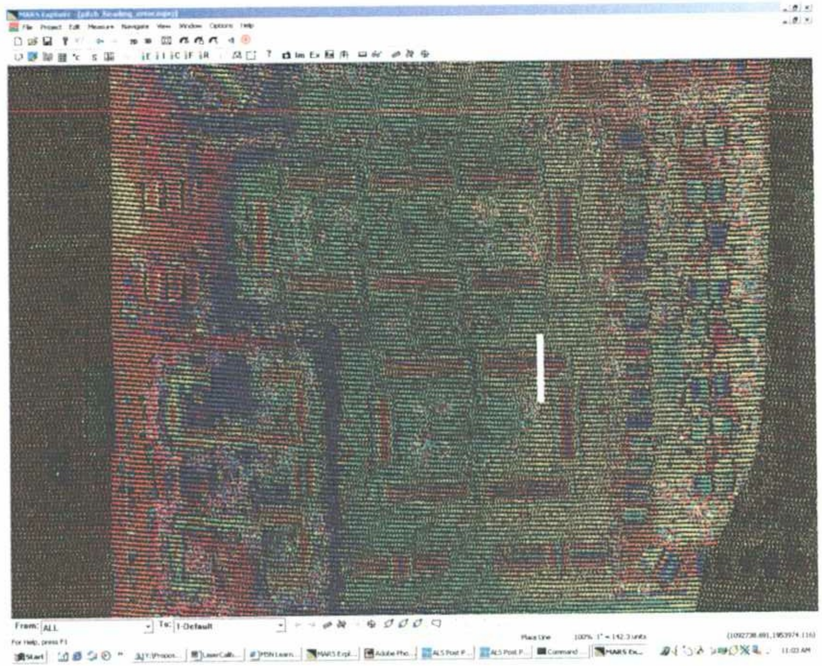


Figure 2: Orthographic view with profile line

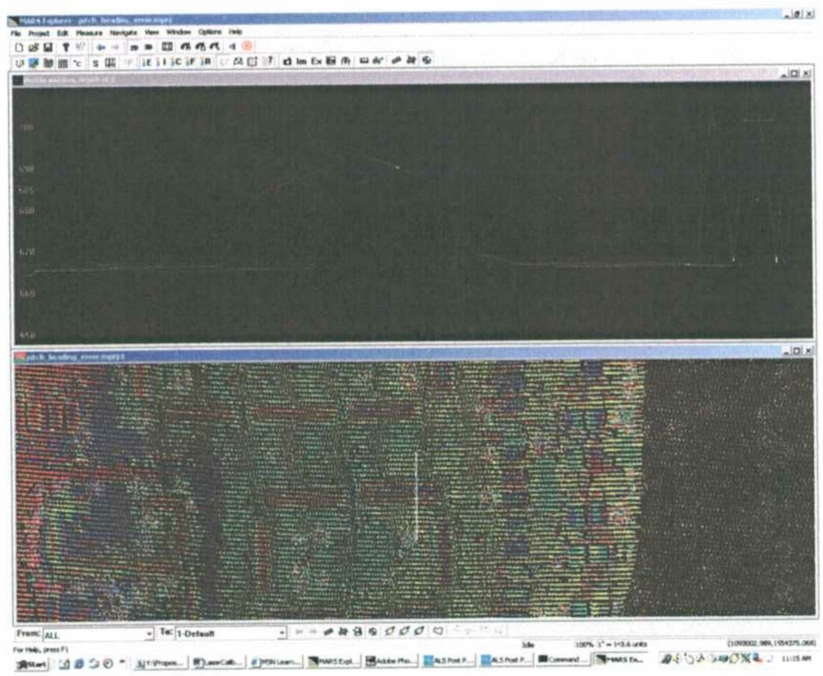


Figure 3: Profile view of misalignment

The profile line in figures 2 and 3 has an additional thin line perpendicular to the cut that shows the direction of the view. In this case, the line is pointing to the right, or east. In the profile window, we are looking through two separate TINs, so there are two lines showing the location of the same building. The yellow line is from the flight line on the left (flown north); the light blue line is from the flight line in the middle (flown south).

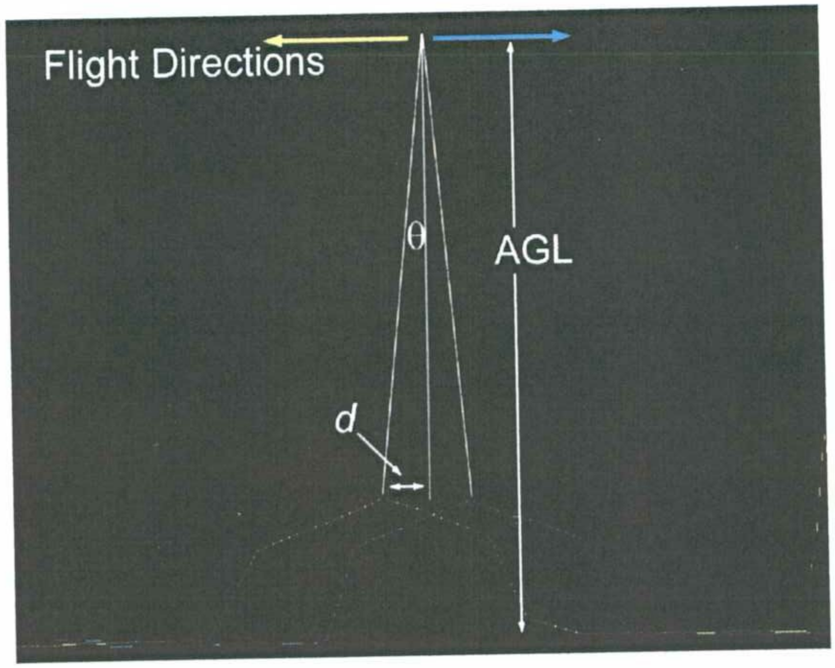


Figure 4: Adjusting pitch

The top arrows represent each respective flight direction. We are looking east, the yellow flight line was flown north, and the blue line is flown south. Adjusting pitch changes the relationship between the pitch from the IMU and the actual pitch of the plane. Increasing pitch sends the nose of the plane up and the data ahead in the flight direction. Lowering pitch does the opposite. In this example, pitch needs to decrease in order to bring these two roof lines together. The angle theta must be expressed in radians. The formula to arrive at this angle is...

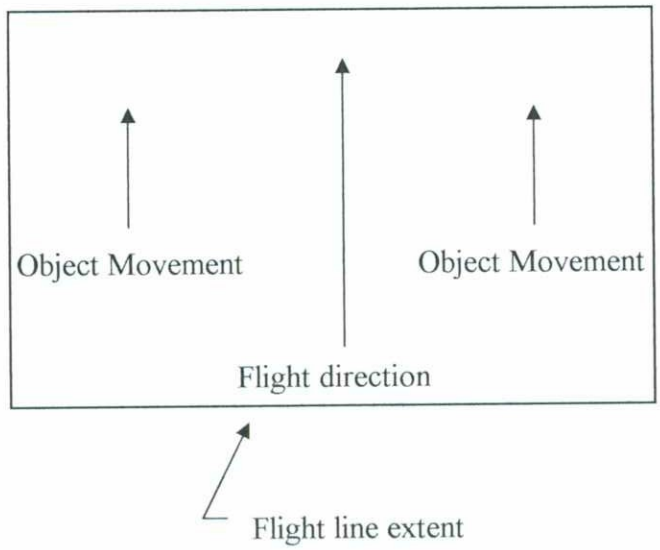
$$\theta = \frac{\arctan\left(\frac{d}{AGL}\right)}{57.2958}$$

where *d* is the distance from nadir (directly under the plane) to the peak of the roof and AGL is the 'above ground level' of the plane. The conversion from degrees to radians is one radian equals 57.2958 degrees. This number is then subtracted from the pitch value that was used to create the data.

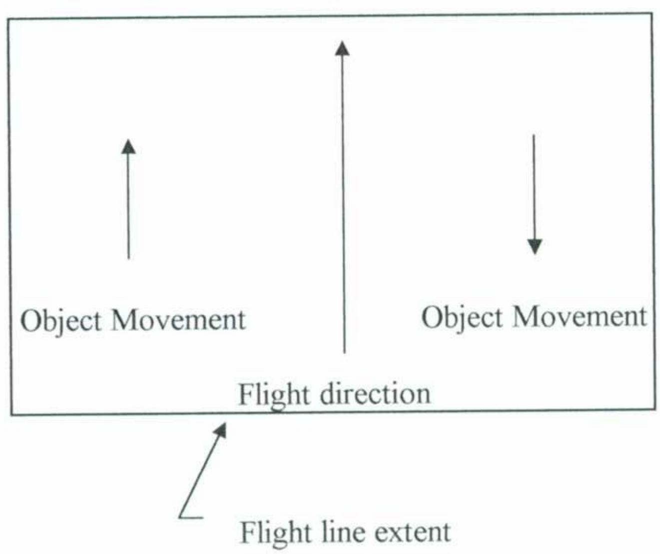
The next issue to resolve, before actually changing the pitch value, is to determine if this shift is at all due to an incorrect heading value, since heading will move data in the direction of flight also. The difference is that heading rotates the data, meaning that when heading is changed, objects on opposite sides of the swath move in opposite directions.

Figures 5 and 6: Pitch and Heading movement

1.1.1 Pitch increases, objects throughout the data move forward.



Heading increases, objects move clockwise.



When heading changes, objects on the sides of the flight line move in opposite directions. If heading is increased, objects in the flight line move in a clockwise direction. If heading is decreased, objects move in a counter-clockwise direction.

To find out if heading is correct, a similar profile line must be made in the overlap area between the middle flight line and the one to the east, or right side. If the distance *d* (see figure 4) is different on the right verses the left, then heading is partially responsible for the error. If the distance *d* is the same on both sides then heading *or* pitch is fully responsible.

Correcting for the Roll Bias

The purpose of a 'truth survey' is to evaluate roll and to ensure that the surface is accurate vertically. This survey is typically done in a localized area and the purpose is to provide a truth reference to every mission and to help in the calibration effort. Since every mission's data must be compared to this survey, it makes sense for this survey to be done at a place where the plane will be for every mission, i.e., the airport. The survey is done along a taxiway or runway, and the calibration flight lines are flown perpendicular to it, which makes it perfect for evaluating roll.

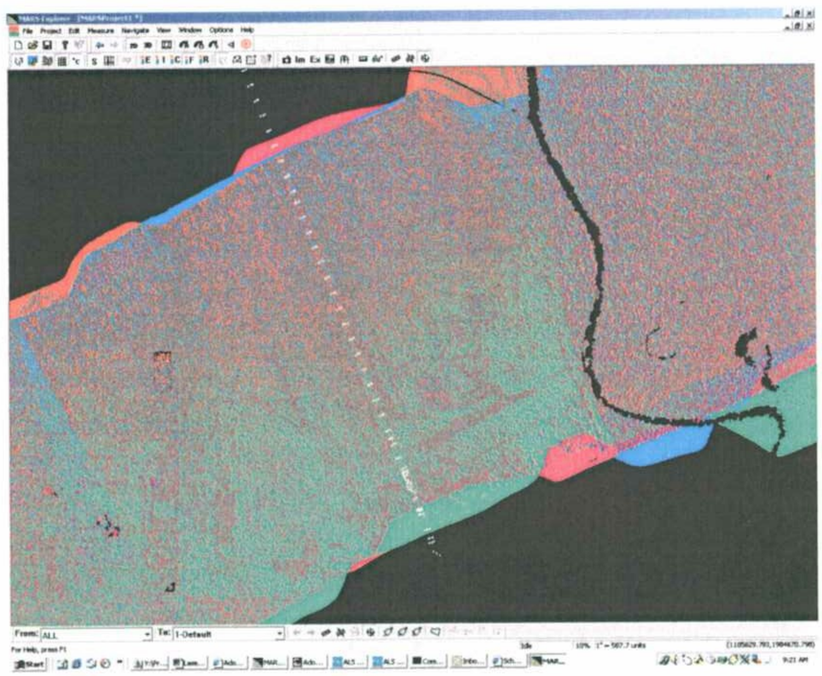


Figure 7: The truth survey

The white dots represent the survey, and four flight lines, two from the beginning of the mission and two from the end, have been flown. Each pair of flight lines was flown in opposite directions, and in this case the red and blue lines were flown east and the green and magenta lines were flown west. The first step is to make a profile line across the survey. It is important to create this cut on one side of the taxiway so as to avoid cutting through and over the crown. Once the profile is created, exaggeration of the elevation by 100 times is necessary to see the pattern. (figure 8)

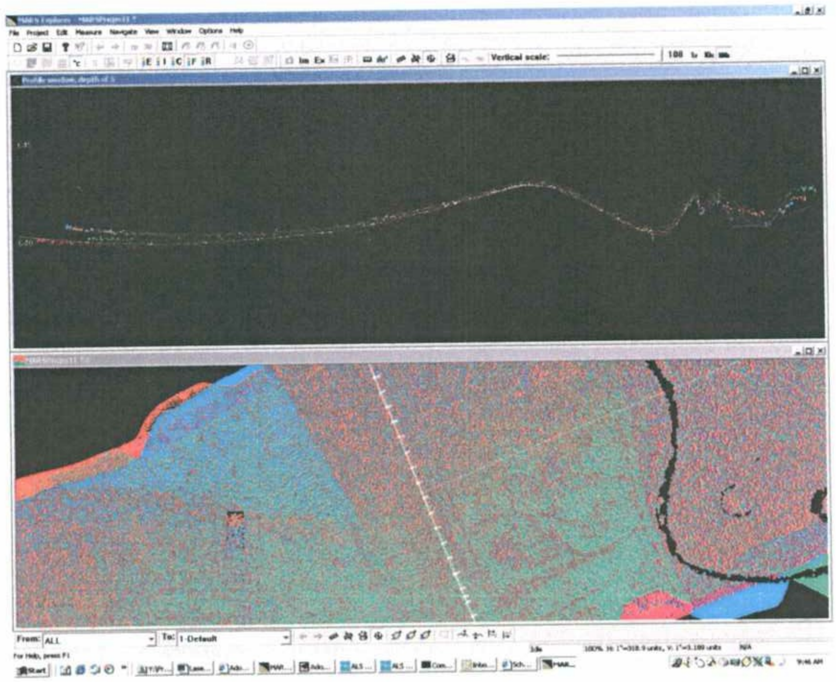


Figure 8: Profile view of calibration flight lines

Even without zooming in, a pattern is already apparent. The two east flown lines, red and blue, are high on the left compared to the west flown lines, and low on the right. Since the profile line was created with the view eastward, it is easiest to think about what the east lines are doing. The east lines are low on the right, which means the relationship between the IMU and the right wing of the plane must be adjusted up. As in heading adjustments, sending the data in a clockwise direction is positive. If the axis of the clock is the tail/nose axis of the plane, then it is obvious this data must go in a counter clock-wise, or negative direction. The method for determining the magnitude of the adjustment is similar to determining the magnitude of the adjustment for the pitch. The only difference is how the triangles are drawn in relationship to the data. (figures 9 and 10)

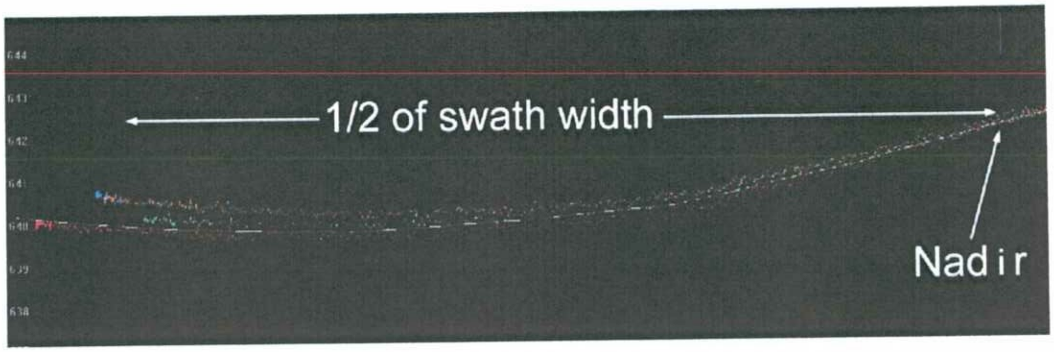


Figure 9: Half of calibration profile

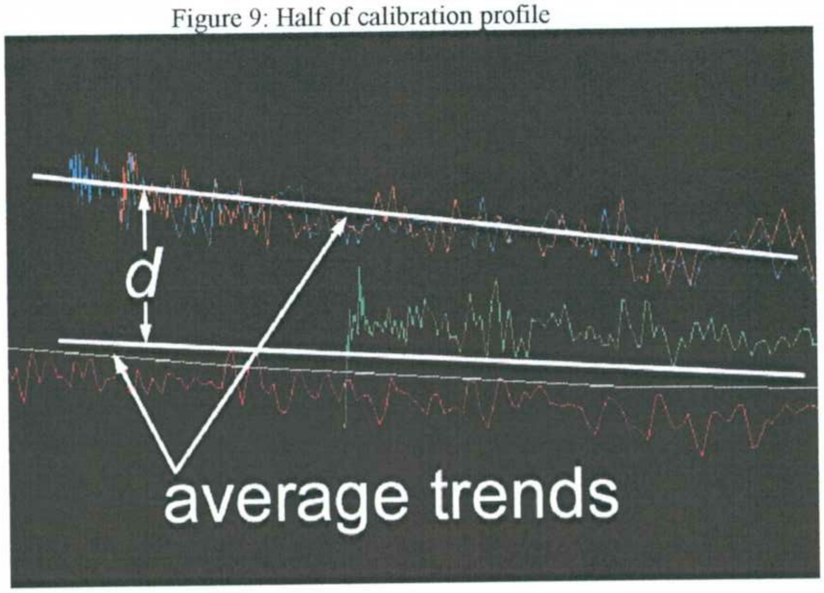


Figure 10: Differences in average roll trends

The important measurements for this formula are the distance from nadir to the edge of the swath, or ½ swath width, and d, the distance from the two average trend lines for each group. Since any adjustments made to roll effect both east and west lines, we are really interested in ½ d; this will give the value that will bring both sets of lines together. The formula is:

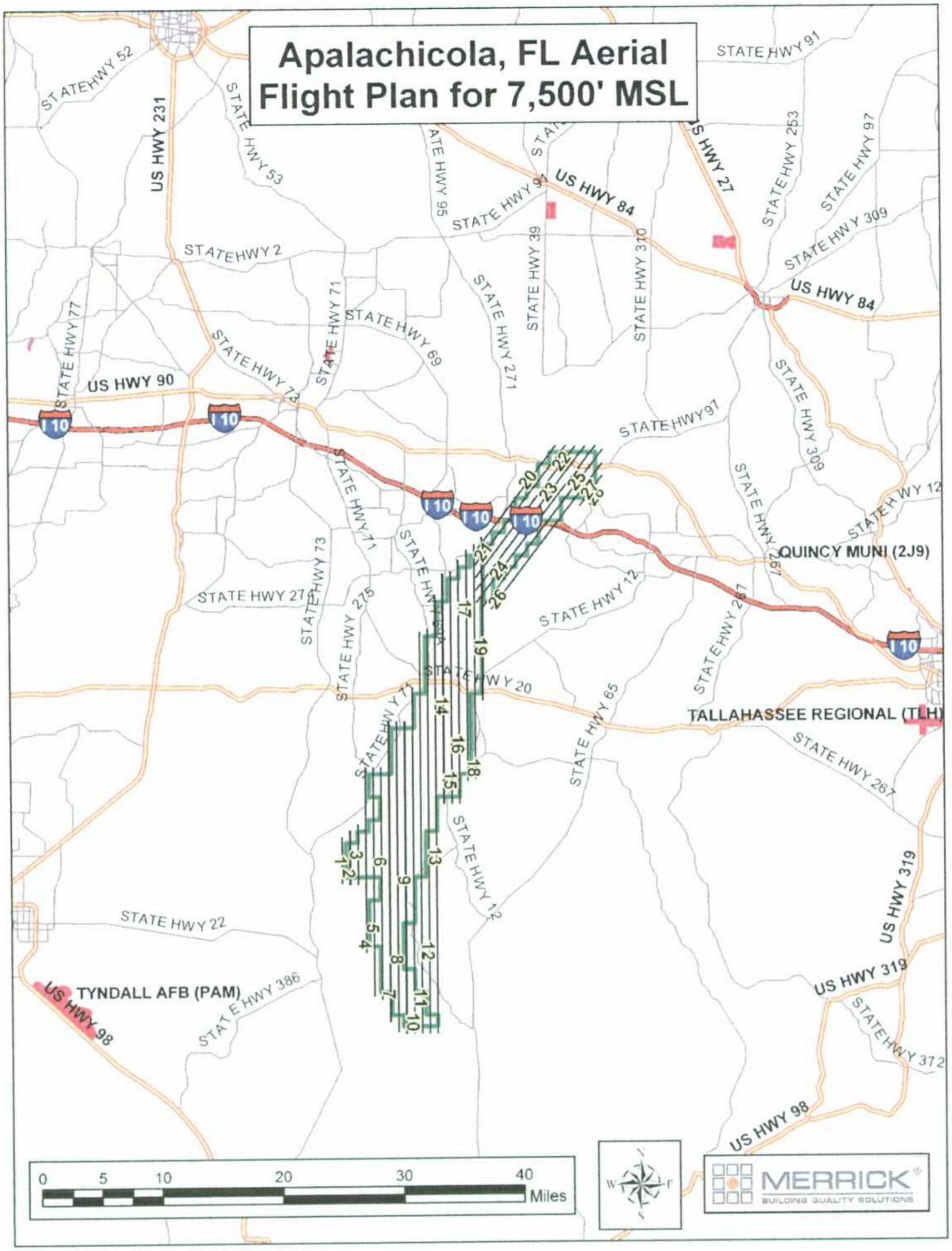
$$\theta = \frac{\arctan\left(\frac{d/2}{EdgeToNadir}\right)}{57.2958}$$

Correcting the Final Elevation

The next step is to ensure that all missions have the same vertical offset. Two techniques are used to achieve this. The first is to compare all calibration flight lines and shift the missions appropriately. The second is to fly an extra 'cross flight' which touches all flight lines in the project. Each mission's vertical differences can then be analyzed and corrected. However, the result of this exercise is only proof of a high level of relative accuracy. Since many of the calibration techniques affect elevation, project wide GPS control must be utilized to place the surface in the correct location. This can be achieved by utilizing the elevation offset control in the post processor or by shifting the data appropriately in MARS. The control network may be pre-existing or collected by a licensed surveyor. This is always the last step and is the only way to achieve the high absolute accuracy that is the overall goal.

APPENDIX A

APALACHICOLA RIVER FLIGHT DIAGRAM



Airborne GPS Base Station Controls

Three GPS airborne base stations were set up, with one receiver located at the airport, and two secondary GPS receivers placed at survey control points in the southern half of the project area, under the flight lines, near Lewis, FL.

The main airborne base station was NGS (National Geodetic Survey) point MARIPORT, also named 070318_Base, located at the Marianna Airport, Marianna, FL.

Latitude = 30 49 39.61594(N)
Longitude = 085 11 10.78091(W)
NAVD 88 Height = 31.265 (meters)
See NGS Datasheet below.

```
NGS DATASHEET
1       National Geodetic Survey
 BE3944 ***********************************************************************
 BE3944  FBN          - This is a Federal Base Network Control Station.
 BE3944  PACS         - This is a Primary Airport Control Station.
 BE3944  DESIGNATION -  MARIPORT
 BE3944  PID          - BE3944
 BE3944  STATE/COUNTY-  FL/JACKSON
 BE3944  USGS QUAD    -  MARIANNA (1994)
 BE3944
 BE3944                   *CURRENT SURVEY CONTROL
 BE3944
 ___________________________________________________________________
 BE3944* NAD 83(1999)-  30 49 39.61594(N)    085 11 10.78091(W)     ADJUSTED
 BE3944* NAVD 88      -       31.265  (meters)     102.58   (feet)  ADJUSTED
 BE3944
 ___________________________________________________________________
 BE3944  X          -     460,009.459 (meters)              COMP
 BE3944  Y          -  -5,462,474.282 (meters)              COMP
 BE3944  Z          -   3,249,503.500 (meters)              COMP
 BE3944  LAPLACE CORR-          -1.54  (seconds)              DEFLEC99
 BE3944  ELLIP HEIGHT-           3.10  (meters)       (04/12/01) GPS OBS
 BE3944  GEOID HEIGHT-         -28.16  (meters)               GEOID03
 BE3944  DYNAMIC HT  -         31.224 (meters)    102.44  (feet)  COMP
 BE3944  MODELED GRAV-    979,350.4   (mgal)                  NAVD 88
 BE3944
 BE3944  HORZ ORDER  -  A
 BE3944  VERT ORDER  -  SECOND    CLASS I
 BE3944  ELLP ORDER  -  FOURTH    CLASS I
 BE3944
 BE3944.This mark is at Marianna Airport (MAI)
 BE3944
 BE3944.The horizontal coordinates were established by GPS observations
 BE3944.and adjusted by the National Geodetic Survey in April 2001..
```

```
BE3944
BE3944.The orthometric height was determined by differential leveling
BE3944.and adjusted by the National Geodetic Survey in May 2001..
BE3944.No vertical observational check was made to the station.
BE3944
BE3944.The X, Y, and Z were computed from the position and the ellipsoidal ht.
BE3944
BE3944.The Laplace correction was computed from DEFLEC99 derived deflections.
BE3944
BE3944.The ellipsoidal height was determined by GPS observations
BE3944.and is referenced to NAD 83.
BE3944
BE3944.The geoid height was determined by GEOID03.
BE3944
BE3944.The dynamic height is computed by dividing the NAVD 88
BE3944.geopotential number by the normal gravity value computed on the
BE3944.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
BE3944.degrees latitude (g = 980.6199 gals.).
BE3944
BE3944.The modeled gravity was interpolated from observed gravity values.
BE3944
BE3944;             North        East      Units Scale Factor Converg.
BE3944;SPC FL N   -  202,796.928   534,334.603   MT  1.00001468   -0 20 41.6
BE3944;SPC FL N   -  665,342.92  1,753,062.78   sFT  1.00001468   -0 20 41.6
BE3944;UTM  16    - 3,411,911.081   673,468.559   MT  0.99997120   +0 55 46.8
BE3944
BE3944!           - Elev Factor  x  Scale Factor =   Combined Factor
BE3944!SPC FL N   -  0.99999951  x   1.00001468  =   1.00001419
BE3944!UTM  16    -  0.99999951  x   0.99997120  =   0.99997071
BE3944
BE3944:           Primary Azimuth Mark                  Grid Az
BE3944:SPC FL N   -  MARIPORT AZ MK                        000 36 49.4
BE3944:UTM  16    -  MARIPORT AZ MK                        359 20 21.0
BE3944
BE3944|-------------------------------------------------------------------|
BE3944| PID    Reference Object                  Distance     Geod. Az  |
BE3944|                                           dddmmss.s |
BE3944| BE3960 MARIPORT AZ MK                 APPROX. 0.7 KM 0001607.8 |
BE3944|-------------------------------------------------------------------|
BE3944
BE3944                    SUPERSEDED SURVEY CONTROL
BE3944
BE3944  ELLIP H (07/14/97)    3.25   (m)                GP(       ) 1 1
BE3944  ELLIP H (10/02/96)    3.05   (m)                GP(       ) 1 1
BE3944  NAD 83(1990)-  30 49 39.61473(N)    085 11 10.77923(W) AD(      ) B
BE3944  ELLIP H (03/09/95)    3.06   (m)                GP(       ) 1 1
BE3944  NAD 83(1990)-  30 49 39.61548(N)    085 11 10.78004(W) AD(      ) B
```

```
BE3944  ELLIP H (09/13/90)   3.22   (m)               GP(      ) 4 1
BE3944  NAVD 88 (05/23/03)   31.27   (m)        102.6    (f) LEVELING   3
BE3944  NGVD 29 (12/04/92)   31.3    (m)        103.     (f) GPS OBS
BE3944
BE3944.Superseded values are not recommended for survey control.
BE3944.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
BE3944.See file dsdata.txt to determine how the superseded data were derived.
BE3944
BE3944_U.S. NATIONAL GRID SPATIAL ADDRESS: 16RFV7346911911(NAD 83)
BE3944_MARKER: F = FLANGE-ENCASED ROD
BE3944_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)
BE3944_SP_SET: STAINLESS STEEL ROD IN SLEEVE
BE3944_STAMPING: MARIPORT 1988
BE3944_MARK LOGO: NGS
BE3944_PROJECTION: FLUSH
BE3944_MAGNETIC: N = NO MAGNETIC MATERIAL
BE3944_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
BE3944_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE
FOR
BE3944+SATELLITE: SATELLITE OBSERVATIONS - June 21, 2004
BE3944_ROD/PIPE-DEPTH: 13.1 meters
BE3944_SLEEVE-DEPTH  : 0.91 meters
BE3944
BE3944  HISTORY    - Date     Condition       Report By
BE3944  HISTORY    - 1988     MONUMENTED      NGS
BE3944  HISTORY    - 19890307 GOOD
BE3944  HISTORY    - 19890328 GOOD
BE3944  HISTORY    - 19910524 GOOD            NGS
BE3944  HISTORY    - 19910627 GOOD            ALHD
BE3944  HISTORY    - 19920113 GOOD            NGS
BE3944  HISTORY    - 19930317 GOOD            NOS
BE3944  HISTORY    - 19930413 GOOD            ALHD
BE3944  HISTORY    - 19940412 GOOD            NGS
BE3944  HISTORY    - 19951116 GOOD            NGS
BE3944  HISTORY    - 19951116 GOOD            NGS
BE3944  HISTORY    - 19990405 GOOD            BANNER
BE3944  HISTORY    - 20010725 GOOD            FLDT
BE3944  HISTORY    - 20030326 GOOD            BANNER
BE3944  HISTORY    - 20040621 GOOD            FLDT
```

The two secondary GPS receivers placed in the project area, under the flight lines were named 070318_B01 and 070318_B02. Only 070318_B02 was used as an Airborne GPS Base Station. The GPS base station at the airport (070318_Base) and the GPS base station located under the flight lines (70318_B02) were tied directly to each other by post processing withTrimble Geomatic Software version 1.62.

Coordinate values on point 070318_B02:
Latitude = 30°13'39.66991"N
Longitude = 85°02'18.81948"W
NAVD 88 Height = 14.770 (meters)
See Field Notes below.

32/898

Cont. 5075.001 03/18/07
MERRICK
LiDAR GROUND SUPPORT

K. MEARS
B. SMITH

ALL TIMES ARE EASTERN DAYLIGHT SAVING TIME which is local time at base stations.

06:30 From LANARK, loaded equipment and arrived
08:00 at LEWIS, FL.
Set control points and setup base sta.
08:45 Discovered LAT/LON given to flight crew for orientation was incorrect. Transposition in LON value. 10' further west. Attempted to contact flight crew via cell phone - no service. Attempted contact via AV Radios borrowed from 3DS - both radios died after several attempts.
09:02 Was able to contact Jonathan Swann on flight crew. Corrected LAT/LON and advised of communication problems.
09:40 Began observations at 1/2 second interval
19:40 Shut down units. LEICA 1200 memory full. Contacted Jonathan Swann - flight complete.
20:30 Removed stakes and flagging from pasture. Spoke with property owner and returned to
23:00 TALLAHASSEE. Unloaded equipment and put batteries on charge.

STA.	HI.	BEGIN	END
	LEICA	1200	
5075 B1	1.3395 m	~~09:30~~	
	+0.360 m	09:40	19:40
	1.699 m Total Vertical Ht. (7:40 pm)		
	LEICA	500	
5075 B2	1.4605		
	+0.360	10:00	20:13
	1.8205 m Total Vertical Ht. (8:13 pm)		

NOTE: Local time offset in unit is incorrect. Corrected time shown.

5075.001
MERRICK 03/18/07
Apalachicola River Basin LIDAR
Ground Support
LIBERTY and JACKSON COUNTY

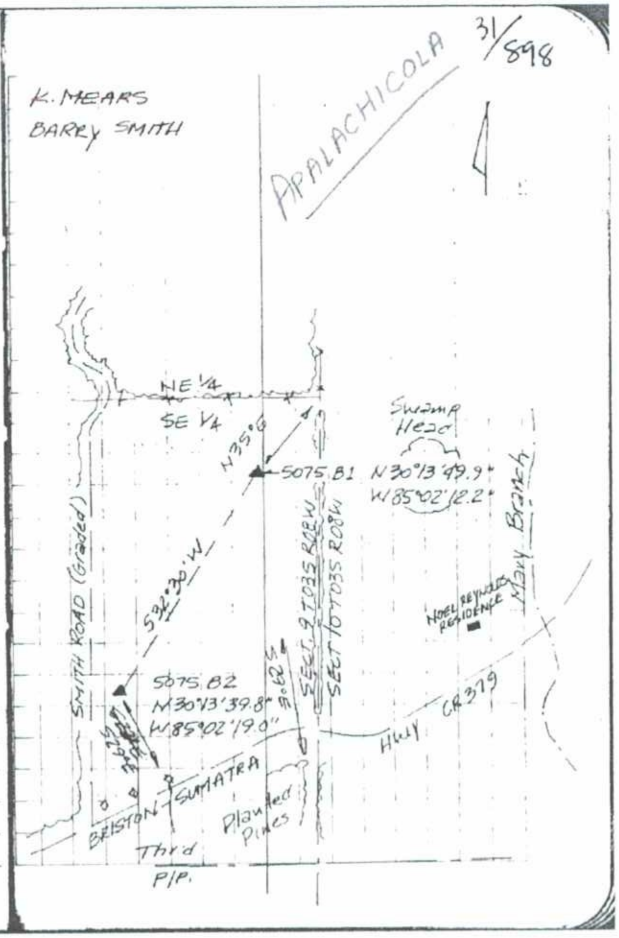
Project area is approximately 5mi wide along Apalachicola River from COTTON LANDING RECREATIONAL AREA, North to LAKE SEMINOLE.

Control points for base stations are located in the SE 1/4 of SECTION 9, T03S R08W, LIBERTY CO., near the community of LEWIS, (South of ORANGE) on the north side of the BRISTOL-SUMATRA Hwy (CR379).

Points were placed in a cow pasture owned by the SMITH Family. Permission to access the property was given by NOEL REYNOLDS 850-643-2042.

Control points are 5/8" IR with 2½" aluminum Cap LB3293. LAT/LON on sketch are approx. Points are set 1" below grade and are stamped "5075 B1" and "5075 B2"

Site elevation from U.S.G.S. quad is approx. 50-ft. NGVD 29.



APPENDIX B

APALACHICOLA RIVER POST-FILTER CONTROL REPORT

Project File	MARSProject1 *		
Date		30-Jun	2007
Vertical Accuracy Objective			
Requirement Type	Accuracy(z)		
Accuracy(z) Objective		1.2	
Confidence Level		95%	
Control Points in Report		18	
Elevation Calculation Method	Interpolated from TIN		
Control Points with LiDAR Coverage		14	
Control Points with Required Accuracy (+/- 1.20)		14	
Percent of Control Points with Required Accuracy (+/- 1.20)		100	
Average Control Error Reported		0	
Maximum (highest) Control Error Reported		0.6	
Median Control Error Reported		-0.01	
Minimum (lowest) Control Error Reported		-0.42	
Standard deviation (sigma) of Z for sample		0.29	
RMSE of Z for sample (RMSE(z))		0.28	PASS
FGDC/NSSDA Vertical Accuracy (Accuracy(z))		0.55	PASS
NSSDA Achievable Contour Interval		1	
ASPRS Class 1 Achievable Contour Interval		0.9	
NMAS Achievable Contour Interval		1	

Control Point Id	Control Point X	Control Point Y	Coverage	Control Point Z	Z from LiDAR	Z Error	Minimum Z	Median Z	Maximum Z
501	702505.17	3398345.17	Yes	97.8	97.7	-0.1	97.7	97.7	97.73
502	707291.59	3395426.08	Yes	157.66	157.69	0.03	157.67	157.77	157.82
503	700015.35	3391210.37	Yes	76.02	76.08	0.06	75.91	76.25	76.34
504	689069.79	3379495.63	Yes	74.08	73.96	-0.12	73.78	73.94	74.03
505	688087.99	3369444.53	Yes	64.78	64.36	-0.42	64.31	64.39	64.82
506	694404.3	3368358.74	Yes	166.25	165.85	-0.4	165.76	165.81	165.9
507	690305.84	3355212.87	Yes	54.77	54.52	-0.25	54.35	54.5	54.69
508	680808.17	3354937.81	Yes	78.54	78.38	-0.16	78.34	78.37	78.41
509	686842.82	3344101.82	Yes	51.37	51.44	0.07	50.96	51.36	51.45
510	685996.35	3336486.69	Yes	38.64	38.8	0.16	38.7	38.85	38.94
511	686936.13	3327652.36	Yes	28.25	28.2	-0.05	28.07	28.14	28.41
512	683393.83	3361855.09	Yes	69.82	69.94	0.12	69.8	69.83	70.08
5075B1	688932.57	3345960.23	Yes	47.14	47.63	0.49	47.58	47.64	47.64
5075B2	688761.24	3345642.23	Yes	48.47	49.07	0.6	49.02	49.09	49.1
AS0886	681913.96	3317375.7	No	16.8					
BE2747	711221.85	3389825.08	No	153.88					
BE3937	669194.01	3351674.52	No	73.99					
BE3938	717829.35	3345689.24	No	66.28					